Conference Proceedings of the AITIE 5th International Conference and Workshop on Innovation, Technology and Education (ICWITE, Minna 2023)

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AITIE

Creative minds innovate to transform the world.

They innovate through forward-thinking ideas to create the desired values.

Beyond the politics of educational research for certification lies the politics of educational research for transformation.

Only the network of dedicated and technology literate individuals can constructively integrate technology to support learning.

Through creative thinking, research and praxes we must Domesticate, Innovate and Integrate Technology for Instruction

This conference is dedicated to educators globally, the legends and pioneers who have made contributions into the integration of media in the Nigerian educational system and to the members of the Association for Innovative Technology Integration in Education (AITIE) who have the desire to facilitate learning in variety of educational settings through innovative and creative use of technology

Vision

To be the foremost professional association in the integration of technologies for teaching, learning, research and administrative purposes in conventional and distance education settings.

Mission

We seek to be a force for qualitative accessible education, through the promotion of scholarship and best practices in the design, development, use, and innovative management of technologies for effective teaching and learning in a variety of educational settings.

Core Values

The following principles guide our work and define the mission of AITIE:

access to quality education: a commitment to access to quality education for all, irrespective of location, gender, race, religion, disability, etc., as education is a human right and an instrument for poverty alleviation and sustainable human development;

excellence: promotion of quality research, teaching, learning, and life-changing scholarship and value-based service, through innovative use of technology

innovation and creativity: encouragement of intellectual inquisitiveness through the promotion of technology for enhanced lifelong learning

teamwork: encouragement of collaboration among individual and institutional members and promotion of shared values in the integration of information and communication technology in all aspects of education;

continuing professional education: promotion of quality professional education for members and graduates already in the workforce;

association, institutions and industry collaboration: encouraging closer social and economic ties among the Association, other professional associations, educational institutions, and the industry;

academic and professional integrity: commitment to maintaining academic quality and standards, and integrity in all programmes of the association;

resources for teaching and learning: commitment to providing resources for teaching, learning, research, and administration in conventional and distance education settings; and

professionalism: expertise and judgment of educational technology and related media professionals are critical to the successful integration of technology in education. AITIE maintains the highest professional standards and expects the status, compensation, and respect due to all professionals.

Presidential Address at the 2023 AITIE Conference (Minna, 2023)

Protocol, Distinguished Ladies, and Gentlemen.

On behalf of the Executive Committee and the entire membership of the Association for Innovative Technology Integration in Education (AITIE), as the President, I wish to welcome you all, to the 5th Annual Workshops and Conference of our August Association, to this beautiful capital city of the Power State, Minna, noted for its serene environment, diversity in culture, and hospitality.

Standing before you, I look back with reminiscence on our commencement of the journey through the birthing of the Association in 2017, at the auditorium of the University of Ilorin. On this occasion permit me to thank all my colleagues in the Association for electing the Executive Committee and supporting us in the last six years. While six years might be too short a period in the existence of any Association, it is worthwhile to take stock of what we had done, what we have achieved, what we failed to do, and what we did not achieve. Based on garnered experiences and planned actions we can focus on the future.

The aims and objectives of the Association are broad, based around technology infusion into all gamut of instruction. Therefore, the Association's focus covered many diverse fields. We charted out paths to develop ourselves to be National Board-Certified Technology Teachers, school administrators, directors of training, multimedia scriptwriter and training materials developer, technology facilitators and coordinators, instructional designers (in educational institutions and workplaces), online educators, professional learning leaders, distance education leaders, and curriculum developers, among others.

Periodic stock-taking, particularly during the annual convention of a professional association, is essential to appraise whether we have taken and followed the right directions and laid an enduring and true foundations progress. From inception, we recognised that there are several professional associations and organisations committed to achieving one or more of our outlined focuses. Individually we are connected in several ways with these associations or organizations. Thus, collectively we have worked in close collaborations with such associations, and we have not antagonised any. However, AITIE, as a body, was determined to be different through an emphasis on the practical skill development of members, with a blend of theoretical foundations to reach the Association's desired goals.

Since its inception and now AITIE engaged in other professional development activities, workshops (onsite and online), and onsite annual conferences. Out of the expected onsite expected seven workshops and conferences we have been able to conduct only five (71.43%), due to the 2020 COVID-19 pandemic and the 2022 long-drawn strike action of the Academic Staff Union of Nigerian Universities (ASUU) which affected a lot of our members. While the percentage might look ok, the fact we could not husband technological resources to have our scheduled programmes leave other educators much to be desired. The online and onsite workshops had been largely successful and this needs to be sustained and enhanced. Through our annual conference instructional technologists and other educators communicate their research findings and update their knowledge of technology integration in training and instruction.

This year's convention, "Towards SDG-4: Open Technologies for Institutional and Corporate Learning" addresses two important sectors of formal school education and corporate world training and self-directed learning. Prof. Dattani I. Wushishi, the Registrar and Chief Executive Officer of the National Examination Council (NECO); Prof. Olatunde I. Salawu of the National Open University of Nigeria; and Dr. Clement E. Onime of the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy; will do justice to the topic. For this year's workshop, we engaged in practical hands-on activities in two areas: (i) 'Design and Development of Open Educational Resources", and (ii) Free and Open Sources Software for Academics. These workshops were meant to equip members with the knowledge and skills to leverage free educational resources (materials and software) for quality instruction and training.

Apart from staging and organising productive workshops and conferences, AITIE publishes the International Journal for Innovative Technology Integration in Education (IJITIE) which is of international repute. The first issue was published in 2017. The Association need to do more in its drive to promote scholarship and encourage the development of competencies required of 21st-century educators. I hope the incoming executive council will do its utmost to ensure that the programmes detailed in the Associations strategic documents are reviewed to meet societal emerging needs.

We should be committed to providing quality activities and creating an environment for networking opportunities for academics and professionals in the field of education and workplaces. We promote and encourage promotion of the latest technological, tools, resources, and training opportunities to drive the growth of our discipline. We shall also continue to promote collaboration with relevant associations and bodies.

I wish us all a worthwhile experience through the workshop tracks and other activities at this year's convention. Wishing us all a safe journey back home after the events.

Thank you.

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KEYNOTE SPEECH DELIVERED AT THE 5TH ANNUAL CONFERENCE OF THE ASSOCIATION FOR INNOVATIVE TECHNOLOGY INTEGRATION IN EDUCATION (AITIE)

Prof. Dantani Ibrahim Wushishi
Registrar/Chief Executive of National Examinations Council (NECO)

Implementing Open Technologies for Institutional and Corporate Learning to Achieve Sustainable Development Goal-Four (SDG-4)

Introduction

Distinguished Participants,

It is a pleasure to be with you today at such an important conference focusing on issues of high relevance to Education and Technology, implemeting open technologies to meet institutional and corporate learning requirements in pursuit of Sustainable Development Goal 4 (SDG-4). Let me commend the Association for Innovative Technology Integration in Education (AITIE) for organising this event in Minna, Niger State. This year's theme, "Towards SDG-4: Open Technologies for Institutional and Corporate Learning", has my express approval. Consequently, an approach to learning based on open technologies highlights the significance of inclusive, equitable, and equal access to education for all and the potential to empower individuals and corporations to advance the welfare of the entire society.

Open technologies for learning have emerged as a top priority for businesses around the globe, as they are increasingly employed to drive business initiatives forward with greater efficacy. The Sustainable Development Goals (SDG-4: Ensure inclusive and quality education for all and promote lifelong learning) provide an opportunity to use these technologies to assist in closing the global education gap, expanding access to learning opportunities, and developing a more inclusive society.

I am personally familiar with the educational benefits of open technologies. As a chemistry education professor, I have extensively used open technologies in my research, teaching, and collaborations with peers. As Registrar and Chief Executive of the National Examinations Council (NECO), I have repositioned the organisation to an enviable position in digital technology. Over the years, open technologies have facilitated candidate registration, the timely release of results, and online result verification for all examinations administered by NECO. Under my leadership, NECO has developed ICT software to improve and ensure fairness in posting staff for official assignments, provided fundamental infrastructure at the ICT department, and purchased computers, printers, scanners and generators for all state and zonal offices to facilitate access to open technologies.

In addition, the Council deploys open technologies to improve the efficiency of nearly all of its departments, states, and regional offices. The Council has effectively implemented open technologies for detecting examination fraud, archiving records and results, and data analysis of test items to eliminate bias and ensure inclusiveness. The Council has recently introduced e-verification of results for candidates and corporations that can be completed in minutes from anywhere in the world. Currently, the Council is exploring open technologies for essay e-marking. Consequently, my presentation aims to examine the potential of open technologies for institutional and corporate learning towards achieving SDG-4, as well as the associated implementation and challenge considerations, while highlighting successful examples of open technologies already used in this context.

What is Open Technology?

Open technology is any technology that is free, open-source, and accessible to everyone and that can be used to increase the effectiveness of organisations. In other words, intellectual property or patents do not protect open technologies. They can therefore be freely utilised and modified. The term incorporates open-source software and hardware, such as Linux and Arduino. These technologies offer the potential to rapidly and affordably develop and deploy solutions to specific problems. Several educational institutions, for instance, have utilised Moodle's open-source software to host and provide online learning.

Open Technologies for Institutional and Corporate Learning

Open technologies offer numerous advantages to institutional and corporate learning, especially with conventional formats such as lectures and seminars. These technologies enable the creation or development of instructional materials, access to online professional resources, and interactive participation in lectures and seminars. Moreover, open technologies are ideally adapted to support e-learning, allowing institutions to provide learning and education opportunities to geographically and financially constrained individuals.

These technologies can increase the efficacy and capacity of staff training while establishing a shared learning environment that promotes collaboration and knowledge-sharing for corporate learning. This can benefit the organisation and its employees, increasing their opportunities to develop new skills and benefit from collective knowledge.

Open Technologies Aiding to Achieve SDG-4

Open technologies can facilitate improved access to education in several ways. Firstly, they allow learning materials to be distributed more widely at institutional and public levels. They also provide access to professional resources and instruction that are accessible regardless of geography and financial resources. These technologies can also be used to drive collaboration for learning initiatives that unite institutional and corporate entities around achieving SDG-4, quality education for all.

Such efforts are already being undertaken around the world. For example, the Open Education Resources (OER) program has seen institutions develop and share learning materials. The OER program has been top-rated in Africa, where many countries have utilised the resources to develop

locally relevant learning materials and provide an online teaching opportunity for many students, especially, indegent students.

Achieving SDG-4 and its ten targets necessitates vigorously using open technologies to improve learning for institutions and organisations. Achieving Quality Education (SDG-4) will be a mirage if we do not transition to education that reaches and works for everyone. Quality Education is a cross-cutting issue that affects all 17 Goals of the SDGs, and any lack of progress on Quality Education will enormously hinder the progress towards achieving all the SDGs. In 2023, the Sustainable Development Goals reached the halfway point in their implementation.

According to Haleem et al. (2022), sustainable development includes social well-being, which depends on education. Open technologies have emerged to spread shared knowledge and are the primary driving force behind education reforms in many countries. Introducing new technology-assisted learning tools such as mobile devices, smartboards, MOOCs, tablets, laptops, simulations, dynamic visualisations, and virtual laboratories has altered education in schools and institutions.

I believe it is essential to talk about how open technologies can play a role in helping institutions and corporations achieve Sustainable Development Goal 4. There are many different approaches to this, but ultimately it's about finding ways to use technology to promote education and lifelong learning in a way that is accessible, equitable, and sustainable. Whether talking about online courses, virtual reality simulations, or other tools and platforms, the key is ensuring everyone has the necessary resources to learn and grow. By working together to explore new ideas and approaches, we can make real progress towards a world where education is genuinely universal, sustainable, accessible and inclusive.

The Urgent need for Open Technologies for Learning

The COVID-19 pandemic scare has decreased, but the effect continues to impact many aspects of our lives. The pandemic has hobbled economies, strained societies and undermined the next generation's prospects. While children are not at the most significant direct risk from the virus, they suffer disproportionately from its socioeconomic consequences. Almost two years into the pandemic, many children endure prolonged school closures and education services disruptions.

The pandemic and the attendant lockdown accelerated the growth of open technologies by using open-source software and other open standards in education and training programs. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), open technologies can help increase access to education and training, reduce costs, and promote innovation in teaching and learning. For example, open-source learning management systems can provide cost-effective solutions for institutions and organisations looking to implement e-learning programs (Tlili, et al., 2020).

Furthermore, the gamification of learning and the use of collaborative tools and social media integration can increase engagement and knowledge sharing among learners. Virtual reality and interactive simulations can provide immersive and practical learning experiences. Finally, using open technologies in institutional and corporate learning can contribute to the achievement of

SDG-4 by increasing access, reducing costs, and promoting innovation and engagement in education and training programs.

Promoting Lifelong Learning and Continuous Professional Development

Open technologies can be essential instrumenst for fostering lifelong learning and ongoing professional development. By providing access to a vast array of learning resources and opportunities, open technologies can assist individuals in acquiring new skills and remaining abreast of the most recent trends and developments in their respective fields. In addition, open technologies can facilitate collaboration and knowledge sharing among professionals, resulting in the development of novel concepts and innovations. To maximise the benefits of open technologies for learning and development, organisations should prioritise providing employee training and support, nurturing a culture of continuous learning, and utilising data analytics to track progress and identify areas for improvement for the benefit of the organization (Lowry, 2023).

Benefits of Open Technologies for Institutional Learning

Open technologies for Institutional learning offer several benefits (Haleem et al. 2022):

- Improve teaching productivity
- Develop online libraries
- Promote distance learning
- Facilitate teaching of students with exceptional needs
- Create and promote virtual classrooms where a teacher can interact with students in real time, share his resources, deliver his lecture, assess students' learning, collect feedback, and reply to their queries.
- Creating inclusive learning environments that provide an equal opportunity for each student with different ability levels to learn in the same place
- Developing teamwork and communication skills
- Solving educational challenges by students using online platforms
- Enhanced access to educational resources anytime, seven days a week. Cloud storage, video recording of lectures and availability of notes in a soft copy made it easy for students to access the resources at their convenience.
- Addressing students to completing the syllabus
- Transformed the innovative way of learning - Students are taught digital skills and encouraged to bring computers to class to access various materials quickly.
- Arithmetic digital class tools help students listen to math classes and respond by typing, scribbling, or dictating their remarks.
- Convenient teaching and learning in challenging times, like during the COVID-19 pandemic
- Making classroom instructions interesting
- Improve students' performance: Studies have shown that open technology improves student performance by systematically approaching instructional procedures and resources.

- Students gain self-learning abilities. Students can build self-directed strong learning abilities by using learning tools and technology.
- Expand knowledge, addresses learning gaps and quickly gain information from E-books and MOOC Platform. Thanks to MOOCs, students and working professionals can study at their speed, from anywhere and at any time.

Benefits of Open Technologies for Corporate Learning

Using open technologies for corporate learning and development can offer several benefits:

- It can provide access to a wide range of high-quality educational resources, courses, and software at little or no cost, which can be especially useful for organisations with limited budgets.
- It enables greater collaboration and knowledge sharing among employees, helping to foster a culture of continuous learning and development.
- Open data and APIs can provide valuable insights into employee performance and training needs, allowing organisations to customise their learning programs to meet the specific needs of their workforce.
- Corporations can create more effective, efficient, and equitable employee learning and development programs by leveraging open technologies.
- Flexible education: Due to technological improvements, education is becoming more flexible and accessible. Online degrees and mobile learning are becoming more popular, physical boundaries have been removed, and technologies can help their employees pursue their education (Haleem et al., 2022).

Examples of Open Technologies for Institutional and Corporate Learning

According to Haleem et al. (2022), the Internet of Things (IoT) is one of the most cost-effective open technologies for educating young brains. It is also a robust mechanism for integrating a world-class learning experience for everybody. As an example of a learning tool, social media has come a long way. Many teachers and students use social media as an essential element of the e-learning experience.

More examples of open technologies include Open Educational Resources (OER), which are freely available educational materials that can be used, adapted, and shared; Open Source Software (OSS), which allows users to access and modify the source code of a program; and Open Data (OD), which provides access to datasets that can be used for research and analysis. Other examples include Open Online Courses (OOC), which provide free or low-cost access to educational content; Open Standards (OS), which facilitate interoperability between different software and systems; and Open APIs, which allow developers to access and integrate data from different sources.

There are also Massive Open Online Courses (MOOCs), Learning Management Systems (LMS), Open Badges, Open Access Journals, Augmented Reality, Virtual Reality, 3D Printing, Robotics,

Artificial Intelligence, Adaptive Learning Algorithms, Asynchronous Learning and Microlearning (and associated micro-credentials), Live Streaming (school to school, school to expert, remote teaching and learning) etc. These technologies provide access to a wide range of learning resources and opportunities, allowing individuals to develop new skills and stay up-to-date with the latest trends and developments in their fields (Haleem et al., 2022). Additionally, they facilitate collaboration and knowledge-sharing among professionals, which can lead to new ideas and innovations. With these open technologies, organisations can promote lifelong learning and professional development for their employees. By leveraging these open technologies, educational institutions and corporations can create more flexible, adaptive, and accessible learning environments that meet the needs of learners in a rapidly evolving digital world, despite the challenges of implementing open technology for learning (Tlili, et al., 2020).

Challenges of Implementing Open Technologies for Learning

Institutions and corporations may face challenges when implementing open technologies for learning, such as;

- the need for technical expertise to set up and maintain the systems,
- the ever-increasing cost of access to technology,
- concerns about data privacy and security, and
- resistance to change from employees accustomed to traditional learning methods. Additionally,
- stakeholders' lack of awareness or understanding of the benefits of open technologies,
- difficulty in securing funding and support for implementation.
- Lack of adequate training and support to use these technologies effectively.
- Not all students may have access to the necessary technology or internet connectivity, which can create barriers to participation,
- data privacy and security may also be a concern when using online platforms and tools.
- Lack of learning curve required for students and educators to adapt to new software. This can take time and resources, especially if training is needed.
- Compatibility issues when transferring files between different software programs.
- Some proprietary software may also have unavailable features in open-source alternatives, limiting specific educational programs' capabilities.

The Hindrances of Open Technologies to Learning in Nigeria

Teachers and students in secondary schools rely on digital technologies to facilitate teaching and learning. Among the hindrances associated with the use of technology are the following:

- Unreliable Power Supply - The prevalent nature of electric power supply in Nigeria is one of the obstacles preventing secondary school students from using these technologies. The lack of power supply appears to be a hindrance to the operation of the devices.
- Computer Illiteracy - The computer illiteracy of the majority of secondary school students and instructors is a significant drawback of the use of technologies. Both the teacher and the student are expected to have digital literacy skills. The ability to use the technology

enables them to readily share information globally, whereas the inability to use it hinders their future academic and professional endeavours.

- Lack of technical expertise - Both students and instructors lack the necessary knowledge and abilities to make effective use of communication technology in the classroom.
- Expensive Communication Service Fees - In Nigeria, where the majority of the population is comprised of low-income earners, communication technology services are quite costly. As a consequence, they have difficulty purchasing these devices. For example, the average student in our secondary institutions in Nigeria cannot afford a laptop due to its prohibitive cost.
- Incapacity to comprehend the messages of others - Moreover, it has been observed that a substantial number of individuals misinterpret messages sent via some of these communication devices. For example, teachers and students continue to struggle with email perusing and sending.
- Corruption within the Nigerian Society - Too many instances of corruption and insecurity have been documented in Nigerian culture. This development hinders technological advancement (Odofin, 2021).

Open technologies can be a powerful instrument for quality and inclusive education, promoting lifelong learning and professional development in Nigeria, if the challenges of implementation are properly addressed and overcome through good strategies.

Overcoming Challenges of Open Technologies Implementation

Overcoming the challenges of open technologies implementation requires a commitment to ongoing professional development, stakeholder collaboration, and a thoughtful approach to implementation in the following directions:

- Ensure the security and privacy of data when using free and open-source software by carefully reviewing the software's privacy policy and security features.
- Use strong passwords and enable two-factor authentication whenever possible.
- Keeping software and operating systems up to date with the latest security updates and patches can also help to prevent vulnerabilities that hackers could exploit.
- Educating oneself on the best data security and privacy practices can go a long way in protecting sensitive information.
- Funding training and support programs to help educators effectively use these technologies.
- Addressing access issues by investing in infrastructure to improve internet connectivity and provide devices to students who may not have them.
- Establishing online platforms, tool guidelines, and regulations promotes data privacy and security.
- Encourage the development of accessible technologies and ensure that all learners can engage with educational content.

Challenges of open technologies implementation for learning can be overcome with proper training, communication, planning and support, and the benefits of using open technologies in education can ultimately outweigh any initial difficulties. By taking these steps, policymakers can help to create a more inclusive and equitable quality education system that leverages the benefits of open technologies.

Addressing some Sub-Themes of the Conference

Endemic, Epidemic, Pandemic: Open Technology as a Panacea

I could not agree more that open technologies are a panacea for effective institutional and corporate learning in Endemic, Epidemic, and Pandemic outbreaks. Open technologies have brought about a transformation in the way institutions and corporations tackle learning in times of crisis. These technologies' flexibility and remote nature make it possible to offer a personalised learning experience tailored to each learner's needs. By leveraging open technologies, organisations can ensure that their employees possess the knowledge and competencies to effectively navigate the challenges of endemic, epidemic, and pandemic outbreaks. This is indeed a groundbreaking development!

Open Technology and Educational Cost

Open technology is a revolutionary concept that can transform how we learn and consume education. The cost of education has been a significant concern for many individuals and families, and by adopting open technology, institutions can reduce these costs and make education more accessible to everyone. It has the potential to significantly reduce educational costs by providing free and open access to educational resources. Students can access educational materials anywhere worldwide without needing expensive textbooks or resources. This can help to level the playing field for students from disadvantaged backgrounds, who may not have access to the same resources as their more affluent peers.

Additionally, open technology can help reduce the cost of education for institutions, as they can avoid the need to purchase expensive proprietary software and hardware. Ultimately, open technology has the potential to democratise education and make it more accessible to everyone, regardless of their background or financial circumstances. This is a huge step forward in the quest for educational equity, and we can all benefit from the opportunities that open technology provides.

Quality Assurance for Open Technologies Inclusion in Education

Quality assurance can ensure equity and inclusion in education by implementing rigorous testing and evaluation processes using open technology. It will help educators to ensure that all students have equal access to the resources and tools they need to succeed, regardless of their backgrounds or abilities, while maintaining quality. Additionally, quality assurance can help to identify and address any issues or barriers that may arise during the implementation of open technologies, further promoting inclusivity and accessibility.

One way to promote accessibility and inclusivity in education through open-source technologies is for educators to create a more equitable learning environment and help identify and address any

issues or barriers that may arise while implementing open technologies. Also, educators can implement measures such as data encryption, access controls, and regular backups. It is also essential to regularly review and update security policies and procedures to stay up-to-date with the latest threats and vulnerabilities. Quality assurance educators should also educate students on the safe and responsible use of technology and data and obtain parental consent before collecting personal information from students. They can ensure that student data remains safe and secure in open technology environments by taking these measures.

Open Technologies for inclusive education

Open technologies can be utilised to bridge the digital divide and give students equal learning opportunities regardless of their circumstances by ensuring equal access to education for all students by providing online resources and tools that can be accessed anywhere with an internet connection. These resources can be at a reduced cost to make them more accessible to all students. These technologies can potentially improve access to education for students who might not otherwise have the resources they need to succeed. One way open technologies can be used for inclusive education is to provide platforms for educators to connect, share ideas and resources, and collaborate on projects. Open-source software and open educational resources can also be used to create and share content, allowing educators to build on each other's work and share their expertise with a broader audience. By leveraging these technologies, educators can work together to improve the quality of education and ensure that all students have access to the tools and resources they need to succeed.

Application of Free and Open Source Software (FOSS) in education

FOSS is free, open-source software that can be used, modified, and distributed. It is excellent for education as it allows access to high-quality software without expensive licenses and is customizable for different school needs. Some examples of FOSS in education are Sugar Learning Platform (SLP), Python, Moodle, and LibreOffice. FOSS promotes collaboration, innovation, and creativity, improving education quality (UNSW, 2023).

Moodle is an open-source learning management system for schools and universities worldwide. Moodle allows educators to create interactive, engaging online courses that facilitate student communication and collaboration.

LibreOffice is a free, open-source office suite that gives students and educators access to word processing, spreadsheet, and presentation software without expensive licenses. LibreOffice can enable students to work on group projects and easily share documents without being limited by the availability of proprietary software.

Sugar Learning Platform (SLP), an open-source software suite designed for education, has been successfully implemented in schools in developing countries, providing students with access to educational content and tools on low-cost hardware. SLP can provide students access to diverse educational resources and tools, promoting knowledge-sharing and collaboration.

Free and open-source software can enhance cooperation and knowledge-sharing among students and educators, enabling a more inclusive and effective learning environment.

Crowdsourcing platforms for learning

Crowdsourcing platforms for learning are online platforms where a community of individuals collaborates to create and share educational content. These platforms allow learners to access a vast array of knowledge and resources, often for free or at a low cost. Crowdsourcing for learning is an excellent way to learn from experts, peers, and educators worldwide, and it provides an opportunity to participate in a global community of learners. Many popular crowdsourcing platforms for learning include Coursera, EdX, and Udemy.

Conclusion

Open technologies can be used to significant effect in improving the quality of educational offerings, both at the institutional and corporate levels. Such technologies can help to bridge the global education gap, increasing access to education and empowering underprivileged populations. Open technology's potential to drive the achievement of SDG-4 cannot be understated. Organisations must use the new opportunities that open technologies provide so that SDG-4 is reached most efficiently and sustainably possible.

Thanks to OT, institutions and corporations can collaborate and share resources to provide a more diverse and inclusive learning experience for all learners. By embracing OT for institutional and corporate learning, we can create a more fair and sustainable future for all learners and help achieve SDG-4.

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UNLIMITED POWER OF TECHNOLOGY: BEYOND APPLICATION OF TECHNOLOGICAL TOOLS FOR THE ATTAINMENT OF SUSTAINABLE DEVELOPEMENT GOAL - 4 IN NIGERIA

Prof. Ibrahim Olatunde SALAWU
Head, Courseware Material Development Unit,
National Open University of Nigeria (NOUN), Abuja

Preamble:

I salute the choice of the Organisers of this conference for their concern for the developing countries and more importantly, Nigeria as a Country. The inclusion of the theme focusing on Sustainable Development Goal-4, to me is a call for an assessment of the present social-economic and political situation especially in the developing countries. Whereas, there are 17 SDGs but one that stands out critical in my personal point of View is SDG-4. This is not just an assumption but based on the premise that if quality education is guaranteed in the functional manner, it will rub on the other 16 SDGs positively. Thus in the course of this presentation, we shall attempt to:

Briefly discuss the historical background to SDG-4

Expectations from implementation of the SDG-4

Realities on Ground – Nigeria as a Case Study

Technological Integration as a Solution Strategy

Technology Integration: The NOUN experience

Challenges of Technological Integration

The Way Forward

Brief History

In 2015, all the member states of the United Nations Organisations expressed their unanimous desire to end poverty, reduce inequality, and build more peaceful and prosperous global society by adopting the Sustainable Development Goals (SDGs) with the achievement Year fixed for 2030. By simple arithmetic we are left with just seven (7) years for the accomplishment of the target focus of the SDGs. By implications, the subject matter of our discourse is rather coming too close to the maturity target year. Nevertheless a lot can still be achieved especially in the areas of calling our attention to specific areas of concern in term of localising the global goal to our immediate environment.

Main Concern: The summary of Facts and Figures as presented by the UNDP in the developing countries presents an awful and alarming concern in terms of commitment to the achievements of SDGs. The UNDP (2022) reports that:

- Enrolment in primary education in developing countries has reached 91 percent
- About, 57 million primary-aged children remain out of school, more than half of them in sub-Saharan Africa.
- In developing countries, one in four girls is not in school
- About half of all out-of-school children of primary school age live in conflict-affected areas.
- 103 million youth worldwide lack basic literacy skills, and more that 60 percent of them are women.
- 6 out 10 children and adolescents are not achieving a minimum level of proficiency in reading and mathematics.
- Enrolment in primary education in developing countries has reached 91 percent
- Still, 57 million primary-aged children remain out of school, more than half of them in sub-Saharan Africa.

You want to ask; what is the situation in Nigeria?

A recent report by Adeyeye (2020) suggests that a lot still has to be done as Nigeria is still battling with issues of not being able to provide easy access to quality education, infrastructural decadence, shortage of human resources, and poor implementation of policies among others. Consequently, over thirteen (13) million school-aged children are out of school. Nigeria in the 2019 SDG Index Rating ranked 159th among 162 countries in terms of their achievement of the SDGs.

This is to emphasise that the fear for the capability of Nigeria to achieve the SDG-4 is real and therefore needs the support of all.

Expectations from Implementing SDG-4

The parameters to measure the degree or extent of success in the implementation of the SDG-4 are ten (10) namely (United Nations Educational Scientific and Cultural Organization, 2017):

1. By 2030, no children irrespective of their gender of school-age up to the secondary level are out of school by providing free, compulsory primary and secondary education.
2. Provision of functional and high quality pre and early childhood Education to prepare the children for seamless transition to primary school should be in place.
3. Affordable and easy access to quality technical, vocational and tertiary education must be provided for all men and women.
4. Provision and absorption of a good number of youths into profitable and decent vocational fields should have been accomplished by the year 2030.
5. By 2030, issues of gender disparities, discrimination against individuals with disabilities arising from none existing or reduction of access to education should have been eliminated.
6. Efforts must be geared towards empowering all youths and quite significant adult members of the society irrespective of their gender literacy and numeracy must be evidenced.

7. By 2030, ensure all learners must have acquired the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of culture, peace and non-violence, global citizenship and appreciation of cultural diversity and contribution to sustainable development.
8. Construct, renovate and improve educational facilities especially those meant for the children, learners with disabilities without gender discrimination. Such environments should be conducive, safe and instructional engendered.
9. By 2030, globally, the number of scholarships available to developing countries, in particular least developing countries, small island developing states and African countries should have been expanded to allowing for enrolment in higher education, including vocational training and information communications and technology, technical, engineering and scientific programmes.
10. By 2030, there must have been substantial increase in the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing states.

(UNESCO, 2018; UNESCO, 2015; Sustainable Development Solutions Network (SDSN))

A critical analysis of the ten (10) expectations suggests that 3 things are needed for the attainment. These are:

Digital Inclusion and Access to Education (Inclusiveness)

Quality of the System (curricular)

Relevance of the Education System (Societal)

We shall devote our attention in the course of the presentation to examine the roles technology could play in the actualisation of the 3 aspects as highlighted. We should at this juncture ask a pertinent question, what has Nigeria achieved in these three (3) core areas as they relate to SDG-4. The answer to this question will be drawn from documented data on the subject matter with particular reference to Nigeria.

As at 2019, the score that placed Nigeria at 157th of the 162 countries was 46.2%. In 2020, Nigeria was placed at 160th in the ranking order. Since then and now what are evidences of activities at the institutional state and national levels that you are aware of which could have changed the ranking from what it was in 2020. Let us be more practical by asking from the audience a few questions:

- How many pre-primary, primary and secondary school teachers are presently in this auditorium as participants?
- Do you notice increase in student enrolment in your school?
- Would you say Nigeria is committed to wiping our illiteracy among children, youths and Adults
- Are there extant policies encouraging inclusive education?

- Is there a policy promoting non-discriminatory admission into the public schools at the primary, secondary and tertiary levels?
- Are Nigerians ready to accept the necessary changes associated with implementation of SDG-4?
- Would you describe the quality of education offered in Nigeria education system as of high quality?
- Would you describe Nigerian educational system as societal relevance?
- Can you specifically mention some of the measures put in place to allow for unfettered access to education in Nigeria?
- Can technology infusion in any way(s) address some of the inherent challenges being witnessed in Nigeria education system?
- How much of technology has your institution integrated into teaching learning process?
- What actually informed the choice of the technology being adopted or adapted?
- How compatible is the technology in use to your system?
- What is the perception of the teaching staff to the technology to be adopted/adapted?
- How competent are the teaching staff in utilising the technology?
- Are students maximising the advantage of the newly introduced technology?
- Is there any institutional policy on technology integration?

Technology Integration in Education

The common description of the concept 'Technology' as application of scientific knowledge to solving problems is succinct for our discussion. It then can be inferred that most socio-economic, political, educational problems can be solved by applying technology. But I must quickly add that 'technology' should not be understood to mean tools, equipment, gadgets or machines only. Its meaning should incorporate the 'process' aspects. Thus, we are reminded of the two major aspects of our discipline/field of study (EdTech.) These two concepts are: Tech in and Tech of education.

Technology integration on the other hand has been variously defined. However, from the various submissions from Drexel University School of Education (2021), Technohella (2021), David/Reed (2021), Technology integration involves using various and varied products of technology together with application of appropriate pedagogies to aid students learning. In this present context, technology integration implies deployment of technology products in such a manner that guarantees unhindered access to quality, diversified and functional education. Literature has availed us with the different ways by which technology integration can be handled, two of the models are; The SAMR Model and TPACK Framework. The former was developed by Dr. Reuben Puentedura while the latter was introduced by Punya Mishra and Mattew I. Koehler of Michigan State University.

According to Puentedura, the acronym SAMR represents the four levels by which technology integration for instructional delivery at any level of institution could follow. The four categorised levels are hierarchical in structure;

“S” stands for Substitution

‘‘A’’ represents “Augmentation” with,

‘‘M’’ for “Modification” and

‘‘R’’ for “Redefinitions”

The TPACK Framework’s view point on technology integration places premium on the need for consideration of three key elements in media utilisation, these are; Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK). According to the developers of the model, a thorough understanding of the three key areas is necessary for the expected outcomes of technology integration to be effected. Any attempt to ignore the infusion of the three elements in the choice and usage of technology may amount to wastage of efforts and resources.

Benefits of Technology Infusion in Education

It has been established through various research reports that education sector and in particular teaching-learning process has been positively impacted by technology integration. Oluwafisoye (2022), Drexel University School of Education (2021) identified some of the benefits derivable from technology in education to include:

- Keeping students engaged
- Helping students with different learning styles
- Preparing students with life skills
- Ease of access to information
- Saving time
- Ease of Mobility
- Better Communication Means
- Cost Efficiency
- Better learning Techniques among others.

The Connection between Technology Integration, and Open and Distance Learning for the SD-4 Attainment

Open and Distance Learning (ODL) for teacher education is widely utilised around the globe (World Bank 2001; Robinson, 2001; Burpee & Wilson, 1995; Salawu & Aniemeka, 1992). In all, ODL has been effectively utilised to serve three broad categories of teacher education and training.These are initial training of would-be teachers (pre-service), Continuing professional development (in-service training) and curriculum reform.

The importance of the need to recognise ODL as a major strategy to increase access to education, retain studentship and enhance quality was provided during the ravaging COVID-19 Pandemic Period. Schools were locked down completely leaving both the teachers and learners at home without any hope of when schools will resume. Addition to this terrific experience was the Boko Haram insurgency orchestrated with incessant banditry, kidnapping and boundary crises across the country. The prevailing economic situation in the country has added its own toll as hindrances to

having access to education by both school age children and significant proposition of adult members of the society.

ODL in whatever name it is called – Distance Learning (DL), Open Learning (OL), Flexible Learning (FL), E-Learning (EL) and a host of others are peculiar education that is received without the direct presence of the teacher but usually with the aid of one or a combination of technology. In other words, it is the teaching-learning arrangement in which the learner and the teacher are separated by geography, space and time.

In Nigeria, it is a happy thing to note that a good number of activities have been embarked upon to demonstrate the willingness at the governmental institutional and organisational levels to accept the ODL as the way to go in providing quality education with easy accessibility. A few of the efforts include:

1. Establishment of the correspondence and Open Studies Unit (COSU) of the University of Lagos-1971.
2. The National Teachers Institute-1978.
3. Teachers-in-Service Education programme of the Ahmadu Bello University, Zaria and The University of Air (1972).
4. The External Degree Programme of University of Ibadan now Distance Learning Institute (DLI), 1979.
5. National Open University (NOU) now Resuscitated as NOUN (1982).
6. Licensing of 17 Conventional Universities to operate as Dual-Mode Universities by the NUC.
7. Licensing of the very first Private Open Universities by the NUC.
8. Inclusion of Distance Education as a section in the National Policy on Education.
9. Assessment of e-capacity of Nigerian Universities by the NUC.
10. Establishment of the National Educational Technology Centre (defunct) by the Federal Government in 1977.
11. Establishment of learning Resources Centre at the State level.
12. Deregulation of policies on establishment of FM Radio Stations by the National Broadcasting Commission of Nigeria.
13. Establishment of the Federal Government Ministry of Information Technology with auxiliary parastatals.
14. Introduction of General courses in ICT for the would-be teachers and students at the higher institutions.

Recent Efforts at the establishing Open Schooling by the Federal government.

One major area of interest and that which is highly encouraging is the enthusiasm by which proprietors of schools especially private owners of primary and secondary schools as well as management of tertiary institutions accepted the reality of the need to integrate technology into instructional delivery during the COVID-19 pandemic era. The list of the deployed technologies ranged from the simplest to the high tech. Smart Phones, WhatsApp, Telegram platforms etc. were used to send assignments to the pupils in their homes while at the University level, the adoption

of Learning Content Management systems (LCMs) became a vogue. Evidently in most tertiary institutions in Nigeria today, the deployment of ICT in the two forms of Computer-Managed Instruction and Computer-Assisted Instruction is the practice. This has assisted a lot in encouraging interested adult members to acquire education especially at the tertiary level.

Challenges of Technology Integration in Nigeria

There are quite a number of hindrances to the deployment of technology in Nigeria. I will dwell on just a few.

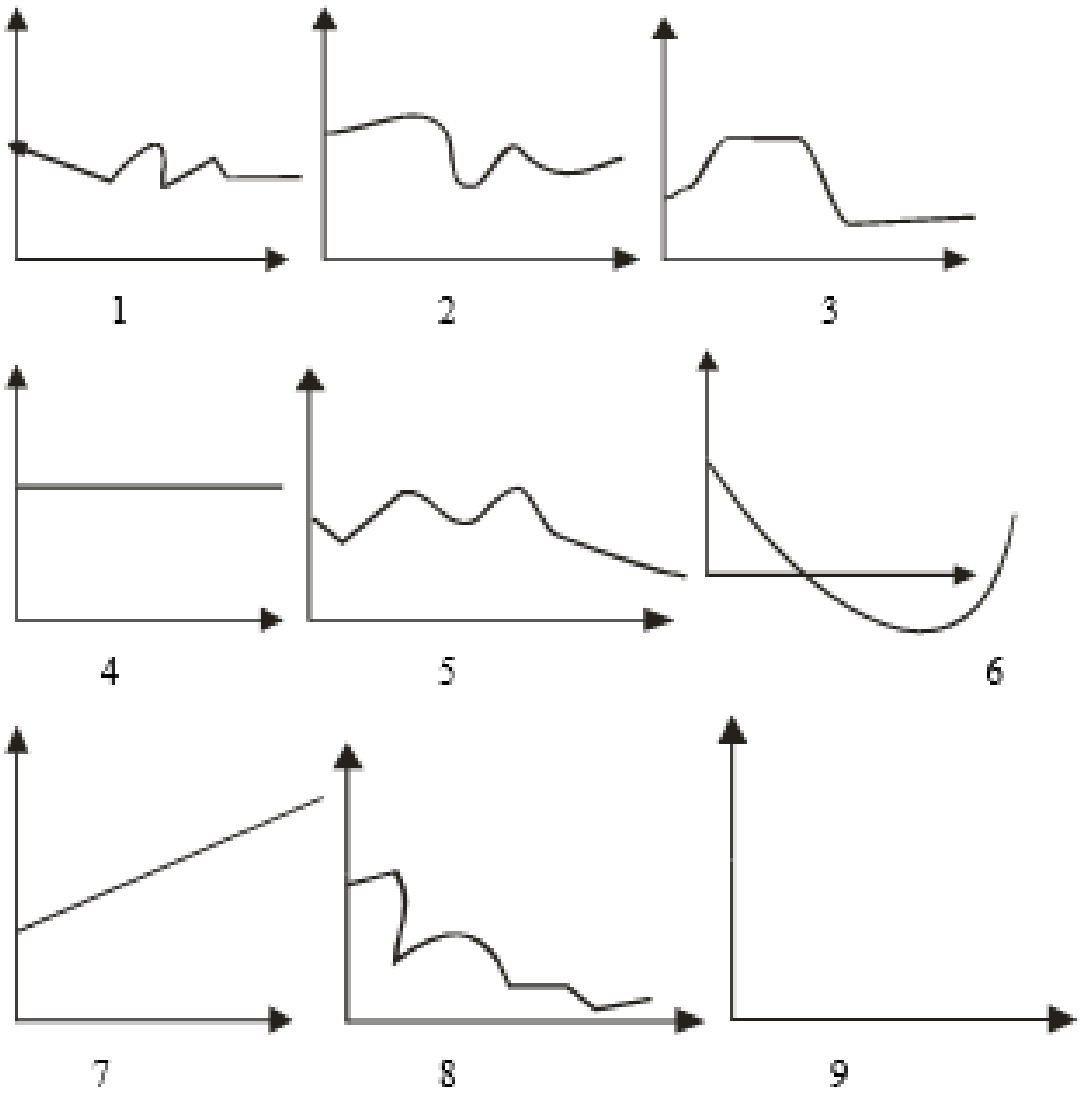
First, the use and drop approach attitude towards technology integration needs to be changed by all concerns. We seem too much in a hurry to adopt the latest technology at the expense of losing the benefits of the earlier ones even at a cost that is colossus. I beg for the understanding of the audience here.

I am not advocating for redundancy or stagnation. But one is of the opinion that our common knowledge of the concept of "Appropriate Technology" should be imbibed. Perhaps, this has been the background to the global advocacy for the adoption of blended instructional strategy. Where the ''Old'' technology is considered still good, it may be of advantage to the third world countries to keep using them together with the latest ones.

Exercise 1

Here are nine (9) different figures showing the possible ways of technology integration by government and institutions.

Instruction: Pick from figures 1-9 below and describe the one you have picked based on your understanding of technology integration by institutions of learning.



Secondly, most Nigerian youths especially those in the rural areas lack ICT competencies. Government may need to intensify efforts at establishing ICT hubs across the country. This could be integrated along the Federal Government Policy on Digital Communication and Economic Empowerment Programmes.

Thirdly, all agencies and other stakeholders in education, the NUC, NCCE, NBTE, NTI, UBEC, SUBEB, Universities, Colleges of Education and Polytechnics (especially those that run teacher education programmes) should be ready to accept reality of the need to adopt ICT by integrating it in the teacher education programme more than ever before. The need for this is simple, one can only give what one has and also in abundance. Teachers are drivers of formal educational system.

Their roles in the accomplishment of the SDG4 is key. It is only when they are well informed and adequately prepared for the task of providing quality education that we should expect them deliver.

Fourthly, Federal Government is advised to fast track the commencement of Open Schooling while other levels of governmental administration should be encouraged to partner the project. By so doing, the number of out of school children will be drastically reduced.

Government at all levels should endeavour to invent more on provision of infrastructure in schools especially at the primary and secondary school systems. Portable, mobile and durable technologies can be provided to the primary and secondary school pupils in a revolutionised manner that will catch the attention of the global community. Individuals, non-governmental organisations, philanthropists and old students associations should not be left out of the clarion call at injecting technology into our educational system. Libraries, Information Centres, Computer Laboratories and projects through which quality education could be provided as such efforts should be geared towards achievement of the SDG4 and even other laudable goals.

The place of data collection and documentation needs to be stressed. The Federal, State and Local Government and agencies that are directly involved in the implementation of SDG-4 must be interested in any little efforts of any institution towards provision of quality education, creating access to education, eradication of literacy and reduction of gender and disabilities stigmatisation.

Achievement and honours received by female Nigerians should be given superlative attention in conventional media and social media. Women should be celebrated to encourage them compete much more favourably than the present situation.

The Advent of Artificial Intelligence (AI)

Artificial intelligence (AI) has several applications in education, including the development of interactive virtual classrooms, the generation of "smart content," the removal of linguistic barriers, the closing of knowledge gaps, and the development of individualized lesson plans for each student.

11 best AI tools for education: (UNESCO International Institute for Higher Education in Latin America and the Caribbean, 2023; McFarland, 2023)

1. Gradescope: The Gradescope AI tool enables students to assess each other while providing feedback, which are often time-consuming tasks without AI technology.
2. Nuance's Dragon Speech Recognition: Nuance provides speech recognition software that can be used by both students and faculty.
3. Ivy Chatbot: Ivy is a set of chatbot AI tools that were specifically designed for universities and colleges. They assist in many parts of the university process, such as application forms, enrollment, tuition costs, deadlines, and more.
4. Cognii: Cognii is AI-based products for K-12 and higher education institutions. It is also deployed in corporate training environments. One-on-one tutoring and real-time feedback customized to each student. Cognii - EdTech Innovation - AI for Education

5. Knowji: Knowji, is an audio-visual vocabulary application that leverages current educational research. Knowji is designed for language learners, and it uses various methods and concepts to help students learn faster.
6. Plaito: Plaito acts as a coach giving prompts and suggestions to move students forward as they write, debate, and collaborate in exciting new ways.
7. Queirum: Querium offers an AI platform that helps students master critical STEM skills while preparing them for college and careers. The platform relies on personalized lessons and step-by-step tutoring assistance.
8. Century Tech: Century Tech offers an AI platform that utilizes cognitive neuroscience and data analytics to construct personalized learning plans for students. In turn, these personalized plans reduce work for instructors, freeing them up to focus on other areas.
9. Carnegie Learning's Platforms: Carnegie Learning, an innovative education technology and curriculum solutions provider, relies on AI and machine learning in its learning platforms for high school and college-level students. These platforms offer many unique solutions for the areas of math, literacy, or world languages.
10. Knewton's Alta: Knewton's Alta is a complete courseware solution that combines adaptive learning technology with openly available content, which helps develop a personalized learning experience for each student.
11. Chaptgpt: ChatGPT is an AI program that uses generative coding to receive, analyses, and produce a response that mimics human natural language. The program uses a transformer-based neural network with a massive database to analyze the input information and create a response.

Conclusion

The potential of technology to address the key targets of sustainable Development Goal-4 are never in doubt but for it to be used effectively for the purpose of fast tracking the achievement of the SDG4 we need to note that Technology integration will thrive when chief executives who are willing to drive it are in office; when the financial implications are not taking for granted; when the driving staff are richly rewarded, when an enabling environment is provided; when its implementation is based on existing policy document and when staff are assisted to upscale their ICT capacity especially in the face of rapid emerging technology.

Mr. Chairman Sir, permit me to declare here that all the points raised at the concluding part of this presentation form the backbone of the National Open University of Nigeria (NOUN) integration of ICT infrastructure in its operation as I finally conclude by recommending the NOUN model for adoption or adaptation by Nigerian institutions and organisations.

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NIGERIAN SENIOR SECONDARY SCHOOL STUDENTS' ENGAGEMENTS OF DIGITAL TECHNOLOGIES FOR LEARNING

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Abstract

This study investigated the Nigerian Senior Secondary School students' utilization of digital technologies for instructional purposes. It also investigated the related motivating factors for students' engagements of digital technologies for learning; challenges facing students on the use of digital technologies; and perceived solutions to the challenges hindering students from engaging digital technologies for learning. Descriptive study of the survey type was used in conducting the study. A total of 600 copies of researcher-designed questionnaires were randomly administered to secondary schools' students in Kwara State out of which 578 respondents participated in the study. Four research questions guided this study and were answered by analyzing the data collected using frequency counts, simple percentages and mean. The findings revealed that aside students and teachers not having sufficient knowledge on the use of digital technologies in facilitating teaching and learning, high cost of digital technologies, subscription to the internet, unstable internet connectivity and erratic nature of electricity were the challenges confronting students from engaging digital technologies for pedagogic experiences. Recommendations were proffered on provision the stable internet connectivity, electricity and procurement of adequate digital technologies. Also, seminars should be organized for teachers and students on judicious engagement of digital technologies in facilitating teaching and learning.

Keywords: Engagement, Learning, Nigerian Secondary School Students, Digital Technologies

Introduction

The deployment and engagement of instructional technology has continued to play a major role for pedagogic experiences within and outside the classroom. Digital technologies are powerful instructional devices that help to improve learning in various ways. The use of these technologies enables instructors to easily generate instructional materials and provides new methods to learn and collaborate (Haleem, Javaid, Qadri & Suman, 2022). The use of digital technologies provide easy access to information, retention of information, enhance increased storage of information and improved presentation of information, thereby enable learning to be more interactive, easy to disseminate knowledge and arouses interest towards learning (Grainger, Liu & Geertshuis, 2021; Lacka & Wong, 2021). It facilitates creativity, thereby encouraging cutting edge thinking

individually and learning outside the traditional techniques. Both developed and developing nations of the world adopts remote learning technologies by using combinations of radio, television, online and mobile platforms to teach and learn.

The emergence of digital era and the use of Internet connectivity worldwide facilitate instructional designers, students and teachers to use advanced digital technology's potential to revolutionise education in such way that effective and efficient instruction is accessible available to everyone and everywhere (Varea, González-Calvo & García-Monge, 2022; Carvalho, Monteiro & Martins, 2022). Traditional classroom instructions fall short of providing an immediate learning environment, faster evaluations, and more engagement; which digital learning tools and technology fill this void via judicious engagements (Vakaliuk, Spirin, Lobanchykova, Martseva, Novitska, & Kontsedailo, 2021). The use of laptops, smartphones and other related digital technologies are becoming very popular among the general public and most especially students in facilitating teaching and learning of various concepts within and outside the classrooms. Some of the efficiencies that the digital technologies provide are simply unrivalled by traditional learning methodologies. The flexibility of technology and non-intrusive nature of digital technologies make learning more appealing, individualistic and collaboratively used for learning. Integrating technology into education provides students with an engaging learning experience, allowing them to remain more interested in the subject without being distracted. The utilisation of projectors, computers, and other related digital devices makes teaching, learning and studying fascinating and entertaining for students. Student learning can become more dynamic and engaging by establishing tasks in class that incorporate technology resources, oral presentations, and group participation (Haleem, Javaid, Qadri & Suman, 2022). The use digital technologies and the internet-enabled gadgets like laptops, smartphones, tablets, Chromebooks, etc.by the students facilitate rapid comprehension of concepts than the the use of "chalk and talk". Instead of taking notes on what the teacher has taught, most of the curriculum is delivered virtually to students through an engaging and interactive platform. The use of the internet has have extended the options for the transmission and access to educational information thereby resulted in the rise of new communication channels. Students learn many concepts and topics on their own by using internet-enabled resources and digital classrooms to update and upgrade their knowledge banks.

Digital technologies have emerged as the saviour of education in this critical time (Javaid, Haleem, Vaishya, Bahl, Suman & Vaish, 2020). Digital technologies assist in developing abilities that will require students' professional performance, such as problem-solving, thinking structure creation, and process comprehension (Araújo, Knijnik & Ovens, 2021); and help to improve the classroom environment by making teaching-learning process become more fascinating and captivating (Seale, Colwell, Coughlan, Heiman, Kaspi-Tsahor & Olenik-Shemesh, 2021). However, some challenges encountered were the newness and acceptance of these devices for teaching and learning. Digital technologies seemed to become a formidable strategy used by both teachers and students to manage initially since traditional instructors are hesitant to include contemporary technology and gadgets in school. Some teachers envision the deployment and engagement of newer technologies as distractions rather than intelligent learning devices (Vakaliuk, Spirin, Lobanchykova, Martseva, Novitska, & Kontsedailo, 2021). Therefore, this study aimed at investigating the Nigerian Senior Secondary School students' utilization of digital technologies for

learning, related motivating factors for students' engagements of digital technologies for learning, challenges facing students on the use of digital technologies and perceived solutions to the challenges hindering students from engaging digital technologies for learning.

Statement of Problem

Globally, there was swift embrace of ICTs utilization and other related digital technologies by all and sundry due to paradigm shift from traditional method of accessing information to the use of digital technologies. Despite the clamouring for utilization of ICT in facilitating pedagogic experiences in many schools, chalkboard, whiteboard, textbooks, charts, radios/televisions and films are being used as instructional materials. Very few institutions can boast of computers, internet facilities and other related facilities. ICT in education is made up of knowledge sharing and transmission, which ICT in education does not necessarily involve physical contact between teachers and students (Orie, 2017). Population explosion of students in Nigerian public secondary schools and the trend of learning styles via engagements with the use of digital technologies compel students to become digital natives.

There seemed to be some perennial challenges that are confronting students from adequate engagement of digital technologies for learning. The use of newer technologies was challenged with high cost of these devices and their judicious usage; which may have detrimental effects on their deployment and engagement for learning. Global Information Technology Report (2012) attested to some challenges plaguing students from engaging digital technologies as inadequate access to digital library, digital classrooms, computer laboratories, computer and other ICT related facilities, internet connectivity, epileptic power supply, wireless applications, multimedia systems and the problem of multimedia courseware development among others.

Kabiru (2019) found out that absence of information about approaches to incorporate ICT to improve the educational program, challenges in coordinating and utilizing diverse of ICT devices and inaccessibility of fund was a significant impediment to fruitful engagement of ICT in various learning institutions in Nigeria. Kennedy (2023) opined that ICT should be fused in a specialized way in order for improvement of instructors and ICT program should be sufficiently robust to upgrade teachers' activity in schools. Hence, this study investigated the Nigerian Senior Secondary School students' utilization of digital technologies for learning, related motivating factors for students' engagements of digital technologies for learning, challenges facing students on the use of digital technologies and perceived solutions to the challenges hindering students from engaging digital technologies for learning.

Purpose of the Study

This study aimed at investigating the Nigerian senior secondary school students' engagements of digital technologies for learning. Specifically, this study:

Found out the secondary schools students' utilization of digital technologies for learning.

Investigated the related motivating factors for students' engagement of digital technologies for learning.

Determined the challenges facing students while using digital technologies for learning.

Found out the perceived solutions to the challenges hindering students from engaging digital technologies for learning

Research Questions

The following research questions guided this study:

1. Do secondary schools students use digital technologies for learning?
2. What is the frequency of students' engagement of digital technologies for learning?
3. What are the challenges facing students on using digital technologies towards learning?
4. What are the perceived solutions to the challenges hindering students from engaging digital technologies for learning?

Methodology

Sample and Sampling Techniques: This research was a descriptive study using the survey approach. The population for this study was all senior secondary school students in Kwara State, Nigeria. A total of 600 copies of researcher-designed questionnaires were randomly administered to secondary schools students in Kwara State out of which 578 respondents participated in the study. The data collected was analysed using frequency counts, simple percentages and mean.

Instrumentation: A researcher-designed questionnaire was used to ascertain the respondents' opinion on senior secondary school students' utilization of digital technologies for learning, related motivating factors for students' engagements of digital technologies for learning, challenges facing students on the use of digital technologies and perceived solutions to the challenges hindering students from engaging digital technologies for learning and the related solutions were proffered. The draft of the instrument was subjected to face and content validity of the items by given instrument to three educational technologists and test and measurement specialists to ensure its suitability. The reviewed draft of the instrument was pilot tested on 40 students outside the domain where the study was conducted. The data collected were analysed using Cronbach alpha in order to measure the internal consistency of the instrument.

Results

The senior secondary school students' responses to the utilization of digital technologies for learning, related motivating factors for students' engagements of digital technologies for learning, challenges facing students on the use of digital technologies and perceived solutions to the challenges hindering students from engaging digital technologies for learning and the related solutions were proffered by collecting, collating and analysed the data using frequency counts, means and percentages to explore engagement among secondary schools students in Kwara State, Nigeria.

A total of 600 copies of researcher-designed questionnaires were randomly administered to secondary schools students in Kwara State out of which 578 respondents participated in the study. Five hundred and seventy- eight (578) male and female senior secondary school students who were

randomly selected and participated in the study. Table 1 shows the analyzed data on research question 1: Do secondary schools students use digital technologies for learning?

Research question 1: Do secondary schools students use digital technologies for learning?

Table 1: Frequency of use of digital technologies for learning

S/N	Item	Mean
1	Camera	2.54
2	Computer	2.73
3	Projector	2.40
4	Internet	2.52
5	Mobile Phones	2.56
	Grand Mean	2.54

Table 1 revealed that use of computer has the highest mean of 2.73; mobile phones has the mean score of 2.56; camera has mean of 2.54 and the use of internet has mean of 2.52 while the use of projector has the lowest mean of 2.40. The grand mean score for utilization of digital media is 2.54. Therefore, it was inferred that students makes use of the digital technologies in facilitating learning.

Research question 2: What are the motivating factors for students' engagement of digital technologies for learning?

Table 2: Motivating Factors for Students' Engagement of Digital Technologies

S/N	Item	Mean
1	Use of digital technologies improves learning	3.10
2	It facilitate learning individually anytime and anywhere	2.52
3	It enhances engagement of students to explore varieties of concepts	2.71
4	Use of digital technologies increases students motivation towards learning	2.10
5	The use of digital technologies facilitate collaborative learning	2.53
	Grand mean	2.59

Table 2 shows the motivating factors for students' engagement of digital technologies for learning. The use of digital technologies improves learning has the highest mean of 3.10; digital technologies enhances engagement of students to explore varieties of concepts has the mean of 2.71; the use of digital technologies facilitate collaborative learning has mean of 2.53; digital

technologies facilitate learning individually anytime and anywhere has mean of 2.52; use of digital technologies increases students' motivation towards learning has the lowest mean of 2.10. Considering the benchmark of 2.5 revealed that access to digital technologies for improved learning, exploration of diverse concepts individually at anytime and anywhere and collaborative learning were the motivating factors for students' engagement of digital technologies for learning. The grand mean score of 2.59 revealed students' consideration as motivating factors on engagement of digital technologies for learning.

Research question 3: What are the challenges facing students on using digital technologies towards learning?

Table 3: Challenges facing students on the use of digital technologies

S/N	Items	Mean
1	Students' inadequate knowledge on the use of digital technologies	2.20
2	Digital technologies are not easily affordable due to their cost	2.73
3	Inadequate knowledge hinder some teachers to engage them for teaching	2.64
4	Subscription to the internet is not affordable	2.65
5	Unstable internet connectivity to engage digital technologies for learning	2.63
6	Erratic nature of electricity mostly hinder their use for learning	2.53
	Grand Mean Score	2.56

The table 3 revealed the challenges facing the use of digital media as thus: digital technologies are not easily affordable due to their cost has the highest mean of 2.73, Subscription to the internet is not affordable has mean 2.65, inadequate knowledge hinder some teachers to engage them for teaching has mean of 2.64; unstable internet connectivity to engage digital technologies for learning has mean of 2.63; erratic nature of electricity mostly hinder their use for learning has mean of 2.53. Students' Inadequate knowledge on the use of digital technologies has the lowest mean of 2.20. The grand mean of challenges facing the use of digital technologies is 2.56. Therefore, it can be inferred that aside that the students are not having sufficient knowledge on the use of digital technologies, digital technologies are not easily affordable due to their cost, subscription to the internet is not affordable, unstable internet connectivity, erratic nature of electricity and inadequate knowledge hinder some teachers to engage the use of digital technologies for teaching.

Research question 4: What are the perceived solutions to the challenges hindering students from engaging digital technologies for learning?

Table 4: Perceived Solutions to the Challenges

S/N	Item	Mean
1	Attending seminar and trainings on the use of digital technologies	2.75
2	Students' self-development to acquire technical skill on the use of digital technologies	2.67

S/N	Item	Mean
3	Internet subscription provider should improve on the connectivity	2.63
4	Subscription to the internet should be subsidized and affordable to learners	2.50
5	Professional development on update teaches skills and knowledge on the use digital technologies should be encouraged	2.55
6	School administrator should procure the needed digital technologies for use	2.74
7	Constant supply of electricity through generating plant or solar source	2.65
	Grand Mean	3.01

Table 4 shows the analysis on the solution to the challenges facing the using of digital technologies in secondary schools. Attending seminar and trainings on the use of digital technologies has the highest mean of 2.75 then the statement that school administrator should procure the needed digital technologies for use has mean of 2.74, also students' self-development to acquire technical skill on the use of digital technologies has mean 2.67 while constant supply of electricity through generating plant or solar source with mean 2.65. Internet subscription provide should improve on the connectivity has mean of 2.63, while professional development on update teaches skills and knowledge on the use digital technologies should be encouraged has mean 2.55. The statement subscription to the internet should be subsidized and affordable to learners has the lowest mean of 2.50. The grand mean of solution to the challenges facing digital media is 3.01. The implication is that challenges facing students towards the use of digital technologies can be remediated via the suggested solutions.

Discussion

This study investigated the Nigerian Senior Secondary School students' utilization of digital technologies for learning, related motivating factors for students' engagements of digital technologies for learning, challenges facing students on the use of digital technologies and perceived solutions to the challenges hindering students from engaging digital technologies for learning were proffered. Based on research questions 1 utilization of digital technologies for instruction, the results of this study agreed with Haleem, Javaid, Qadri and Suman (2022) that digital technologies were frequently utilized for due to the fact that the provide easy access to information, retention of information, enhance increased storage of information and improved presentation of information, thereby enable learning to be more interactive, easy to disseminate knowledge and arouses interest towards learning (Grainger, Liu & Geertshuis, 2021; Lacka & Wong, 2021). Both developed and developing nations of the world adopts the use of remote learning technologies by using combinations of radio, television, online and mobile platforms to teach and learn. The findings from this study concurred with Lacka and Wong (2021) that their frequent utilization facilitates creativity, thereby encouraging cutting edge thinking individually and learning outside the traditional techniques.

Based on research questions 2 on the motivating factors for students' engagement of digital technologies for learning, this study corroborates Javaid, Haleem, Vaishya, Bahl, Suman and Vaish (2020) that student learning can become more dynamic and engaging by establishing tasks in class

that incorporate technology resources, oral presentations, and group participation. The use digital technologies and the internet-enabled gadgets like laptops, smartphones, tablets, Chromebooks, etc.by the students facilitate rapid comprehension of concepts than the use of "chalk and talk". Instead of taking notes on what the teacher has taught, most of the curriculum is delivered virtually to students through an engaging and interactive platform (Haleem, Javaid, Qadri & Suman, 2022). Students learn many concepts and topics on their own by using internet-enabled resources and digital classrooms to update and upgrade their knowledge banks. Digital technologies assist in developing abilities that will require students' professional performance, such as problem-solving, thinking structure creation, and process comprehension (Araújo, Knijnik & Ovens, 2021); and help to improve the classroom environment by making teaching-learning process become more fascinating and captivating (Seale, Colwell, Coughlan, Heiman, Kaspi-Tsahor & Olenik-Shemesh, 2021).

Research question 3 on what are the challenges facing students on using digital technologies towards learning? The study agreed with Vakaliuk, Spirin, Lobanchykova, Martseva, Novitska, and Kontsedailo, (2021) that there some perennial challenges that are confronting students from adequate engagement of digital technologies for learning. Some teachers envision the deployment and engagement of newer technologies as distractions rather than intelligent learning devices (Kennedy, 2023). The use of newer technologies was challenged with high cost of these devices and their judicious usage; which may have detrimental effects on their deployment and engagement for learning. Global Information Technology Report (2012) attested to some challenges plaguing students from engaging digital technologies as inadequate access to digital library, digital classrooms, computer laboratories, computer and other ICT related facilities, internet connectivity, epileptic power supply, wireless applications, multimedia systems and the problem of multimedia courseware development among others. Kabiru (2019) found out challenges in coordinating and utilizing diverse of ICT devices and inaccessibility of fund was a significant impediment to fruitful engagement of ICT in various learning institutions in Nigeria.

Research question 4 provided answers on what are the perceived solutions to the challenges hindering students from engaging digital technologies for learning? The findings from this study agreed with Kennedy (2023) opined that ICT should be fused in a specialized way in order for improvement of instructors and ICT program should be sufficiently robust to upgrade teachers' activity in schools through attending seminar and trainings on the use of digital technologies, students' self-development to acquire technical skill on the use of digital technologies. Digital technologies assist in developing abilities that will require students' professional performance, such as problem-solving, thinking structure creation, and process comprehension (Araújo, Knijnik & Ovens, 2021); and help to improve the classroom environment by making teaching-learning process become more fascinating and captivating (Seale, Colwell, Coughlan, Heiman, Kaspi-Tsahor & Olenik-Shemesh, 2021); of which internet connectivity should be improved upon, likewise the subscription to the internet should be subsidized and affordable rate to the users (Kennedy, 2023; Vakaliuk, Spirin, Lobanchykova, Martseva, Novitska, & Kontsedailo, 2021); professional development on update teaches skills and knowledge on the use digital technologies should be encouraged (Varea, González-Calvo & García-Monge, 2022); school administrator

should procure the needed digital technologies for use, constant supply of electricity through generating plant or solar source (Carvalho, Monteiro & Martins, 2022).

Conclusions

The findings from this study revealed that most students frequently use the available digital technologies in facilitating learning. Considering the motivating factors on engagement of digital technologies for learning, access to digital technologies for improved learning, exploration of diverse concepts individually at anytime and anywhere and collaborative learning were the related factors that motivate students to engage the use of digital technologies for learning. However, aside that the students are not having sufficient knowledge on the use of digital technologies, digital technologies are not easily affordable due to their cost, subscription to the internet is not affordable, unstable internet connectivity, erratic nature of electricity and inadequate knowledge hinder some teachers to engage the use of digital technologies for teaching. The perceived solutions to remediate the challenges are: organizing seminar and trainings on the use of digital technologies for teacher and students, students' self-development to acquire technical skill on the use of digital, technologies, internet subscription provider should improve on the connectivity, subscription to the internet should be subsidized and affordable to learners, professional development on update teaches skills and knowledge on the use digital technologies should be encouraged, school administrator should procure the needed digital technologies for use and constant supply of electricity through generating plant or solar source.

Recommendations

To remediate the perceived challenges confronting students on the use of digital technologies, the following recommendations were suggested:

1. Seminars should be organized for teachers and students on judicious engagement of digital technologies in facilitating teaching and learning
2. Students' self-development to acquire technical skill on the use of digital should be encouraged.
3. Teachers' professional development on knowledge and skills to acquire on the use digital technologies for teaching.
4. Internet subscription provider should provide stable internet connectivity.
5. Internet subscription should be subsidized, affordable and accessible to students.
6. School administrator should procure the needed and adequate digital technologies.
7. Constant supply of electricity should be provided through generating plant or solar source.

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TEACHERS' REFLECTIONS IN THE USE OF OPEN TECHNOLOGIES FOR INCLUSIVE EDUCATION

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Abstract

This study deals with teachers' reflections in the use of open technologies for inclusive education in a school with special educational needs. It was argues that steady progress has been made to facilitate inclusive education in educational settings over some period of time towards educating more learners with special needs in conventional schools, particularly learners not only with tasking learning challenges but mental, sensory handicaps and physical. More so, open technologies are being instituted and approved in various educational settings, its provide privilege for innovation and for making learning processes more engaging, collaborative and encompassing and above all, making the learning material more available, accessible, and meaningful for learners with learning disabilities. However, though open technologies have been instituted and approved in various educational setting, much as not been reported on teachers' reflection in the use of it for inclusive education, in School of Special needs in Kwara State. This study employed a qualitative research design of phenomenology type to capture six teachers' reflections on the use of open technologies for inclusive education through interview and observation. The collected data was analysed in line with the theoretical framework of reflections. Results showed that teachers adapted the conventional open technologies strategies to the level of learners who had positive learning experiences with technological tools. More So, it was acknowledged that teachers need professional training and development in the use of open technologies for inclusive education.

Keywords: Information and Communications Technology, inclusive education, open technologies, learners with special educational needs, reflection.

Introduction

Dewey (1910) referred to reflective practice as: "an active, persistent, and careful consideration of one's belief or its supposed form of knowledge in the light of the grounds that support it, and the conclusions to which it tends". Donald (2022) opined that reflective practice is the ability to reflect on one's actions so as to engage in a process of continuous learning. Thus, reflective practitioners are educators who builds, examine knowledge about learners, the culture and curricula of schooling, and the context in which teaching and learning occur (Wisconsin Lutheran College, 2018). Makoelle (2017) contend that learners' learning difficulties emanate from poor focus and concentration, below average concrete and logical reasoning, poor fine motor skills as a result of low muscle tone, problems associated with visual perception and auditory discrimination, as well

as a low self-esteem and social difficulties. Thus, the use of open technologies in the teaching and learning process by teachers can make huge differences to life experiences of their learners and including those who are experiencing learning difficulties in the learning process (Dikusar, 2018).

Background to the use of Open Technologies in Inclusive Education

Szczytko, Carrier & Stevenson (2018) stated that Inclusive education has the potential to improve learning outcomes of students with special needs, these learners have varying cognitive, physical, emotional, and behavioral learning needs. They demonstrate diverse abilities and academic achievement. In support for students with special needs, the Nigeria Government drafted The National Policy on Education for Special Needs (NPE) 2015 on Inclusive Education to accommodate all learners with learning disabilities in schools. The justification of the policy on inclusive education and training is to: (i) acknowledge that all children and students can learn and need support; (ii) acknowledge and respect differences in learners while building on similarities; (iii) foster attitudes, behaviour, teaching methods, curricula and learning environments that meet the needs of all learners, and (iv) uncover and minimize barriers to learning.

Studies has shown that the major objective of any education system in a democratic society is to provide quality education for all learners, including those with physical, mental and socioeconomic challenges, so that they will be able to reach their full potential and contribute meaningfully to their host society and make a living throughout their lives. UNESCO (2020) affirms that education is a fundamental human right for everyone. Nigeria has inculcated an inclusive education policy to teaching and learning to address barriers to learning in the education setting. Similarly, inclusive education is seen as a process of addressing and responding to the diversity of needs of all learners through increasing participation in learning. It involves modifications in content, approaches, Methodologies and strategies, with a common vision which covers all children of the appropriate age range and a conviction that it is the responsibility of the regular system to educate all children (United Nations Educational, Scientific and Cultural Organization, 2005). However, it was noted by Conway (2017) that the implementation of this policy is hindered by the bereft of teachers' knowledge and skills in differentiating the curriculum to address the extensive needs of the learners. Therefore, in order to support teachers in the implementation of inclusive education, the Nigeria Government in 2015 drafted a policy via The National Policy on Education that upholds that every Nigerian learner with special needs should have access to the use of Information and Communications Technology (ICT).

Information and Communication Technologies (ICTs) in teaching and learning is use to enhance knowledge sharing and the delivery of courses (Randa, Ghadeer, & Aayat, 2016). Gregorian (2017) opined that through the help of ICT, students have been able to gain more expertise and techniques by communicating with others. ICT is all about networking, using the online platform to communicate with students in order to improve their skills. In a study conducted by Fransson, Lindberg and Olofsson (2018) and Mare (2019) it was reviewed that Technologies like Microsoft package (PowerPoint, MSWord, Excel, or Access), videos and sound files; tablets, smartboards, can be linked to computers, projectors and to the cloud so that learners and teachers can communicate through text, drawings and diagrams.

More So, using ICT in education provide more teaching and learning tools for both students and teachers to help them learn according to their pace, the Federal Government of Nigeria through the Universal Basic Education Broad introduced Smart School in Some State with facilities like smartboard (paperless) classrooms while some State uses mobile devices, such as tablets, to transform teaching and learning in the province and certainly to keep learners engaged in their learning process (Ifeduba, Ohikhena and Alabi, 2013). This studies uses reflections as a theoretical framework in the interpretation, understanding and challenges teachers faced in teaching with open technologies in inclusive education. Reflection is defined by Dewey (1938) as a performance of an individual where one actively and consistently involves in meditation of related experience and practice to make it more meaningful and successful. For Schön (1983) reflection is the element that turns experience into learning. This concept has been acknowledged as important element of effective teaching and it was from that continuing conversation that the term "reflective practitioner" emerged (Schön, 1987). Accordingly, reflective practitioner is someone who actively engages in thinking about teaching with the express intent that reflections about those experiences to inform future practice (Arslan, 2019).

It was noted that there are three major styles of reflective practice, consistent with (Schön, 1983; Killion and Todnem 1991; Farrell, 2012), reflection on-action is a reflecting on how practice can be developed, changed or improved after the occurrence of the event and reflection-in-action is reflecting on the situation while changes can still be made in other to affect the outcome. Critical reflection is the third style of reflection that is defined by Mezirow (1997) as a transformative learning in that we are encouraged to view learning as a process of becoming aware of our own assumptions and revising them. Cranton (2002) posited that critical reflection deals with beliefs and assumptions and ways of assessing their validity in the light of new experiences or knowledge, considering their sources, and examining underlying premises in the teaching practice. However, though there are different types of reflections in teaching practice, it was noted that teachers lack skills and knowledge of implementing inclusive education and how to teach with open technologies. Hence, the objective of this study majorly based on the teachers' reflections in the use of open technologies for learning in inclusive education. Specifically, based on the main objective, the following questions were raised and answered to address the study objective.

1. Do the School leadership and management implement learning technologies policies in your School?
2. Is there support by the management in other to integrate open technologies into your teaching?
3. Do your ICT skills affect the teaching and learning activities in your classroom?
4. Do your students benefit from the use of ICT in the school?
5. Do you have access to newer ICT resources for teaching and learning?

Methodology

This study uses a qualitative research design of Phenomenology types. Phenomenology is basically looking into the 'lived experiences of the respondents and aims to explore how and why respondents behaved a certain way, from their view and perspective. The Phenomenology in the context of this study is to examine teachers' reflections in the use of open technologies for teaching

in a school of students with special needs in Ilorin, kwara State. There are a total of 35 staff members in the school and six teachers were purposefully selected for this study based on their experiences. A semi structured interview was conducted to gain an in-depth understanding based on the research purpose and the researcher is a non-participant. This study looked into two categories of learner: Severe mentally handicapped and Mild Mentally Handicapped. This was emanated from medical reports brought to the school as admission requirement. The study also looked into the Learners profile which indicate the level and nature of support needed by the learners.

A semi-structured interview with six teachers was conducted in order to gain an in- depth understanding of how they reflected in their teaching process when using open technologies in teaching students with special needs. Two teachers who participated in the semi-structured interview were further asked to participate in individual interviews in order to expatiate further on how they reflected in their teaching process when using open technologies for teaching in inclusive education. Observation was used as a method of data collection and six teachers were observed on how they used open technologies on their students in the laboratory. Documentary sources that are relevant were used to describe the case of how teachers used technological tools to support their Students and for their professional development.

Method of Data Analysis

This study used a qualitative content analysis for describing the meaning of collected qualitative data. It is worth noting that regardless of the many kind of qualitative data one generate, it is important to follow the step by step processes when presenting qualitative data. After collecting the qualitative data, the researcher abides by the six steps (Table 1) identified by Merriam (2014). The analysis is done as a way of answering the research questions. The result obtained was use to judged based on the objective of the study.

Table 1. Step by step processes in presenting qualitative data

Step	Description
Familiarising with the data	Reading, Transcription, Proofreading and assigning of ideas
Generating initial Codes	Coding interesting feature in a systematic manner in the data se and organizing important points in each code
Themes Search	Gathering relevant data into themes and collecting code into major themes
Revisiting the themes	Checking the themes information that relates to the code extracts and the whole data set
Defining the themes	Defined the specific themes and the information by generating clear definition and nice names for the theme
Producing the report	This segment involve the selection process through the processed data by relating the analysis to research questions and literature.

Source: (Merriam, 2014).

Do the School leadership and management implement learning technologies policies in your School? (QRQ1)

It was noted by one of the teachers that the leadership and management structure of the school were not using information technologies policies in the teaching and learning as stated the in the policy book. Another teacher from individual interviews noted that the school was not utilizing ICT policies, indicating that: "Policies in ICT are in place but not used for teaching and learning". The comment of this teacher is corroborated by another teacher that: "ICT policy is on ground but not well actualized for teaching and learning". It was deduced that the Management and school head have not created a clear and distinct plan or a schedule for both the teachers and learners to have access to the computer laboratory.

Another teacher reflected that when she has to access the laboratory: "…she has to be on ground in other to take her learners down to the computer laboratory". This teacher's reflection shows that teachers have limited access to the use of open technologies when they have to take learners to the computer laboratory and this was in line with Navsaria, Pascoe, & Kathard, (2011) that management and school head do not provided the necessary support for teachers to integrate the use of ICT.

Is there support by the management in other to integrate open technologies in to your teaching? (QRQ2)

Regarding support by the management and school head to integrate open technologies into teaching and learning process, a teacher reflected that: "There is not enough support, each teacher will have to see to it, on his own he will have to see how he will be able to integrate the use of technologies it was also noted by another teacher that he once brought his personal generator to school to use in the laboratory and he was not reinforced by the school head. It was noted by Sangra & González-Sanmamed, (2010) that lack of support can be attributed to the lack of vision amongst the management structure of the school to develop ICT policies that support the use of ICT tools for achieving educational goals.

Do your ICT skills affect the teaching and learning activities in your classroom? (QRQ3)

It was noted by a teacher that he his computer literate and he believe that with his level in the use of ICT that it will have positive impact on his learners and his claim was support by Adeoye, Oluwole, and Blessing (2013) that ICT promotes teaching and learning through its interactive and engaging contents and also provides the needed opportunities for individualize learning for student's despite, it was also noted by another teacher that she lack ICT knowledge but depict the lack of teachers' competence and ICT skills, learners were able to complete some activities given to them in the laboratory this was confirmed during the observation and another teacher also confirmed that: "… they work to get to the end product. I think it works well they can type, draw, insert they can even print, looking at what they have done".

As your students benefited from the use of ICT? (QRQ4)

A teacher posited that his students have benefited from the use of ICT. Some of my students can now operate basic ICT gadget like phone on their own. This confirmed that learners can use ICT tools to complete some activities and this claim was supported by her colleague:

"Yes, on the benefit of ICT there are some who benefited because they now learn at their own pace".

Teachers reflected that the use of ICT tools support learners who are under-achieving: "I think it can be used more especially in school because we have learners who are able to comprehend what you are teaching them but because they cannot put it into writing, because of in a school of special needs, fine motor skills are not yet developed. With the use of the keyboard, mouse and joy stick they can be able to give you the correct answer". Teachers were aware that any ICT tool that is available can be used to support learners in achieving their learning activities. It was reviewed during the observation that some students are in the computer laboratory using the computer system on their own.

Do you have access to newer ICT resources for teaching and learning? (QRQ5)

It was noted by a teacher that the schools of Special needs are allocated with little budgets to procure ICT resources, making it difficult for teachers to access various forms of currently available technology. The unavailability of ICT resources was confirmed from individual interviews by one of the teacher:

"…we have limited numbers of computers, IPad, overhead projectors, the white boards, video cameras, digital camera and some are outdated".

Despite the unavailability of ICT tools, teachers have limited access to the computer lab. It was also noted by another teacher that as a result of the school's timetable structure they have limited access to the computer laboratory. One teacher reflected that: "… for the purpose of teaching and learning, I have not been to computer lab because we go with the timetable… So we have not had the chance yet to use the computer lab". To be able to use computer you need to be there every day, you have to practice it every day to understand it better".

It was reviewed during the observation that the system of timetabling denied teachers access to the computer laboratory. It was also deduced from the reflection made by one of the teachers that:

"I use resources like posters, charts and sometimes real objects to teach. I will love to integrate the use of ICT gadgets if the timetable give room for its usage".

Even with the limited technological resources, teachers were not able to use them within the curriculum as a result of the structure of the school's timetable. Sangra et al., (2015) opined that effective use of ICT can provide students with more opportunities to be exposed to advanced technologies and improved students' performance if teachers have unlimited access to resources and services.

Discussion of Findings

Teachers reflected that Information and Communications technologies policies are not well utilized by the school management and other stakeholders. It was observed that ICT/open technologies policies are not used for teaching and learning in school of special needs instead Learner's Supportive Material are used, such as hearing aids. This is inconsistent to the National Policy on education for Special Needs. Similarly, teachers reflected that there is no proper plan for

accessing the computer laboratory for teaching and learning. Due to a lack of a special ICT curriculum for Special needs students. Critical reflection enabled teacher to reflect on their own limitation of ICT skills in the teaching activities in the classroom. This reflection gives the teachers the opportunity to reflect on their own strengths or weaknesses. Despite some teachers' lack of competence and ICT skills, learners were able to complete the activities. Teachers reflected that the timetable structure of the school limit them to access the use of ICT resources for teaching and learning. Teaching with learning technologies one needs to have access to the computer laboratory at least every day but unfortunately that is not the case, as there is no time on the timetable to access the computer laboratory. Using computers at the school is treated in isolation. Teachers also reflected that learning with open technologies, learners had positive outcomes in the learning process irrespective of their learning levels or the differences in the learning areas.

Conclusion

The reflection as a theoretical framework of this study is an active and careful consideration of one's belief and knowledge in a given situational context. The aim of this study is to examine teachers' reflections in the use of open technologies for learning in inclusive education. The research question that this study answered is: What are the teachers' reflections in the use of open technologies for learning in inclusive education? This is how the research question was answered - teachers reflected that (i) information and communication technologies policies are not implemented by the school management; (ii) on their own limitation of ICT skills in the teaching and learning process; (iii) they need professional development to use ICTs for learning in inclusive education; (iv) funding and the timetable structure limit their access to use ICT resources for teaching and learning and (v) learning with open technologies learners can improve in the learning process. Recommendations and scope for further research are needed, since only six teachers participated in this study out of 35 teachers and it is recommended that more teachers should be part of enquiry, a further study is needed that include learners' reflections in the learning with open technologies.

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SDG-4: OPEN TECHNOLOGIES FOR LEARNING: EXPLORING RESEARCHERS' PERCEPTION AND INTEREST TOWARDS THE USE OF GOOGLE FORMS FOR DATA COLLECTION IN NORTH-CENTRAL NIGERIA

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Abstract

This study investigates SDG-4: Open Technologies for Learning: Exploring Researchers' Perception and Interest Towards the use of Google Forms for Data Collection in North-Central Nigeria. The study has three objectives, three research questions and three corresponding hypotheses. The study adopted the descriptive survey research design. The population of the study consists of 1,714 lecturers from state colleges of education in North-Central Nigeria, a sample size of 171 was obtained using the purposive sampling technique. The instrument for data collection titled "Researcher's Perception and Interest Questionnaire (RPIQ)" was used to collect data from researchers in academic institutions in North-Central Nigeria. The data was analyzed using mean and standard deviation while the hypotheses were tested using the independent t-test statistics. Findings of the study revealed that researchers have a negative perception towards Google Forms for data collection. Researchers had a positive perception and showed interest in Google Forms for data collection. The hypothesis testing revealed that there is no significant difference between male and female researchers in North-Central Nigeria in their perception and interest towards Google Forms for data collection. Based on the findings, recommendations were made amongst others; Institutions should encourage the use of Google Forms for data collection.

Keywords: Google Forms, Perception, Interest, Gender.

Introduction

The Sustainable Developmental Goal (SDG4) stands for Quality Education which aims to ensure inclusive and equitable quality education for all and promote lifelong learning opportunities. Within SDG 4, the specific target of "Open Technologies for Institutional and Corporate Learning" recognizes the transformative role of technology in education (United Nations, 2015). Technology has revolutionized education, making it more accessible, engaging, and interactive (UNESCO, 2017). In the context of research, technological advancements have significantly impacted the data collection process. Researchers now have access to various tools and methodologies, such as surveys, experiments, case studies, and observations, which contribute to the systematic and scientific inquiry process (Creswell, 2014).

Google Forms is an open technology that provides accessibility and availability to a wide range of users. It is an online survey tool offered by Google, allowing individuals and organizations to easily create customized surveys and collect data without the need for advanced technical skills (Google Forms, n.d.). The user-friendly interface makes it accessible to users with different levels

of technological proficiency. Being a web-based tool, Google Forms can be accessed from any internet-connected device, offering flexibility and convenience to users (Google Forms, n.d.). This open access enables researchers, educators, and professionals from various fields to utilize Google Forms for data collection in their respective domains. Additionally, Google Forms integrates with other Google tools like Google Sheets and Google Drive, facilitating collaboration and efficient data management (Google Forms, n.d.). The integration with these open technologies enhances the overall usability and functionality of Google Forms, making it a valuable resource for institutional and corporate learning. Google Forms, as an online survey tool, has become widely used for data collection in research studies (Vasantha & Harinarayana, 2016). Its ease of use, customization options, and integration with other Google tools have made it popular among researchers (Jazil et al., 2020; Ahmed & Rehman, 2021). Google Forms has been particularly beneficial for researchers in North-Central Nigeria, where it has been utilized for data collection (Yakkop et al., 2021).

Perception refers to the interpretation and understanding of sensory information from our surroundings. It involves cognitive processes such as attention, sensation, and interpretation. The perception of researchers towards Google Forms is generally positive, considering it a valuable resource for data collection (Yakkop et al., 2021; Alharbi et al., 2021; Rahmania, 2021). Interest refers to a person's curiosity, attention, and attraction towards a particular topic, activity, or idea. It is a psychological state that motivates individuals to explore and engage with a specific area of knowledge or experience. Researchers have shown a high level of interest in using Google Forms due to its user-friendly interface and features like real-time data collection and analysis (Nurmahmudah & Nuryuniarti, 2019; Yakkop et al., 2021). The integration of open technologies like Google Forms for data collection aligns with the goal of promoting inclusive and equitable quality education through innovative approaches (United Nations, 2019). By utilizing open technologies like Google Forms, researchers can enhance the efficiency and accessibility of data collection, ultimately contributing to the advancement of knowledge and the improvement of educational practices.

The use of open technologies, such as Google Forms, for data collection in research studies has gained popularity in the field of education. However, there is a lack of comprehensive understanding regarding researchers' perception and interest towards the use of Google Forms for data collection in North-Central Nigeria (Abubakar & Akor, 2017; Al-Mustapha et al., 2022). Despite the growing interest in open technologies for data collection in educational research, limited literature specifically focuses on researchers' perception and interest towards the use of Google Forms in the context of institutional and corporate learning. Existing studies have primarily explored the general benefits and features of Google Forms in data collection (Nayak et al., 2019), but there is a dearth of research that investigates perception and interests of researchers in North-Central Nigeria towards this tool. Furthermore, while some studies have examined the use of online survey tools in educational research, there is limited research that delves into the perceptions and interests of researchers towards open technologies like Google Forms. Hence, this study aims at Researchers' Perception and Interest Towards the use of Google Forms for Data Collection in North-Central Nigeria

Purpose of the Study

The aim of this study is to explore Researchers' Perception and Interest towards the use of Google Forms for Data Collection in North-Central Nigeria. Specifically, the study aims to achieve the following objectives. To;

1. Examine the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
2. Examine the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
3. Examine the gender difference in the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection.
4. Examine the gender difference in the interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

Research questions

1. What is the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
2. What is the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
3. What is the gender difference based on the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
4. What is the gender difference based on the interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Research Hypotheses

H01: there is no significant difference of male and female researchers on their perception towards Google Forms for data collection.

H02: there is no significant difference of male and female researchers on their interest towards Google Forms for data collection.

Literature Review

In a study conducted by Da Silva and Albuquerque (2018), Google Forms was used to collect data on the perceptions of Brazilian university students regarding the use of mobile devices in the classroom. The authors found that Google Forms was an efficient and effective tool for data collection, as it allowed for the collection of large amounts of data in a short period of time. The authors also noted that the use of Google Forms reduced the risk of errors in data entry and simplified data analysis. In another study, Kim et al., (2017) used Google Forms to collect data on the opinions of Korean nurses regarding the use of mobile devices in nursing practice. The authors found that Google Forms was a convenient and efficient tool for data collection, as it allowed participants to complete the survey at their own convenience and eliminated the need for paper-based surveys. Similarly, a study by Alsharari et al., (2021) utilized Google Forms to collect data on the attitudes of Saudi Arabian students towards the use of smartphones in education. The

authors found that Google Forms was an effective tool for data collection, as it allowed for the easy distribution and completion of surveys, as well as simplified data analysis. One empirical study on researchers' attitudes towards Google Forms was conducted by Han and Ellis (2019). The study aimed to investigate the perceptions of researchers in the field of information and library science towards using Google Forms for research data collection. The study found that most participants had a positive attitude towards using Google Forms, citing its ease of use, accessibility, and cost-effectiveness as benefits. However, some participants expressed concerns about data security and privacy.

Methodology

The study adopted a survey research design to collect information from respondents using questionnaires. This design is suitable for describing, analyzing, and interpreting the prevailing circumstances at the time of the study. The population for this research comprises seven state colleges of Education located in North-Central Nigeria, namely Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and the Federal Capital Territory (FCT). These colleges include College of Education Oju in Benue State, Kogi State College of Education Ankpa, Kwara State College of Education, College of Education Akwanga in Nasarawa, Niger State College of Education, College of Education Gindiri in Plateau State, and FCT College of Education in Zuba. The total population across these states consists of 1,714 lecturers, 37 faculties, and 169 departments.

Table 1 Population of the study

S/N	States	Colleges of Education	Lecturers	Faculties	Departments
1	Benue	College of Education Oju	215	5	22
2	Kogi	Kogi State College of Education Ankpa	280	6	32
3	Kwara	Kwara State College of Education	157	6	19
4	Nasarawa	College of Education Akwanga	310	5	24
5	Niger	Niger State College of Education	271	3	22
6	Plateau	College of Education Gindiri	249	6	24
7	FCT	FCT College of Education, Zuba	232	6	26
Total			1,714	37	169

The study utilized purposive sampling to select samples from four state Colleges of Education in North-Central Nigeria. Purposive sampling is a non-probability sampling method based on the researcher's judgment, allowing for samples to be drawn from the population. The selection of the four colleges was based on accessibility for field study and data collection. This sample represents 57% of the total population of state-owned Colleges of Education in the region. A total of 171 lecturers, representing 10% of the lecturer population, were selected using stratified sampling from the four selected colleges. This sample size was considered appropriate, as it falls within the recommended range of 10-20% for research work. The sample included lecturers from six faculties

and 41 departments, representing 10% of the total population of faculties and departments. The sample distribution table is shown below:

Table 2: Sample Distribution of States Colleges of Education, Lecturers, Faculties and Departments for the Study.

S/N	Colleges of Education	Lecturers	Faculties	Departments
1	College of Education Akwanga	41	2	12
2	Niger State College of Education	50	1	6
3	College of Education Gindiri	40	2	12
4	FCT College of Education, Zuba	40	1	11
	Total	171	6	41

Research Instrument

A twenty-item questionnaire titled "Researcher's Perception and Interest Questionnaire (RPIQ)" was developed for the study. The questionnaire utilized a 4-point Likert scale, with response options ranging from Strongly Agree-4 (SA) to Strongly Disagree-I (SD). The questionnaire underwent expert scrutiny and appraisal by professionals from the Department of Curriculum and Instruction, School of Education, FCT College of Education Zuba. The experts evaluated the instrument's appropriateness (face validity), comprehensiveness (content validity), and clarity in terms of relevance and language. To determine the instrument's reliability, a pilot test was conducted involving 30 lecturers from two state universities who were not part of the study's sampled subjects but belonged to the overall population. The scores obtained from the pilot test were analyzed using the Cronbach alpha reliability method, resulting in a reliability coefficient of 0.89. Anikweze (2009) revealed that a reliability index above 0.8970 indicates sufficient reliability for measuring variables in research.

Method of Data Collection and Analysis

One hundred and seventy-one (171) questionnaires were distributed to lecturers in the state colleges of Education in four selected states (Nasarawa, Niger, Plateau, and FCT) in North-Central Nigeria. The researcher enlisted the help of four research assistants who were assigned to administer the questionnaires in their respective states. The instruments were administered and collected within one week, with an effort made to collect responses on the spot to minimize the risk of loss or missing questionnaires. The research questions were analyzed using mean and standard deviation, comparing the obtained mean averages to the benchmark value of 2.50. Mean values above 2.50 were considered as “agree” while mean values below 2.50 were considered as

"disagree". The hypotheses were tested using t-test statistics in SPSS (Statistical Package for Social Sciences) at a significance level of 0.05.

Data Analysis

Research Question 1: What is the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Table 3: Perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

S/N	Items	N	Mean	Std.	Decision
1	I am familiar with Google Forms	171	2.42	0.880	Agree
2	Data collected through Google Forms are reliable and accurate	171	2.47	0.897	Agree
3	I find it easy to create a survey using Google Forms	171	2.45	0.953	Agree
4	Google Forms is user friendly	171	2.52	0.972	Agree
5	I encounter technical issues while using Google Forms	171	2.35	0.972	Agree
	Grand Mean		2.44		Agree

Decision mean: 2.50

Table 3 shows the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection. The mean score for item 1 ("I am familiar with Google Forms") is 2.42, which is slightly below the neutral score of 2.50. This suggests that respondents have a slightly negative perception of their familiarity with Google Forms. Item 2 ("Data collected through Google Forms are reliable and accurate") is 2.47, which is also slightly below the neutral score of 2.50. This suggests that respondents have a slightly negative perception of the reliability and accuracy of data collected through Google Forms. The mean score for item 3, 4 and 5 which is below the neutral score of 2.50, suggests that respondents have a negative perception towards Google Forms. The grand mean of 2.44 suggests that respondents generally have a slightly negative perception of Google Forms.

Research Question 2: What is the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Table 4: Interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

S/N	Items	N	Mean	Std.	Decision
1	I am interested in learning more about the features of Google Forms for research purposes.	171	2.87	1.027	Agree
2	I find Google Forms to be an exciting tool for data collection in research.	171	2.87	1.051	Agree
3	The use of Google Forms for research purposes sparks my curiosity.	171	2.77	1.031	Agree

S/N	Items	N	Mean	Std.	Decision
4	I am eager to explore the capabilities of Google Forms for my research projects.	171	2.78	0.981	Agree
5	I have a strong desire to incorporate Google Forms into my research methodology.	171	2.73	1.056	Agree
6	I am motivated to use Google Forms for data collection in my research projects.	171	2.75	0.993	Agree
7	The potential benefits of using Google Forms for research strongly interest me.	171	2.99	0.970	Agree
	Grand Mean		2.81		Agree

Decision mean: 2.50

Based on the table 4, it can be interpreted that the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection is generally positive, as indicated by the grand mean of 2.81 and the decision mean of 2.50. The majority of the participants agreed or strongly agreed with the statements, indicating a high level of interest in learning more about Google Forms, exploring its capabilities, and incorporating it into their research methodology. Overall, the findings suggest that researchers in North-Central Nigeria are receptive to using Google Forms for data collection and are interested in learning more about its potential benefits.

Hypothesis Testing

H01: there is no significant difference of male and female researchers on their perception towards Google Forms for data collection.

Table 5: T-test for the gender difference and the perception towards Google Forms for data collection.

Group	N	df	$\bar{x}$	SD	t-value	p-value	Decision
Male	108		2.38	0.73			
		169			-1.29	0.19	NS
Female	63		2.54	0.87			

Not Significant at 0.05 level

The findings indicate that there is no significant difference between male and female researchers on their perception towards Google Forms for data collection. The mean score for male researchers is 2.38 with a standard deviation of 0.73, while the mean score for female researchers is 2.54 with a standard deviation of 0.87. The t-value of -1.29 with a p-value of 0.19 indicates that the difference in perception between male and female researchers is not statistically significant at the 0.05 level. Therefore, we can accept the null hypothesis (H01) and conclude that there is no significant difference between male and female researchers in North-Central Nigeria in their perception towards Google Forms for data collection.

Table 6 male and female researchers on their interest towards Google Forms for data collection

H03: there is no significant difference of male and female researchers on their interest towards Google Forms for data collection.

Group	N	df	$\bar{x}$	SD	t-value	p-value	Decision
Male	108		2.81	1.06			
		169			0.21	0.87	NS
Female	63		2.78	0.79			

Not Significant at 0.05 level

Based on the results presented in Table 6, the null hypothesis (H03) is that there is no significant difference in the interest of male and female researchers towards using Google Forms for data collection. To test this hypothesis, a t-test was conducted on the mean interest scores of male and female researchers. The results show that the mean interest score for male researchers towards using Google Forms is 2.81 with a standard deviation of 1.06, while the mean interest score for female researchers is 2.78 with a standard deviation of 0.79. The calculated t-value is 0.21 with a p-value of 0.87, which indicates that the difference in mean interest scores between male and female researchers is not statistically significant at the 0.05 level. Therefore, we accept the null hypothesis (H03) and conclude that there is no significant difference in the interest of male and female researchers towards using Google Forms for data collection. Both male and female researchers have similar levels of interest in using Google Forms for data collection.

Discussion of Findings

The findings from this study suggest that researchers in North-Central Nigeria generally have a positive perception towards the use of Google Forms for data collection. However, the researchers also had some negative perceptions about Google Forms. Despite these negative perceptions, the researchers in North-Central Nigeria expressed a high level of interest in learning more about the features of Google Forms for research purposes and were motivated to use Google Forms for data collection in their research projects. This suggests that they are open to incorporating Google Forms and believe that it has the potential to provide benefits for their research. The study investigated two hypotheses related to the perception and interest of male and female researchers towards using Google Forms for data collection. The findings indicated that there was no significant difference between male and female researchers in their perception and interest of Google Forms for data collection.

Conclusion

Researchers have a negative perception towards Google Forms for data collection.

Researchers show interest towards the use of Google Forms for data collection.

There is no significant difference between male and female researchers in North-Central Nigeria in their perception and interest towards Google Forms for data collection.

Recommendations

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

Researchers should be encouraged to use Google Forms for data collection, as it has been found to be an effective tool despite their negative perception towards it. Institutions can provide training and support on the use of Google Forms to help researchers become more comfortable and proficient in using it.

Institutions should encourage the use of Google Forms for data collection, given the positive perception and interest of researchers towards it. This can be done by providing access to the necessary technology and resources to facilitate its use.

Suggestions for Further Research

Replication of the study with a larger and more diverse sample size to increase generalizability of the findings.

Investigation of the factors that influence researchers' perceptions, s, and interests towards Google Forms for data collection in North-Central Nigeria.

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THE INTEGRATION OF IMMERSIVE TECHNOLOGIES IN NIGERIAN PUBLIC LIBRARIES: A QUALITATIVE ANALYSIS OF THE ROLE OF AUDIOVISUAL AND MULTIMEDIA SECTION IN FOSTERING SUSTAINABLE COMMUNITIES

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Abstract

This qualitative study aimed to explore the integration of immersive technologies in Nigerian public libraries and their role in fostering sustainable communities, with a specific focus on the audiovisual and multimedia section. The study collected data from 36 participants, including library staff members, patrons, and other stakeholders involved in the integration of immersive technologies in Nigerian public libraries. Thematic analysis was used to analyze the data, and the findings indicated that immersive technologies are facing significant challenges in public libraries in Nigeria, including lack of availability, high cost, and lack of technical expertise among library staff. However, the integration of immersive technologies has the potential to bring several benefits to the community, including enhanced learning, increased access to information, promotion of creativity and innovation, improved engagement, career development, and increased revenue. The study suggests that user demand, training and support, and privacy and safety concerns should be considered when implementing immersive technologies in public libraries.

Keywords: Immersive Technologies, Public Libraries, Audiovisual and Multimedia, Communities

Introduction

Public libraries have been instrumental in promoting sustainable communities through access to resources that support social, economic, and environmental development (Nwachukwu, 2023). The Audiovisual and Multimedia Section and Information Technology Section of public libraries play an important role in providing multimedia resources and technology to enhance learning, research, and entertainment (Afolayan&Okunoye, 2023). With the emergence of immersive technologies such as augmented reality (AR), virtual reality (VR), and the metaverse, public libraries now have new avenues to engage and educate their communities (Ezeani&Egboka, 2023). These technologies offer interactive simulations that provide a more engaging and personalized learning experience (Abdullahi et al., 2023) and a virtual world that allows users to interact with each other and digital content in a more immersive and collaborative way (Aina, 2023). Many African countries, including South Africa, Ghana, Rwanda, and Kenya, have already embraced the integration of immersive technologies in various sectors, including education, healthcare, and entertainment (Ndlovu, 2022; Asante, 2021; Mutara, 2022; Muthoni, 2021).

For example, the Nelson Mandela Foundation has partnered with the Google Cultural Institute to create a VR experience that allows users to explore the former South African President's prison cell on Robben Island (Ndlovu, 2022), while in Ghana, the government has launched a virtual reality platform that enables users to explore tourist attractions in the country (Asante, 2021). In Nigeria, where sustainable community development is a top priority (Ajayi, 2023), the integration of immersive technologies in public libraries holds great promise for enhancing community engagement and education. However, it is unclear if these technologies are available in Nigerian public libraries, and if so, what are the benefits and challenges they pose to the library stakeholders. Therefore, it is against this gaps that this studyseeks to investigate the role of the Audiovisual and Multimedia Section and Information Technology Section of public libraries in Nigeria in fostering sustainable communities through the integration of immersive technologies. Through a qualitative analysis of the experiences and perspectives of library staff, patrons, and other stakeholders, the study also seeks to assess the readiness and roles associated with the integration of immersive technologies in public libraries in Nigeria and explore strategies for maximizing the potential benefits of these technologies for sustainable community development.

Objectives of the Study

The aim of this study is to investigate the role of the Audiovisual and Multimedia Section of Nigerian public libraries in fostering sustainable communities through the integration of immersive technologies, and to explore the opportunities and challenges associated with this integration. The specific objectives were;

1. To identify the current availability of immersive technologies in public libraries in Nigeria, specifically within the Audiovisual and Multimedia Section and Information Technology Section.
2. To assess the potential benefits associated with the integration of immersive technologies in public libraries in Nigeria for promoting sustainable community development.
3. To assess the readiness of library staff, patrons, and other stakeholders regarding the integration of immersive technologies in public libraries in Nigeria for promoting sustainable community development.
4. To assess the role of Audiovisual and Multimedia Section and Information Technology Section of Nigerian public libraries in fostering sustainable communities via the immersive technologies

Literature Review

There has been a surge of interest in the use of virtual and augmented reality technologies in public libraries. These technologies have the potential to improve the learning experience for library users, particularly in the Audiovisual and Multimedia Section and Information Technology Section. However, a study conducted by Adekunle and Adekunle (2019) revealed that most Nigerian public libraries lack the infrastructure and resources necessary to implement immersive technologies. While a few libraries have incorporated some form of immersive technology, they are often outdated and not fully functional. Therefore, there is a need for increased investment and

support to enable Nigerian public libraries to effectively implement and utilize immersive technologies.

In contrast, a study by Oyewumi (2017) found that there is growing interest in immersive technologies in Nigerian universities. Some universities have implemented virtual reality technology in their libraries and classrooms, though adoption is still in the early stages. In terms of the Audiovisual and Multimedia Section, Oladokun et al. (2018) discovered that most Nigerian university libraries possess multimedia resources such as CDs, DVDs, and slides, but they are not being fully utilized. The study recommended that libraries should invest in modern multimedia resources and provide adequate training for library staff to utilize them effectively. Similarly, Aina and Ogunyade's (2016) study on the use of electronic resources in Nigerian university libraries found that most libraries have electronic resources, including databases, e-journals, and e-books, but they are underutilized due to a lack of awareness and training among library staff.

Despite the rising interest in immersive technologies in Nigerian public libraries, there are still several challenges to address. Adekunle and Adekunle (2019) identified a lack of funding, inadequate infrastructure, and a lack of technical expertise as major barriers to the implementation of immersive technologies in Nigerian public libraries. Additionally, there is a lack of awareness and training among library staff on how to effectively utilize immersive technologies. Nonetheless, there are opportunities for the adoption and utilization of immersive technologies in Nigerian public libraries. Oyewumi (2017) suggested that the increasing interest in immersive technologies in Nigerian universities presents an opportunity for public libraries to leverage these technologies to enhance their services. Furthermore, the availability of modern multimedia resources and electronic resources in Nigerian university libraries (Oladokun et al., 2018; Aina and Ogunyade, 2016) provides an opportunity for public libraries to collaborate with universities to access and utilize these resources.

The literature on the perspectives and experiences of library staff, patrons, and other stakeholders regarding the implementation of immersive technologies in Nigerian public libraries is limited. Previous studies have explored the integration of immersive technologies in Nigerian public libraries and the views of stakeholders, including library staff and patrons. Ajiboye, et al. 2019) found that while library staff had positive perceptions of the potential benefits of virtual reality (VR) technology, concerns about the cost and technical skills required to implement the technology effectively were present. The authors recommended that libraries invest in training and development programs for staff to improve their skills and knowledge of VR technology. Akande et al. (2020) found that library users had positive experiences with augmented reality (AR) technology, which enhanced their learning experiences, but there were challenges related to the availability and accessibility of AR technology in Nigerian academic libraries. Okebukola (2020) found that Nigerian university students had positive attitudes towards the integration of immersive technologies in libraries, but identified challenges related to their availability and accessibility in Nigerian libraries.

Studies have also identified the potential benefits and challenges of integrating immersive technologies in public libraries in Nigeria for promoting sustainable community development. Immersive technologies such as VR and AR have been identified as effective tools for enhancing

the learning experience and promoting community engagement in public libraries. Folorunso et al. (2020) found that immersive technologies could improve access to information and education, enhance user engagement, and promote cultural exchange and social inclusion. However, Adekunle and Adekunle (2019) identified several challenges associated with implementing new technologies, including inadequate funding, lack of technical support, and insufficient infrastructure. Additionally, a lack of awareness and understanding among library staff and other stakeholders about the potential benefits of immersive technologies could also hinder their effective implementation. Addressing these challenges through training and development programs for library staff, public-private partnerships, and community engagement initiatives can help promote the effective integration of immersive technologies in public libraries in Nigeria for sustainable community development.

The literature suggests that the incorporation of immersive technologies in public libraries can enhance the user experience, facilitate knowledge acquisition, and promote community engagement, but successful integration necessitates the readiness of library staff, patrons, and other stakeholders. To integrate these technologies effectively, library staff require sufficient technical skills and knowledge, and must be provided with adequate training and support, according to Zhang and Xu (2019). Similarly, public libraries should develop strategies that consider the digital divide and diverse user needs, as stated in Houghton et al.'s (2019) study. Furthermore, strong leadership and support from local government officials are critical for successful integration, as highlighted by Zhu and Lu (2019). The study recommends that local government officials develop policies and programs that support immersive technology integration and provide necessary resources and funding.

The use of immersive technologies, such as virtual and augmented reality, in public libraries for fostering sustainable communities has been explored in recent literature. However, little research has been conducted on the specific roles of the Audiovisual and Multimedia Section and Information Technology Section in this process. Studies have shown that immersive technologies have the potential to promote community engagement and sustainable development in public libraries. For instance, Zeng and Yang (2020) found that virtual reality can enhance the user experience in public libraries and promote community engagement. Similarly, Smith et al. (2019) reported that virtual reality can be used to showcase local history and culture, contributing to sustainable development and preserving cultural heritage in communities.

The Audiovisual and Multimedia Section is recognized as having a crucial role in promoting sustainable communities via immersive technologies. Fang and Zhang (2018) suggest that the section can provide technical support and resources to library staff for the integration of immersive technologies in public libraries. They also recommend creating immersive and interactive content that showcases local culture and history to promote community engagement. Moreover, the Information Technology Section plays an important role in the successful integration of immersive technologies. Chen et al. (2018) emphasized the significance of the section in providing technical support and training to library staff and in developing policies and programs to support the integration of immersive technologies in public libraries.

The use of immersive technologies, such as virtual and augmented reality, is gaining popularity in Nigerian libraries, particularly in universities. However, many libraries lack the necessary infrastructure, funding, and technical expertise to effectively implement these technologies. Additionally, there is a lack of awareness and training among library staff on how to utilize immersive technologies effectively. Nevertheless, the availability of modern multimedia and electronic resources in Nigerian university libraries presents an opportunity for public libraries to collaborate and utilize these resources. While stakeholders view immersive technologies positively, there are concerns about their cost, technical requirements, and availability. To promote sustainable community development through the integration of immersive technologies, public libraries should develop strategies that address the digital divide and diverse user needs, and library staff should possess sufficient technical skills and knowledge. Successful integration of immersive technologies in public libraries also requires strong leadership and support from local government officials. Further research is necessary to understand the specific roles of the Audiovisual and Multimedia Section and Information Technology Section in the integration of immersive technologies in Nigerian public libraries.

Method, Data and Model

Method: This study aimed to qualitatively explore the integration of immersive technologies in Nigerian public libraries and their role in fostering sustainable communities, with a specific focus on the audiovisual and multimedia section. The study employed a descriptive survey approach, utilizing snowball sampling techniques to form a focus group discussion and conduct semi-structured interviews with participants. The interviews and focus groups were conducted virtually, depending on the availability and preference of the participants. The study utilized open-ended and flexible questions to gather rich and meaningful insights from participants.

Data: The study collected data from 36 participants, including audiovisual and multimedia section staff members, library patrons, and other stakeholders such as e-librarian, system librarians and directors of the library involved in the integration of immersive technologies in Nigerian public libraries. The participants were recruited through purposive sampling, targeting those with knowledge and experience related to the integration of immersive technologies in Nigerian public libraries. The data collection process involved semi-structured interviews and focus group discussions, which were audio-recorded and transcribed verbatim for analysis. Additionally, document analysis was performed to provide contextual information and additional insights into the challenges and opportunities related to the integration of immersive technologies in Nigerian public libraries.

Model: This study used qualitative interview data as the model, focusing on the attitudes, perceptions, experiences, challenges, opportunities, and strategies related to the integration of immersive technologies in Nigerian public libraries. Thematic analysis was employed to identify patterns and themes in the qualitative data, providing a nuanced view of the experiences and perspectives of the participants. This approach enabled a comprehensive understanding of the role of the audiovisual and multimedia section in fostering sustainable communities through the integration of immersive technologies in Nigerian public libraries.

Analysis: The study employed thematic analysis to analyze the data from the interviews, focus groups, and document analysis. The coding process involved identifying themes and patterns in the data, as well as analyzing the nuances of the participants' responses to obtain a comprehensive understanding of their experiences and viewpoints. The data codification process provided valuable insights into the role of immersive technologies in fostering sustainable communities in Nigerian public libraries, as well as the challenges and opportunities associated with their integration. A detailed explanation of the data codification process is provided in the study report.

Ethical considerations: The study will adhere to ethical guidelines, including obtaining informed consent from the participants and ensuring their anonymity and confidentiality. The study will also prioritize the safety and well-being of the participants and the researchers.

Table 1: Phase Analysis

Phase of Analysis	**Description**
Transcription	The semi-structured interviews were transcribed verbatim.
Data Familiarization	The transcriptions were read multiple times to gain a comprehensive understanding of the data.
Initial Coding	The data was systematically reviewed and coded according to the research objectives.
Theme Development	Similar codes were grouped into themes to identify patterns in the data.
Final Review	The themes were reviewed and refined to ensure they accurately represented the data.

Each group was allotted 35 minutes for the interview, and the resulting conversations were transcribed into a 32-page transcript. The transcribed data were then coded based on the research objectives that were developed to guide the study.

Result and Discussions

Research Objective 1:To identify the perspectives of library staff, patrons, and other stakeholders on the current state of immersive technologies in public libraries in Nigeria, specifically within the Audiovisual and Multimedia Section and Information Technology Section.

This section aims to investigate the current availability of immersive technologies within the Audiovisual and Multimedia Section and Information Technology Section of public libraries in Nigeria. Participants were asked to identify the current availability of immersive technologies in public libraries in Nigeria, specifically within the Audiovisual and Multimedia Section and Information Technology Section. The thematic responses will provide valuable insights into the current state of immersive technologies in Nigerian public libraries, and help identify opportunities for improvement and advancement in the integration of these technologies for enhanced library experiences. The findings from the responses are provided thematically thus:

Limited availability: Many participants reported that immersive technologies were not available in most public libraries in Nigeria. They mentioned that only a few libraries in big cities like Lagos

and Abuja had some immersive technologies, but they were not fully utilized. For example, one librarian said, "We have a virtual reality headset, but it's not in use because we don't have the necessary software and technical expertise to run it." Another librarian noted "Our library doesn't have any immersive technologies, and I haven't heard of any other libraries in our area that do." - Library user" It's unfortunate that immersive technologies are not widely available in Nigerian public libraries. It would be great if more libraries could have access to them."

High cost: Several participants stated that the cost of acquiring and maintaining immersive technologies was prohibitive for most public libraries in Nigeria. They explained that most libraries lacked sufficient funding to purchase and maintain such technologies. For instance, one library user said, "We don't have any immersive technology in our library because it's too expensive for us to afford." A librarian noted "The cost of immersive technologies is too high for most public libraries in Nigeria. We have other pressing needs to meet." A library user "We need funding support from the government or other organizations to acquire immersive technologies for our library."

Technical expertise: Many participants emphasized that a lack of technical expertise among library staff was a significant barrier to the implementation of immersive technologies in public libraries in Nigeria. They explained that most library staff lacked the necessary training and expertise to handle and maintain such technologies. For example, one librarian said, "We have some immersive technologies in our library, but we don't use them because we don't have the technical expertise to handle them." One library noted "The library staff needs training on how to use and maintain immersive technologies. We can't just rely on volunteers or interns to handle them." A librarian "We need to hire more technical staff who have expertise in immersive technologies to help us implement them effectively."

The findings indicated the current state of immersive technologies in public libraries in Nigeria is facing significant challenges. The majority of participants noted that such technologies are not widely available in most libraries, with only a few in major cities having access to them. High cost was also identified as a significant barrier, with most libraries lacking sufficient funding to acquire and maintain them. Another crucial obstacle was the lack of technical expertise among library staff to handle and maintain the technologies. The findings indicate the need for increased funding, technical training, and support for the implementation of immersive technologies in Nigerian public libraries.

Research Objective 2: To assess the potential benefits associated with the integration of immersive technologies in public libraries in Nigeria for promoting sustainable community development.

This section aims to investigate the potential benefits of integrating immersive technologies in public libraries in Nigeria for promoting sustainable community development. Participants were asked to share their perspectives and experiences on how immersive technologies could enhance community development through public libraries. The thematic responses will provide insights into the potential benefits of immersive technologies for community development and identify

opportunities for leveraging these technologies to promote sustainable development in Nigerian communities. The findings from the responses are provided thematically thus:

Enhanced Learning: Many participants expressed that the integration of immersive technologies in public libraries could enhance learning opportunities for the community, particularly for students. The immersive experience offered by technologies such as virtual reality could help to bring learning to life and make it more engaging. For example, one librarian stated, "Integrating virtual reality into the library can offer students a unique and interactive learning experience that could improve their understanding of complex subjects." a library user suggested, "We could create virtual scavenger hunts or puzzle-solving games that require students to learn about specific topics in order to progress through the game." Another librarian noted, "We could use virtual reality to simulate laboratory experiments, allowing students to practice and refine their skills before they attempt them in real life."

Increased Access to Information: Participants also highlighted the potential for immersive technologies to increase access to information for community members. Virtual reality, for instance, could enable users to visit locations and access information that may not be easily accessible in real life. A library user noted, "With virtual reality, we can explore different parts of the world and learn about different cultures without leaving our community." A librarian noted “Immersive technologies like augmented reality could be used to provide information overlays on physical objects in the library, allowing users to access additional information and details on a particular topic.” Another librarian further notes that "Virtual tours of historical sites or landmarks could be created using immersive technologies, enabling users to experience and learn about these places in a unique and engaging way."

Promotion of Creativity and Innovation: The integration of immersive technologies in public libraries was also seen as a way to promote creativity and innovation within the community. Participants noted that immersive technologies could provide an avenue for individuals to explore and express their creativity. For example, one library user stated, "By using virtual reality, we could create new and innovative solutions to problems within our community."

Improved Engagement: Participants also recognized that immersive technologies could improve engagement with library resources and services. The use of immersive technologies could attract new users to the library and encourage them to engage with the resources and services on offer. A librarian noted, "By integrating immersive technologies, we can create a more engaging and interactive library experience that could help to attract and retain library users." One library user noted that "The use of augmented reality in the library could create an interactive experience where users can scan books and receive additional information, enhancing their engagement with the library's resources." Another librarian mentioned that "The use of immersive technologies could create a more social experience for library users. For example, virtual reality could enable users to engage with each other in virtual spaces and discuss topics related to the library's resources."

Career Development: Some participants also identified the potential for immersive technologies to support career development within the community. For instance, virtual reality could provide a platform for vocational training and skill development. One library user stated, "With virtual

reality, we could provide training in areas such as engineering, architecture, and other technical skills, which could help to enhance career prospects for individuals within our community."

Increased Revenue: The integration of immersive technologies in public libraries was also seen as a way to generate revenue for the library. Participants noted that immersive technologies could attract new users to the library, increasing the potential for revenue generation through services such as rental fees for equipment. A librarian stated, "By integrating immersive technologies, we could generate additional revenue for the library, which could be reinvested into improving services and resources for the community."

The findings shows that the integration of immersive technologies in public libraries in Nigeria has the potential to bring several benefits to the community, particularly in terms of enhanced learning, increased access to information, promotion of creativity and innovation, improved engagement, career development, and increased revenue. Participants believe that immersive technologies, such as virtual reality and augmented reality, could enhance the learning experience of students and provide access to information that may not be easily accessible in real life. The integration of immersive technologies is also seen as a way to promote creativity and innovation and improve engagement with library resources and services. Moreover, participants see the potential for immersive technologies to support career development within the community, particularly in areas such as vocational training and skill development. Finally, the integration of immersive technologies is viewed as a way to generate revenue for the library and improve services and resources for the community.

Research Objective 3: To assess the readiness of library staff, patrons, and other stakeholders regarding the integration of immersive technologies in public libraries in Nigeria for promoting sustainable community development.

This section aims to investigate the readiness of library staff, patrons, and other stakeholders regarding the integration of immersive technologies in public libraries in Nigeria for promoting sustainable community development. Participants were asked to share their perspectives and experiences on the current level of preparedness of library staff, patrons, and other stakeholders towards the integration of immersive technologies in public libraries in Nigeria. The thematic responses will provide valuable insights into the current state of readiness for immersive technologies in Nigerian public libraries and help identify areas where further education and training may be needed for successful implementation. The findings from the responses are provided thematically thus:

Willingness to Embrace Immersive Technologies: The majority of participants expressed a willingness to embrace immersive technologies in public libraries to promote sustainable community development. For example, one librarian stated, "I think integrating immersive technologies in our library can help us reach more people in the community, and provide them with unique learning experiences." A library user added, "I'm excited about the possibilities of virtual reality and augmented reality in the library. It could be a fun and engaging way to learn new things."

Limited Technical Knowledge: Some participants expressed concerns about their limited technical knowledge and skills, which could impact their ability to effectively use and integrate immersive technologies in public libraries. For instance, a librarian noted, "I'm interested in integrating immersive technologies, but I'm not sure how to get started or where to find the resources to support it." Another library user stated, "I'm not very tech-savvy, so I worry that I might struggle to use virtual reality or other immersive technologies."

Infrastructure and Resource Constraints: Participants identified infrastructure and resource constraints as potential barriers to integrating immersive technologies in public libraries. For example, one librarian stated, "We don't have the budget to purchase expensive equipment, and we don't have the technical expertise to maintain it." A library user added, "Our library is located in a rural area, so we don't have access to high-speed internet or other resources that might be necessary for immersive technologies."

User Demand: Participants noted that the demand for immersive technologies in public libraries is largely driven by the interests and needs of library users. For instance, a library user stated, "I think we need to survey our community to find out what they're interested in and what they want to see in the library." Another library user added, "We need to make sure that immersive technologies are meeting the needs of our diverse community, not just a select group of users."

Training and Support: Participants emphasized the need for training and support for library staff, patrons, and other stakeholders to effectively integrate and use immersive technologies in public libraries. For example, a librarian stated, "We need to invest in training and professional development for our staff to ensure that we have the skills and knowledge to effectively integrate immersive technologies." Another library user added, "We need to provide user support and resources to ensure that everyone can access and use immersive technologies."

Privacy and Safety Concerns: Finally, some participants expressed concerns about privacy and safety when using immersive technologies in public libraries. For instance, a librarian noted, "We need to be mindful of user privacy when using immersive technologies, particularly when collecting data or personal information." Another library user added, "We also need to ensure that the use of immersive technologies is safe and doesn't pose any physical or mental health risks to users."

The findings suggest that there is a general willingness among participants to embrace immersive technologies in public libraries to promote sustainable community development. However, limited technical knowledge, infrastructure and resource constraints, and concerns about privacy and safety were identified as potential barriers to implementation. Participants noted that user demand for immersive technologies in public libraries is an important factor to consider, and that training and support for both library staff and users will be necessary to ensure effective integration and use of these technologies. Moreover, participants emphasized the need to be mindful of user privacy and safety when using immersive technologies in public libraries.

Research Objective 4: To assess the role of Audiovisual and Multimedia Section and Information Technology Section of Nigerian public libraries in fostering sustainable communities via the immersive technologies.

This section aims to explore the role of the Audiovisual and Multimedia Section and Information Technology Section of Nigerian public libraries in fostering sustainable communities via immersive technologies. Participants were asked to share their experiences and perspectives on how immersive technologies can contribute to sustainable community development through the library. The thematic responses will provide valuable insights into the current state of the Audiovisual and Multimedia Section and Information Technology Section of Nigerian public libraries in promoting sustainable communities and identify opportunities for improvement and advancement through the integration of immersive technologies. The findings from the responses are provided thus:

Enhancing learning: Participants noted that the Audiovisual and Multimedia Section of Nigerian public libraries can play a key role in enhancing learning through the use of immersive technologies. For example, a librarian stated, "By incorporating virtual and augmented reality into our audiovisual resources, we can offer patrons an interactive and engaging learning experience."

Promotion of creativity and innovation: Participants also noted that the Audiovisual and Multimedia Section can promote creativity and innovation in the community through the use of immersive technologies. A library user stated, "We can use immersive technologies to help users explore new ideas and perspectives, and to encourage creative thinking and innovation."

Career development: Participants emphasized the potential for immersive technologies to support career development within the community, particularly in areas such as vocational training and skill development. For example, a library user stated, "By incorporating immersive technologies into our audiovisual resources, we can offer patrons opportunities to learn new skills and develop their career paths."

Access to information: Participants noted that the Information Technology Section of Nigerian public libraries can play a key role in increasing access to information through the use of immersive technologies. A librarian stated, "By offering access to virtual libraries and digital archives, we can offer patrons a wealth of information that may not be easily accessible in the physical world."

Improved engagement: Participants also noted that the Information Technology Section can improve engagement with library resources and services through the use of immersive technologies. A library user stated, "By creating interactive and immersive experiences, we can encourage patrons to explore our resources and services in new and exciting ways."

Revenue generation: Finally, participants discussed the potential for immersive technologies to generate revenue for the library and improve services and resources for the community. A librarian noted, "By offering immersive experiences for a fee, we can generate revenue to support the library's mission and improve our offerings for the community."

Cultural preservation: Participants highlighted the potential for immersive technologies to support the preservation of Nigerian culture and heritage. For example, a library user stated, "We can use virtual and augmented reality to showcase Nigerian cultural artifacts and historical sites, and to help preserve our cultural heritage for future generations."

Community engagement: Participants emphasized the potential for immersive technologies to increase community engagement with the library and its resources. A librarian noted, "By offering immersive experiences that are tailored to the interests and needs of our community, we can foster greater engagement and participation with the library."

Inclusivity: Participants discussed the potential for immersive technologies to support inclusivity in the community, particularly for individuals with disabilities or other accessibility needs. For example, a library user stated, "By incorporating immersive technologies that are accessible and inclusive, we can ensure that everyone in our community has the opportunity to engage with the library's resources and services."

Collaboration: Participants emphasized the importance of collaboration between the Audiovisual and Multimedia Section and the Information Technology Section to effectively integrate and use immersive technologies in the library. A librarian stated, "By working together and sharing our expertise, we can ensure that the library is using immersive technologies in the most effective and impactful way possible."

Social impact: Finally, participants discussed the potential for immersive technologies to have a positive social impact on the community. A library user stated, "By using immersive technologies to address social issues such as poverty, healthcare, and education, we can have a meaningful impact on the lives of people in our community."

The study results demonstrate that immersive technologies have the potential to benefit Nigerian public libraries and their communities in various ways. According to the participants, immersive technologies could be used by the Audiovisual and Multimedia Section and the Information Technology Section to enhance learning, promote creativity and innovation, support career development, increase access to information, improve engagement, generate revenue, preserve culture, increase community engagement, promote inclusivity, encourage collaboration, and have a positive social impact. The participants also stressed the importance of collaboration among the different library sections to effectively integrate and use immersive technologies. Additionally, the participants acknowledged the potential of immersive technologies to address social challenges, such as poverty, healthcare, and education, suggesting that the library could play a role in addressing these broader social issues.

Discussion of Findings

Previous literature and studies have identified challenges that impede the implementation of immersive technologies in Nigerian public libraries. Oladokun et al. (2018) found that the lack of funding, inadequate technical skills, and limited availability of immersive technologies were major barriers. Oyewumin (2017) also highlighted the issues of limited availability and high cost of technology as significant challenges. These studies align with the current study's interpretation, indicating that the limited availability, high cost, and lack of technical expertise among library staff are significant barriers to implementing immersive technologies in Nigerian public libraries. On the other hand, other studies have shown that immersive technologies can benefit public libraries and their communities in various ways. Folorunso et al. (2020) and Adekunle and Adekunle (2019) found that virtual reality technology could enhance learning opportunities,

improve engagement with library resources and services, promote creativity and innovation, and support career development. Fang and Zhang (2018) and Chen et al. (2018) also showed that immersive technologies can promote sustainable community development, but limited technical knowledge and infrastructure, user needs and preferences, and privacy and safety concerns can impede their implementation. Both studies emphasized the need for training and support for library staff and users to ensure effective integration and use of immersive technologies. Zeng and Yang (2020) and Smith et al. (2019) support the current study's findings on the potential benefits of immersive technologies for public libraries and their communities. Immersive technologies can enhance the learning experience, improve engagement, promote creativity and innovation, increase access to information, and support community engagement, inclusivity, and social impact. In conclusion, while there are significant challenges to implementing immersive technologies in Nigerian public libraries, their potential benefits are numerous and require appropriate strategies to overcome the barriers.

Conclusion

In conclusion, the integration of immersive technologies in Nigerian public libraries has the potential to benefit their communities in numerous ways, such as enhancing learning opportunities, improving engagement with library resources, promoting creativity and innovation, supporting career development, increasing access to information, and fostering sustainable community development. However, the limited availability, high cost, and lack of technical expertise among library staff are significant barriers that need to be overcome. The study findings emphasize the importance of providing training and support for library staff and users to ensure effective integration and use of immersive technologies. With appropriate strategies to address the challenges, Nigerian public libraries can leverage immersive technologies to fulfill their mission of providing access to information and supporting lifelong learning and community development.

Implications for Policymakers

Based on the results of the study, the following are recommendations for policymakers;

1. Policymakers should prioritize funding for the acquisition and maintenance of immersive technologies in Nigerian public libraries, particularly in the Audiovisual and Multimedia Section and Information Technology Section, to enhance the libraries' ability to promote sustainable community development.
2. Policymakers should provide adequate training and development opportunities to library staff, patrons, and other stakeholders on the effective integration and use of immersive technologies in Nigerian public libraries.
3. Policymakers should invest in the development of the necessary infrastructure, including high-speed internet access and appropriate hardware and software, to support the integration of immersive technologies in Nigerian public libraries.
4. Policymakers should encourage collaboration among the different sections of the library to effectively integrate immersive technologies into library services and resources, and foster sustainable community development.

5. Policymakers should implement appropriate policies and guidelines to address privacy and safety concerns associated with the integration of immersive technologies in Nigerian public libraries.

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ENVISIONING THE DEPLOYMENT OF EXTENDED REALITY (XR) TECHNOLOGY FOR THE PROVISION OF LIBRARY SERVICES: THE PERSPECTIVE OF NIGERIAN ACADEMIC LIBRARIANS

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Abstract

This study examines Nigerian academic librarians' perception of envisioning the deployment of extended reality (XR) technology for the provision of library services: the perspective of Nigerian academic Librarians. The research adopted a qualitative approach where data was collected through an open-ended survey. Thirty librarians represent the sample for the study. The findings from the study demonstrate that most Nigerian academic librarians do not envision deploying the XR technology as a result of the fact that they are not aware of the technology. The majority of participants indicated that Nigerian academic libraries are not prepared to deploy XR, and there is no consensus among academic librarians in Nigeria over their intention to use it for the provision of library services. This is because academic libraries in Nigeria are now dealing with several issues, including inconsistent power supplies, outdated technology infrastructure, a lack of technical expertise, a poor attitude toward accepting innovation, financial issues, and technophobia. The study concluded that academic libraries in Nigeria do not envision the deployment of XR technology for the provision of library services. Based on these findings, the study recommended among others that Academic librarians in Nigeria, as well as all other library staff, need to adopt a new attitude. Those who are unwilling to adjust their mindset and accept the deployment of XR technology should be given financial support to travel abroad for professional development and training.

Keywords: Extended Reality, Educational Technology, Library Services, Nigerian LIS academics.

Introduction

It is no longer news that the information services offered by libraries have changed naturally in today's age of information abundance as a result of new technologies that supply information to users at the click of a button. Some information sources can be linked to but never formally collected, whereas others can only be temporarily gathered. We may now take into account a wider range of informational resources that can be compiled based on particular user requirements. In many ways, accessing content is no longer as important as being able to control the flow of metadata about it using developing technology. The wide phrase "extended reality" encompasses augmented reality (AR), mixed reality (MR), and virtual reality (VR) technologies (XR). Currently, XR technology is primarily used in libraries to provide sophisticated information services including virtual tours, internal navigation, and makerspace (Oyelude 2017). However,

the ability to deploy XR in libraries is expanding globally, especially as the necessary equipment becomes more readily available and devices become more affordable than before.

With XR technology, every object can have a user interface superimposed on it and every physical form of the interface can be virtualized by the library. As technology develops, we start to discover new ways to interact with it. Major technology giants like Facebook, Apple, Microsoft, Google, and Amazon are investing in XR applications and aiming to take market share through corporate acquisitions and the development of new proprietary technologies (Lee, Braud, et al., 2021). Facebook recently bought VR hardware manufacturer Oculus Rift, while Microsoft's HoloLens platform has made large investments in the development of MR technologies. These improvements in cost and capability present new opportunities for libraries of all kinds to experiment with this technology and examine how XR technology will influence how our users discover and interact with our content. Lee(2020) opined that XR is not a gimmick and should be regarded as a serious tool that libraries may utilise to interact with and better serve their audience. Innovative technology can be used to increase engagement, making sure that information about how to utilise them is taught properly.

According to Nebeling et al., (2018), several libraries use augmented reality applications that users can download to their mobile devices. Academic libraries are beginning to provide a range of XR services to boost client engagement and impart information literacy. For instance, some libraries offer VR headsets for use in-house for storytelling, virtual travel, gaming, and the acquisition of new skills. Frost et al.,(2020) noted that some lend out their Oculus Rift headsets to patrons for two or three days at a time, including Ryerson University Library and Archives in Toronto. Furthermore, some academic libraries also give out headsets, and 360-degree cameras, and offer a virtual reality environment for students to create content (Suen, Chiu& Tang, 2020). The Claude Moore Health Sciences Library at the University of Virginia implemented a project that educated its students and staff on the uses of VR in the health field through a combination of large-group demonstrations, one-on-one consultations, and workshops (Barker, 2017).

Without a doubt, library users will undoubtedly gain a lot from the enhanced information delivery on a particular topic made possible by XR technology as well as from the variety of ways they can master the fundamental digital literacy skills that will enable them to successfully conduct information searches using all of the resources at their disposal to complete their assignments. Miltenoffand Borowske (2021) emphasized that owing to developments in VR, AR, MR and XR librarians now have more alternatives for carrying out the tasks for which they were trained. However, the field of libraries and information services is already using cutting-edge intelligent technologies like the Internet of Things (IoT), cloud computing, artificial intelligence (AI), and robotics in Nigeria and a few other African countries generally. Although research to apply different technologies to the library has been conducted, it is unfortunate that no study has specifically explored and discussed the deployment of XR technology in Nigerian library settings. Therefore, it is crucial to examine the perspectives of academic librarians in Nigeria who desire to use XR technology to deliver library services.

Objectives of the Study

The main objective of the study was to examine the perspectives of Nigerian academic librarians on envisioning the deployment of an XR technology for the provision of library services. The specific objectives of the study were to;

i. examine the Nigerian academic librarians' rationale for envisioning the deployment of XR for the provision of library services;
ii. determine the perspective of Nigerian academic librarians on the intention to deploy XR for the provision of library services;
iii. investigate the perspective of Nigerian academic librarians on the readiness for the deployment of XR for the provision of library services; and
iv. identify the perspectives of Nigerian academic librarians on the envisaged challenges associated with the deployment of XR technology for the provision of library services.

Literature Review

The fourth industrial revolution (4IR) has ushered in a slew of new advanced technologies, including XR technology. This technology has changed the way information is being dished. It has aided in finding new answers to old problems, challenged traditional business models, and improved efficiency. Organizations such as libraries, archives and museums in the advanced world are progressively using XR technology and Africa is no exception. According to the literature, businesses use XR technologies because they provide efficient and cost-effective services. XR technology has both advantages and disadvantages for libraries. Cost-effective, productivity improvements, accessibility, and flexibility must be balanced against security, privacy, and information management hazards. However, it is important to note that cloud. XR is not new; rather, it is a new model for delivering information services to library users (Ellern& Cruz, 2021).

According to Rauschnabel, Felix, Hinsch, Shahab and Alt (2022), XR is a term referring to technology that enables interaction outside of physical space and the reality of what is visible, audible, or felt. Augmented reality, mixed reality, merged reality, and virtual reality is all phrases used to describe various technologies that enhance or alter our perception of reality. Although there has been significant discussion about the academic definitions and range of these categories, XR can be used to refer to all of them collectively. It has long been anticipated that XR technology will empower and improve all aspects of our daily life, entertainment, education and employment. And it has been changing for years. Immersive experiences that blend digital items, information, and overlays into real-world surroundings are predicted to be made possible by XR technologies fusion of digital and reality can also give wonderful and unrealistic additions to daily lives, similar to deep false videos that mislead the eye and ear with lifelike duplicates, which can be both fascinating and frightening (He, 2021).

The idea is that digital or distant sights, including holographic videos with spatial sound and the ability to touch or generated objects, will be incorporated into our everyday experience of reality. The physical and digital worlds will blend closer together with the help of haptics (technology that can simulate touch) and spatial sound (Barhorst, McLean, Shah& Mack, 2021). Even if XR technology makes a significant contribution to education overall, it also presents more risks and difficulties. First, because many libraries and users are prejudiced against applications that need

technical knowledge, creating and deploying educational XR material is a significant difficulty (Tromp, Zachmann, Perret &Palacco. 2022). External elements including output, light effects, and image quality are the second issue. Additionally, users of libraries may run into a lot of knowledge, which increases their cognitive burdens and makes it harder for them to learn. Users may need to use many devices, necessitating teamwork, problem-solving, and technological manipulation skills (Heitplatz, Nellen, Sube&Bühler, 2020).

The XR industry is expanding swiftly, and XR services could be advantageous for the academic setting. A few colleges and universities already provide courses on VR platforms. This is especially true, according to Oyelude (2017), in professions that carry a significant risk of discomfort. For instance, medical students can benefit from practising electronically before performing surgery on an actual body. Alaker, Wynn and Arulampalam (2016) claimed that the University of New England has been using XR technology to teach empathy to its medical and other health profession students by placing the learner in the shoes of their patients, in addition to any potential surgical benefits. A recent attempt to integrate VR into the teaching of anatomic pathology and the use of virtual operating rooms to train nurses and inform the public are two other instances of XR utilisation in the medical sectors (Dyer, Swartzlander, &Gugliucci, 2018). In a recent study by Madrigal, Prajapati and Hernandez-Prera (2016), they found that employing VR platforms in engineering education has significantly improved student performance.

Because XR has 3D features, it makes the provision of information services more fascinating and can hold users' attention for a long time. Additionally, pupils are enthralled by 3D objects, which give the events more meaning and elevate the entire learning experience. Additionally, it is believed that as students move the figures on the screen to interact with them, their level of involvement increases. As a result, more applications of narrative development have been noted, with XR currently covering 3D multi-environment aspects (Khan, T., Johnston, K., &Ophoff, 2019). More interactive, fascinating, important, and inventive stories are now feasible thanks to XR technology (Mystakidis, 2022). In particular, it is believed that XR might make a significant addition to the storytelling process by utilising AR's capacity to transform two-dimensional (2D) things into three-dimensional (3D) objects and evoke a sense of enchantment. The ability of pupils to set and tell a tale successfully can be viewed as a storytelling skill, which can be improved by this technology (Alam, 2021).

XR has already developed from being viewed as a novelty to a proven method to engage students. According to Frost, et al., (2018), one of the advantages of using XR technology in public libraries is its capacity to arouse interest and a desire to learn in both library users and library employees. In some educational programmes, students can progress their learning through the use of XR apps that let them fully immerse themselves in what they are learning while avoiding risk (such as risky science experiments) or expensive costs (such as overseas travel) (Frost, Goates, Cheng & Johnston, 2020). According to Siegle (2019), XR can raise students' general levels of involvement, which are linked to how effectively they learn. It also has the power to focus kids' attention and remove outside distractions. According to Loup, Serna, Iksal, and George (2016), this is especially true for students who suffer from attention deficit disorder, anxiety disorders, or impulse-control difficulties. The use of XR extends beyond conventional educational contexts. After experiencing

game plays designed by their coaches in a virtual environment, players displayed an overall improvement of 30%, according to a case study evaluating the advantages of VR in American football training (Alcaiz, Olmos-Raya & Abad, 2019).

At the American Library Association (ALA) Midwinter Conference, Mahnaz Dar (2018) outlined the three steps for exposing teens to virtual reality (VR). She saw VR as a method for librarians to develop instructional programs that appeal to youth. The first step is to get the teens interested in the VR device by enlisting their assistance in learning how to use it; develop thematic, curated programming connected to holidays and occasions the teens celebrate, such as Black History Month, Independence Day, etc.; use statistics to decide what to emphasise, and encourage teens to contribute their content. Encourage them to use the included cameras to create short movies that they can watch through the Oculus Rift. Iziko Museums of South Africa reported about their virtual winter exhibition on their website on January 8, 2018. The exhibition organised by Iziko Museums of South Africa and Nature's Best Photography features the best nature-themed photography. The display showcasing this year's "winners," which is sponsored by Digital Agency, NMPi South Africa, "brings guests an amazing augmented reality (AR) experience." To access the experience on their digital devices, visitors to the exhibition must download the Zappar AR application to their smartphones. When visitors scan unique AR codes located throughout the exhibit, the Zappar App will also turn on an "augmented audio guide" for the display.

Numerous studies of AR, VR, MR, and XR applications in various fields, such as physics education, biology education, literacy, medical/anatomy education, science education, mathematics/geometry education, engineering education, chemistry education, and astronomy education, have been published in the literature. Researchers studied the effects of traditional methods and augmented reality technologies on students' attitudes and laboratory skills in physics instruction. According to their findings, augmented reality technology helped students develop better laboratory skills and favourable attitudes toward physics labs (Akcayir et al. 2016). Lin et al. (2012) used AR technology to create an application for elastic impact. Their findings demonstrated that by using the AR Physics system, learners dramatically increased their understanding. Yoon et al. (2012) assessed the usefulness of augmented reality apps in education and created a conceptual framework for scientific phenomena. Their findings suggested that AR had a positive impact on participants' engagement with and knowledge of the scientific material.

Researchers created augmented reality content (A virtual butterfly garden) for biology instruction and looked at students' academic performance. Their findings suggest that implementing an AR system could enhance students' learning efficiency (Tarng et al. 2015). The influence of perceived enjoyment on students' acceptance of an AR education platform was examined by Balog and Pribeanu (2010). Their findings suggested that behavioural intention to use the AR education platform was influenced by perceptions of utility and enjoyment. Kye and Kim (2008) looked at how AR technology-related aspects affect learning. The findings demonstrated that the learning effects of AR application were significantly influenced by sensory immersion, manipulation, presence, and flow. Researchers have employed augmented reality (AR) in chemistry education to investigate molecular structures and display crystal structures in 3D, compare AR models to other models, and discover the relationships between them (Singhal et al. 2012). According to their

findings, augmented reality (AR) in the classroom encouraged students to learn more about chemistry while having fun, and they also discovered that when students interacted with AR, they tended to treat it as a genuine thing (Chen, 2006).

Dalgarno & Lee (2010) conducted research that demonstrated how using augmented reality in the workplace encouraged users to interact with virtual items in real-time to increase sensory stimulation. The interaction and direction used to promote learning satisfaction, effectively increase knowledge, and boost motivation to finish the learning task can be experienced and transversed personally by the learners. Augmented reality technology will offer engaging learning environments through a variety of practical channels. Hung et al., (2017) claim that using augmented reality can make learning more enjoyable and that students can all agree that it is an effective teaching tool. Positive learning environments can encourage students to participate more. According to Alaet al, et al., (2020), augmented reality as a teaching tool has the potential to significantly boost students' enthusiasm for lToder to facilitate learning conversion with digitalized instructional content and simultaneously enhance the learning experience and motivation during implementation, the museum can use augmented reality. However, the systems must create relevant content and concentrate on more accessible mobile devices.

In museums, XR is utilised to give visitors real-time experiences that can take place inside the building as well as online and elsewhere. Applications for museums offer more inspiration for how libraries may use AR and VR. Tina Sauerla-nder, a curator, promoted virtual reality (VR) as an artistic medium by showcasing alternative reality media in a physical setting. Curating VR displays from the ZKM blog allowed for this. In Karlsruhe, Germany, there is a centre for art and media called ZKM. Similar to this, on March 1, 2018, YuliLetov contributed a guest post to the Victoria and Albert Museum blog titled Hearing Futures: Gamification of hearing aid technology. This article emphasised the underutilization of contemporary hearing aids. The most recent models of hearing aids contain apps that can teach elderly users how to better operate the device. The devices can do much more than just amplify sound; in 3D, they can even help people who do not have hearing impairments to better understand and empathise with those who do.

A wide range of goods is available, from games that educate children without hearing impairments on what it's like to have hearing loss to increase empathy with affected families, to applications that teach older users how to better understand the many hearing aid functions. On February 7, Irena Pamic urged readers to attend an AR tour of the museum to view outstanding paintings of British landscapes from the early nineteenth century by J.M.W. Turner and John Constable. While at it, one could solve a riddle. A RiddleMachine is located there. The numerous VR tours of museums honouring Black History Month are summarised in the Oculus blog post from February 28, 2018. The various museum exhibits that honour influential black people can be explored in virtual reality. A collection of immersive content on the Oculus Platform that recognises the enduring influence of Black culture throughout the African diaspora to inspire and educate was featured by Oculus. The post commemorates Black History Month in style in virtual reality, with tours of "the Smithsonian's National Museum of African American History and Culture in 360°" and "The People's House: Inside the White House with Barack and Michelle Obama."

Methodology

This section explains the methodology used to conduct the research. It covers the design, population, sample, data collection instrument, administration technique, data analysis, and results in presentation. The research used a completely qualitative approach. An open-ended survey is used to collect data in the qualitative method. Qualitative approaches typically allow for more in-depth probing and questioning of participants based on their responses, in which the participants and/or researcher attempt to understand their motivations and feelings. Understanding the perspectives of Nigerian academic librarians on envisioning the deployment of XR for the provision of information services will aid in the study's conclusion.

The qualitative technique was chosen because it is expected to convey librarian perspectives about the study's subject matter, which focuses on the perspectives of the Nigerian academic library on envisioning the deployment of XR for the provision of information services. Similarly, the design was chosen because the results are usually more descriptive, allowing the researcher to draw inferences from the data collected from the participants. Furthermore, the qualitative method is cost-effective, particularly when self-administered. The researcher was able to collect relevant data by using an open-ended survey in this investigation. Although there are many other types of qualitative procedures (Creswell & Poth, 2018), the open-ended survey was chosen since it is one of the most prevalent qualitative research methods and because it is the most practical way during this epidemic moment of social separation.

Population and Sample

Academic librarians from each of Nigeria's Federal Universities, located in each of the nation's six geopolitical zones, took part in the study. Currently, there are 49 federal universities in Nigeria (National Universities Commission, 2020). A Federal university was designated for each of the six zones, and the library at each of these universities was selected. The total number of libraries included in the study now stands at six. The ongoing Academic Staff Union of Universities (ASSU) strike, security concerns, and Covid-19 protocols prevented the study's expansion to academic librarians in other types of academic libraries in Nigeria. The six chosen academic libraries are located in Cross River (University of Calabar), Enugu (University of Nigeria), Ibadan (University of Ibadan), Kano (Bayero University), and Kwara (University of Ilorin), and Bornu (University of Maiduguri). The survey was limited to the six academic libraries chosen from each of the six geopolitical zones due to widespread security concerns at the time. Five (5) librarians, including the university librarian, system librarian, and digital librarian, were specifically chosen from each of the six selected university libraries in Nigeria. 30 people overall made up the study's sample out of which 19 respondents eventually participated in the study (see Table 1).

Instrument

An open-ended survey that featured performed questions relating to the four objectives of the study was developed. For participants to have a good understanding of what XR technology is and how it can be deployed for the provision of information services, the survey included instructions on how to respond to it and explained the features of XR technology and its relevance to information

services. The open-ended survey items are relevant in obtaining data on the variables that are relevant to the study's aims.

The Procedure of Administration

Participants were supposed to be contacted individually for an interview by the researcher, however, due to security concerns in the country with the ongoing ASSU strike and Covid-19 guidelines, which required strict adherence to social distancing from administering the interview, this was not possible. Instead, a different arrangement was formed with each University library contact person, which resulted in the creation of an open-ended questionnaire (survey) using a Google form that was shared with the appropriate participants. Participants were urged to complete the survey as soon as possible and submit it within four weeks intervals. In terms of ethical considerations, the participants were asked for their informed consent, and each of them enthusiastically stated their desire to participate in the study. Similarly, they were free to abandon their participation if they believed it would be counterproductive. Twenty-four of the Thirty-six survey copies issued to participants were returned and filled and ready for processing. Table 1 shows the breakdown of the survey responses.

Table 1: Survey Administration and Return Rate

S/N	Geopolitical Zones	Chosen States	Chosen Libraries	No Survey Administered	No Survey Returned
1	North-Central	Kwara	University of Ilorin Library	5	4
2	North-East	Bornu	University of Maiduguri Library	5	2
3	North-West	Kaduna	Ahmadu Bello University Library	5	3
4	South-East	Enugu	University of Nigeria Library, Nsuka	5	3
5	South-South	Cross River	University of Calabar Library	5	3
6	South-West	Oyo	University of Ibadan Library	5	4
	Total			30	19

Source: Field Survey (2022)

From the table, 19 copies of the open-ended survey were returned out of 30 copies that were administered. The returned copies of the open-ended survey were sorted, collated, and transcribed by the researcher and reported accordingly.

Data Analysis

Data was gathered in qualitative formats and was thematically analysed.

Objective 1: Rationale for envisioning the deployment of XR technology for the provision of library services: The participants were asked if they were aware of XR s potential use in the delivery of library services and, if yes, whether they had considered using it in Nigerian libraries. If so, what led them to envision its deployment for the delivery of library services? In general, the results showed that few librarians were aware of its deployments for the delivery of library services, although the majority were not. However, several different and similar responses were obtained. Specifically, a participant emphatically mentioned that:

“I'm aware of XR, and I've personally observed how well it has performed in libraries in other developed countries. I learned about the power of this technology through a documentary show I watched on YouTube. Additionally, I have read research papers that emphasize its application in libraries and other sectors. How Nigerian libraries intend to use XR to deliver library services strikes me as being sluggish. The truth is that libraries in Nigeria are reluctant to adopt modern technology. Many libraries in Nigeria are still having trouble adjusting to the new trends in librarianship, especially in this digital age, despite the usage of the most basic ICT.”.

In consonance with the above response, a few participants also mentioned:

“they are aware of the application of XR for library services. Specifically, a participant emphasised that this fantastic technology is indeed highly helpful for giving library patrons access to information in a different dimension. It seems to me that libraries in developed nations probably employ this potent technology to teach pupils about historical events and other study topics. With the use of its visual strength, it helps students study subjects like chemistry, physics, biology, and more quickly by presenting information and knowledge as a three-dimensional figure. Unfortunately, this potent technology has not yet been adopted or incorporated into my library, and I don't believe Nigerian libraries are prepared to take that step. Due to its financial implications and a host of additional considerations that, depending on my institution's policy, I might not be able to discuss.”

In a similar vein, the majority of the participants acknowledged that they were aware of the widespread adoption of XR technology in the majority of sectors in developed nations. For support, a participant highlighted the following: As a professional librarian, I am aware of the technology and am aware that it is being utilised by numerous global industrial sectors.

A respondent noted that:

“Use the entertainment industry as an illustration. It has completely digitalized the gaming sector and made it possible for players to communicate electronically. It has also proven helpful in the medical field, where it is applied to diagnose patients and deal with medical-related issues. However, I am eager for my libraries to deploy this powerful technology since doing so will radically transform how the Nigerian public views the profession of librarianship and might result in a rise in demand for library services.”

Few respondents also noted that:

They do not know what the XR technology is all about. They emphasized, as a result of the interview conducted with them, the experience of the interview has raised their level of awareness

about XR and concerning the envisioning the deployments of the technology, a respondent indicated that: I don't believe Nigerian libraries have plans to deploy XR technology, and the main reason for this is because the majority of Nigerian libraries lack the fundamental infrastructure that could help the technology to operate correctly, as well as skilled employees who will handle the technology, should it ever be deployed. Therefore, I advise that if Nigerian librarians are considering collaborating with XR technology to effectively provide information services, they should be ready and acquire the necessary skills or hire a professional with experience in managing the facilities that intersect with or have some bearing on the use of XR technology.

Considering what is obtainable from the findings, participants in this study are unaware of the deployments of XR technology, but few that were aware indicated that XR has already become a reality in libraries because it is now being adopted and used for in providing library services, except in the context of academic libraries in Nigeria and Africa. Focusing on envisioning the deployment of the technology by Nigerian academic libraries, it is discovered that, very few librarians comprehend what XR is all about and that they don't believe Nigerian libraries have plans to deploy the technology. The fact is that the majority of Nigerian libraries are unaware of what XR technology is all about, and the few that know are expressing problems and obstacles they may likely face if the technology is deployed. This finding is consistent with the opinion of Koukopoulos and Koukopoulos (2018), who indicated that several libraries use augmented reality applications that users can download to their mobile devices. Academic libraries are beginning to provide a range of XR services to boost client engagement and impart information literacy. For instance, some libraries offer VR headsets for use in-house for storytelling, virtual travel, gaming, and the acquisition of new skills.

Objective 2: Perspective of Nigerian academic librarians on the intention to deploy XR for the provision of library services: Participants were asked to indicate their perceptive perception of the intention of Nigerian academic librarians to deploy XR for the provision of library services. The results reveal that the intention of Nigerian academic librarians is somewhat positive.

The majority of the academic librarian noted that:

“The extended reality (XR) technology is formidable; it is one of the cutting-edge innovations brought by the fourth industrial revolution and it can mould and remodel the information universe using the power of imagination. In other words, because of its durability, adaptability, and invisibility, this technology has already entered the phase of all works of life. However, from my perspective, the intention of academic librarians in Nigeria to implement XR is a mixed reality. This is because, while some conventional librarians are concerned about losing their position and job, others who are more digitally inclined hope to have a change of routine with the power of advanced information technology. At all costs, numerous traditional librarians are unwilling to let advances in the field of librarianship take place. These types of librarians are frequently seen in Nigeria's academic institutions. As a result, I don't believe this will achieve the goal of deploying XR for the delivery of library services.”.

A few participants also added this:

Although XR technology is one of the newest technologies to enter the field of education, it was introduced by the Fourth Industrial Revolution and has shown to be quite disruptive. I don't believe Nigerian librarians may have any plans to use XR because the majority of them are unaware of what the technology is all about. As a result, I can't guarantee that librarians may have any plans to use XR to provide immersive information services. Without a doubt, XR fulfils a variety of functions in the businesses in which it is used, but its applicability in academic libraries in Nigeria is in some ways problematic, according to my research.

A respondent explained that:

Implementing XR technology would significantly alter how information services are delivered as a result of how the Nigerian educational system is set up. Therefore, I have a largely negative opinion of what Nigerian academic libraries intend to do when they deploy XR for library services. This is the case due to the numerous challenges Nigerian libraries have in delivering information services to their patrons, particularly in this digital age. Epileptic power supply, low skill knowledge, a reluctance to accept new technology, and bad policies to improve library services are only a few of the drawbacks.

A respondent also noted:

Without a doubt, XR will be highly beneficial if academic libraries in Nigeria can adopt it because it is a very viable technique for the preservation and sharing of material in 3D form. Whether we like it or not, the technology will eventually arrive because "we all know the difficulties most library users confront when it comes to accessing and obtaining critical information." Therefosinceer of time. This is because many libraries in both developed and developing African nations are already embracing technology, which may make quack librarians obsolete by assuming their position if they take the time to become skilled in meeting the needs of XR technology users. However, based on my perspective on the intention to deploy XR for the delivery of library services, I will answer No, as academic libraries in Nigeria are not yet there, let alone considering it".

Based on the librarian perspectives on the intention to deploy XR for the provision of library services; the result implies that deployment of XR technology will of course take Nigerian libraries to disseminate by reducing the barriers to disseminating information accurately and in time and it is proven in the result that the perspective on the intention of Nigerian academic librarian to deploy XR for the provision of library services lethargic as a result of many shortcomings facing the Nigerian libraries. This result is against the discussions of Dyer, Swartzlander and Gugliucci (2018) who emphasise recent attempts to integrate VR into the teaching of anatomic pathology and the use of virtual operating rooms to train nurses and inform the public are two other instances of XR utilisation in the medical sectors.

Objective 3: Perspective of Nigerian academic librarians on the readiness for the deployment of XR for the provision of the library. Based on the objectives of the study, participants were asked to indicate whether Nigerian academic libraries are ready to deploy XR and to describe what they consider as readiness to deploy the technology for the provision of library services.

The results showed that the majority of participants indicated that Nigerian academic libraries weren't ready to deploy XR technology for library service. To demonstrate their readiness to implement advanced technologies for the delivery of library services, the participants named libraries in Africa, notably in Kenya, Namibia, Ghana, and South Africa. A small number of participants said that only a few academic libraries in Nigeria have implemented this change. While justifying the reason for their agreement, some explanations were offered. For instance, a respondent indicated that:

"I will state unequivocally that academic libraries in Nigeria are not ready for the deployment of XR for the delivery of library services. This is based on my belief that the majority of academic libraries in Nigeria have not accepted the revolution that is currently occurring in higher education institutions in the developed world, including America, Asia, and Europe. Many academic libraries in Nigeria are still having trouble with ICT integration at the most basic level, let alone with the implementation of XR technology. This is also evident in their expressions of sluggish desire to spend the resources that would enable them to adapt to the changes brought about by modern librarianship technology."

Another respondent claimed:

"I think academic libraries in Nigeria are not ready for the deployment of XR for the provision of library services,"

Another respondent noted this in a similar vein. This is due to cost implication attached to the integration of ICT facilities"

A few participants had conflicting opinions regarding whether academic libraries in Nigeria are ready to deploy XR to deliver library services, but they did note that not all of them are unprepared. In support of this claim, a respondent said:

"Yes, but not all Nigerian academic libraries are prepared to deploy XR. I'd say that some university libraries in Nigeria have implemented a variety of technologies to offer information services. One such library is the University of Lagos library, which has a robot that helps librarians disseminate information to library patrons. Another academic library in Nigeria that has proven it is ready to use cutting-edge technology is Covenant University Library, which has ICT facilities in place as a show of its readiness to integrate any technology to help deliver information services efficiently.

Few participants reported that academic libraries in Nigeria are prepared to deploy XR to provide information services, but institutional barriers are preventing this from happening; "few participants reported that most university libraries have a cautious attitude toward embracing change in the library operation and services because XR may paralyse traditional ways of providing information to the users," they said."

The majority of participants stated that Nigerian academic libraries are not ready to deploy XR for the provision of library services except very few participants who noted that they are institutionally ready to deploy the technology as a result of the fact that are aware of what opportunities and huge differences it brought to the phase of librarianship worldwide. It is evident in the findings from the

study that most academic libraries in Nigeria are entirely automated, according to these participants, except for a few libraries that have attempted to integrate new technologies to improve their services.

Many libraries in the US, UK, and Asia have implemented advanced technology as a demonstration of their willingness to implement XR in their operations and services, as is seen from the examined literature. Others who haven't yet are integrating new technology into business operations and services, including robotics, artificial intelligence, blockchain, and the Internet of Things. The fact that is that some academic libraries give out headsets, and 360-degree cameras, and offer a virtual reality environment for students to create content (Wang, Kimberley & Wang, 2017). According to the research by Odeyemi findings indicated that Nigerian libraries are partially ready to embrace any technological framework to offer information services.

Objective 4: Perspective of Nigerian academic librarians on the envisaged challenges associated with the deployment of XR technology for the provision of library services: Participants were asked to submit the envisaged challenges in deploying XR for the provision of library services. Findings reveal that participants indicate several challenges that may hinder the use of the technology. Among the challenges envisaged are inadequate experts, limited power supply, and a limited budget to procure the technology and training personnel that will be in charge of the system maintenance.

In the sequel to the aforementioned submissions, other explanations and the identification of perceived challenges by participants are hereby summarised:

“There is going to be a challenge for Nigerian academic libraries in adjusting to the new shift in the provision of library services because most of these libraries lack technical personnel that will take charge of the XR”

Another Respondent emphasized that:

Deploying XR technology for the provision of library services may likely face serious problems. Why because most Nigerian sectors are paralysed by the failure of power supply. Therefore, without a stable power supply in the library system, this may likely hinder the smooth running of the XR technology for the provision of library services to the users.

Few Participants noted:

“Nigerian academic libraries may reluctantly or refuse to accept the deployment of XR as a result of fear of change in the provision of information services to the library users. For instance, they may likely be afraid to work with new technology if it’s eventually integrated into the library system”

A few participants also submitted:

“Very limited academic libraries in Nigeria are ready to deploy XR for the provision of library services. The reason is that Nigerian academic libraries that are currently automated are limited. The XR technology may not likely work perfectly in archives that are not fully automated. Therefore, there is a need for academic libraries in Nigeria to look in the direction of the installation

of sophisticated IT infrastructure to meet up with the current global practices in the field of librarianship.

Another respondent also noted:

No academic libraries in Nigeria are currently deploying XR for the provision of library services to the information users' other African academic libraries inclusive. Therefore, I cannot see the Nigerian academic libraries getting there soon".

These findings here align with Saibakumo's (2021) report that unreliable power supply, inadequate technology infrastructure, absence of technical skills, poor attitude towards advanced automation, use of inappropriate archival software or digital platforms, and technophobia are the challenges faced by academic libraries to optimize cloud computing technology records management and services. The findings also corroborate with (Wheatley & Hervieux 2019) all of whom identified challenges of skills mismatches and inadequate relevant skills as the challenge facing Nigerian academic libraries.

Conclusion

The study examined the perspective of Nigerian academic libraries on envisioning the deployment of XR technology for the provision of library services. The findings reveal that most Nigerian academic librarians do not envision deploying the XR technology as a result of the fact that they are not aware of the technology. The majority of participants indicated that Nigerian academic libraries are not prepared to deploy XR, and there is no consensus among academic librarians in Nigeria over their intention to use it for the provision of library services. This is because academic libraries in Nigeria are now dealing with several issues, including inconsistent power supplies, outdated technology infrastructure, a lack of technical expertise, a poor attitude toward accepting innovation, financial issues, and technophobia. The study concluded that academic libraries in Nigeria do not envision the deployment of XR technology for the provision of library services.

Recommendations

Based on the findings of this study, the following are therefore recommended.

Improved funding should be allocated to academic libraries in Nigeria, together with facilities acquisition and staff training on new developments in the profession of librarianship, particularly concerning utilising cutting-edge technology to enhance the delivery of information services.

Academic librarians in Nigeria, as well as all other library staff, need to adopt a new attitude. Those who are unwilling to adjust their mindset and accept the deployment of XR technology should be given financial support to travel abroad for professional development and training.

There is a need for adequate funding for Nigerian academic libraries, the funding may be directly from the government or the parent institutions to improve the provision of information technology facilities that will aid the deployment of various sophisticated technology that will enable the use of XR. In other words, most academic librariesNigeria are full of staff that lack the required skills to operate the technology. In light of this, academic librarians are required to be skilled in the usage

of cloud computing technology so that they can conquer the fear of displacing them from their job roles.

When it comes to the adoption of technologies, one barrier that is typical of developing countries is the issue of power, which needs to be appropriately addressed. Making alternate power-generating units accessible will accomplish this. Academic libraries in Nigeria may come up with other options, such as solar energy or biofuel for generating electricity.

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LECTURERS' AWARENESS AND ATTITUDE TOWARDS UTILIZATION OF E-LEARNING TOOLS FOR INSTRUCTIONAL DELIVERY IN COLLEGES OF EDUCATION IN NIGER STATE

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Abstract

The study investigates lecturers' awareness and attitude towards utilization of e-learning tools for instructional delivery in colleges of education in Niger State. The study adopted descriptive survey design. The population of this study comprised of 665 lecturers from Federal College of Education Kontagora and Niger State College of Education Minna Niger State respectively. Sample for the study was made up of 237 lecturers (149 male & 88 female). A random sampling technique was used to arrive at sampled used for the study. The research instrument named 'Lecturers' Awareness and Attitude towards Utilization of E-learning tools for Instructional Delivery was employed for the study and all items were presented using a 5-point Scale. The reliability of the research instrument was carried using 20 respondents' lecturers with the following reliability coefficient; awareness 0.89 and 0.87 alpha level using Cronbach respectively. The data collected from the administration of research instrument was analyse using mean and standard deviation for research instrument while t-test was used to analyse research hypotheses. The significance difference of the statistical analyses was ascertained at 0.05 alpha level of significance. Results; there was no significant difference between in the mean of male and female lecturers' on the level of awareness towards using e-learning tools for instructional delivery in Colleges of Education and there was no significant difference between in the mean of male and female lecturers' attitude towards use of e-learning tools for instructional delivery in Niger State Colleges of Education. Conclusion; lecturers are aware and had positive attitude on the use of e-learning tools for instructional delivery in colleges of education in Niger State.

Keyword: Awareness, attitude and e-learning tools

Introduction

With the continued proliferation of technological tools and their early adoption by youth, Nigeria education system is challenged to unleash the power of these technologies and related digital media for teaching and learning. In education, the learning process can be through face-to-face or e-learning tools and technology development leads to innovations, so that many emerging methods

are identified in e-learning. The focus is more on the increasingly popular stage of higher education and helps lecturers, students and institutions to develop further, but many of the lecturers are afraid and technology illiterate in using e-learning (Chiasson et al 2015). Many lecturers are confused in using e-learning method and therefore afraid of technological change, because they prefer their lectures to be deliver through traditional way of teaching (De, 2018).

Despite being notified, the lecturers did not heed the rules, many lecturers do not agree to change teaching from traditional or face to face to use e-learning tools, although the institutions of higher learning have provided the training to use e-learning tools. Chin and Osborne (2018) indicated that in teaching with e-learning, the lecturer strives to make the communication of the message to be conveyed in learning appropriately to students as a whole, besides that when giving constructive feedback, the lecturer as a supporter finds a way to promote positive messages and criticism from students and thereby makes learners become independent and understand peoples need to learn according to their time. In teaching with e-learning tools, lecturers must have cognitive and metacognitive strata so that learning is achieved (De, 2018).

E-learning, recently have become more popular and is gaining wide acceptance as a "non-traditional" mode of accessing higher education. Throughout the world, higher institutions of learning are increasingly turning to e-learning to support and enhance their learning and teaching activities (Decman, 2015).

The term e-learning connotes electronic method of learning which is associated with computerized learning in an interactive interface at the convenience of both the learners and lecturers. According to Eze et al. (2018) e-learning education is concerned with the holistic in corporation of modern telecommunication equipment and ICT resources into the education system. Parks (2013) posited that the word "e" should refer to "everything, everyone engaging and easy" in addition to electronic". The benefits of the e-learning tools include better content delivery, interactivity, quality content delivery and confidence of both learners and lecturers in the educational sector. Pingle (2011) opined that e-learning system will completely reduce the issues of insufficient classrooms for lectures as student can easily take the lectures online without any disruption at their convenience. Also, e-learning tools afford students and lecturers to participate in classes in their comfort zone, with basic amenities they need when compared to the traditional teaching method where sometimes these basic amenities are not available for conducive learning. Despite the advantages of the e-learning tools, its awareness still at its infancy and early adoption stage in our schools in Niger State in particular.

Chinedu (2008) viewed awareness as the conditions of being aware and able to understand what is happening around one. In the context of this study and in agreement with the above views, awareness implies understanding and knowledge of the activities and events going on around one's environment. Looking at the attitude as one of the variables in this study is also crucial towards use of e-learning tools for instructional delivery in colleges of education.

According to Edo (2016) students' attitude is a key factor for a proper implementation of e-learning tools and one of the main reasons to differentiate whether e-learning tools is efficient. It is

important for lecturers to know how to implement e-learning tools in their various subjects, in order to have positive attitude towards it and gender of lecturers need to be considered.

Appiah-Boateng (2011) researchers agreed that the gender gap in e-learning tools awareness may be the reason which has narrowed significantly among lecturers. Stephen and Asiimwe, (2013) found that females in general tend to exhibit less favorable to computer attitudes. Stephen and Stephen and Asiimwe (2013) asserted that female lecturers possess more positive attitudes than their male peers. Investigations have reported that gender has no significant effect on user attitude (Alakpodia, 2014). The inconsistencies in these findings necessitate the study on lecturers' awareness and attitude towards utilization of e-learning tools for instructional delivery in colleges of education in Niger State.

Statement of the Research Problem

Over the years, the most common use of instructional delivery in Nigeria particularly for the colleges of education has been the conventional method of teaching. Sadly, this form of teaching method has been characterized by numerous problems such as pace leaning and learning at any distance apart from been in the classroom, thereby denying students that need to listen to instructional delivery repeated before they can learn better and carry along. This disturbing trend in Nigeria colleges of education shows a serious threat to education of slow learners that need to listen to instructional delivery repeatedly. However, researchers have revealed that e-learning can be an alternative way of curbing this problem. If instructions are to be conducted by the lecturers through e-learning tools mode in colleges of education in Niger State, are the lecturers aware of e-learning tools? More so, what attitude would lecturers have towards it in Niger State? What is the level of awareness of lecturers towards using e-learning tool? It is on this note that the researcher intends to find out lecturers' awareness and attitude towards utilization of e-learning tools for instructional delivery in colleges of education in Niger State.

Aim and Objectives of the Study

The aim of this study was to determine the lecturers' awareness and attitude towards utilization of e-learning tools for instructional delivery in colleges of education in Niger State. Specifically, the study:

i. Examined level of lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education.
ii. Determined the level of awareness of male and female lectures towards the use of e-learning tools for instructional delivery in Colleges of Education.
iii. Examined lecturers' attitude in the use of e-learning tools for instructional delivery in Colleges of Education.
iv. Examine the attitude of male and female lecturers towards the use of e-learning tools for instructional delivery in Colleges of Education.

Research Questions

The following research questions were raised to guide the study:

i. What is the mean response of lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education?
ii. What are the mean responses of male and female lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education?
iii. What is the mean response of attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education?
iv. What are the mean of attitude of male and female lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education?

Research Hypotheses

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

Ho1: There is no significant difference between mean of male and female lectures awareness towards use of e-learning tools for instructional delivery in Colleges of Education.

Ho2: There is no significant difference between mean responses of attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education.

Methodology

The research design that was adopted for this study was a descriptive survey design. The population of this study comprised of 665 lecturers from both Federal College of Education Kontagora and Niger State College of Education Minna Niger State respectively. Sample for the study was made up of 237 lecturers (149 male & 88 female) from FCE kontagora and Niger State College of Education. A random sampling technique was used to arrive at sampled used for the study, the reason for using this technique was for every respondent to be given equal opportunity of being selected. The instrument for the research named 'Lecturers' Awareness and Attitude towards Utilization of E-learning tools for Instructional Delivery was employed for the study. The questionnaire was a close-ended questionnaire and it consists of three sections (Sections A, B & C). Section A was used in collected demographic data of the respondents, Section B consists of statements on lecturers' awareness towards the use of e-learning tools for instructional delivery while Section C was used in gathered data on lecturers' attitude towards use of e-learning tools for instructional delivery. All items were presented using a 5-point Scale in which Strongly Agree (SA) was awarded 5 points, Agree (A) was awarded 4 points, Undecided (U) was awarded 3 points, Disagree (D) was awarded 2 points and Strongly Disagree (SD) was awarded 1 point. Validated of the instrument was done by two experts in Educational Technology and Education Psychology. The reliability of the research instrument was carried using 20 lecturers and the following reliability coefficient were obtained, awareness 0.89 and attitude 0.87 alpha level using Cronbach respectively. The data collected from the administration of research instrument was analyse using mean and standard deviation for research instrument while ANOVA was used to analyse research

hypotheses. The significance difference of the statistical analyses was ascertained at 0.05 alpha level of significance.

Results

Research Question One: What is the mean response of lecturers' awareness on the use of e-learning tools or instructional delivery in Colleges of Education?

Table 1: Mean and standard deviation on lecturers' awareness on the use of e- learning tools for instructional delivery in Colleges of Education

SN	Item	N	Mean	Sd	Decision
1	The use of e-learning tools for instructional delivery will create awareness to the lecturers' as a mode of instruction.	237	3.47	1.39	Agree
2	Am aware that e-learning tools can be used for instructional delivery in colleges of education	237	3.33	1.24	Agree
3	Am aware that using e-learning platform for instructional delivery would yield good result on students than conventional teaching.	237	3.32	1.31	Agree
4	Am aware that e-learning tools encourages learning without boundary.	237	3.75	1.19	Agree
5	Am aware that e-learning tools can curb examination malpractices in colleges of education.	237	3.37	1.26	Agree
6	E-learning tools as a mode of instructional delivery can reduce examination cost.	237	3.42	1.324	Agree
7	E-learning tools can be used to monitor academic progress of students through assignment submission with stipulated time.	237	3.36	1.26	Agree
8	Am awareness that e-learning tools develop lecturers' course writing skill.	237	3.03	1.31	Agree
9	Am aware that e-learning platform encourage collaborative learning amongst students to students and lecturers to students.	237	3.18	1.38	Agree
10	Am aware e-learning tools is a reliable means of learning.	237	3.13	1.34	Agree

Decision mean 3.0

Table 1 Indicate mean and standard deviation of mean response of lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education. It was agreed with the mean values ranging from 3.03 to 3.75. From the analysis, it was revealed that lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education is positive. The implication is that, the awareness on the use of e-learning tools for instructional delivery in Colleges of Education is positive since all the ten items on awareness show agree based on decision mean of 3.0.

Research Question Two: What are the mean responses of male and female lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education?

Table 2: Mean and standard deviation of male and female lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education

Gender	N	Mean	Sd
Male	149	34.34	9.49
Female	88	35.39	9.60

Table 2 shows the mean and standard deviation of male and female lecturers' awareness on the use of e-learning tools for instructional delivery in Colleges of Education. From the result, it can be seen that mean and standard deviation of male and female are; male $\bar{X}$= 34.34, SD = 9.49 and $\bar{X}$= 35.39, SD = 9.60, the mean difference is 1.05 in favour of female lecturers awareness.

Research Question Three: What is the mean response of attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education?

Table 3: Mean and standard deviation of mean response of attitude of lecturers' towards' use of e-learning tools for instructional delivery in Colleges of Education

SN	Item	N	Mean	Sd	Decision
1	I prefer using e-learning tools to conventional methods in teaching and learning.	237	3.38	1.41	Agree
2	I believed that e-learning tools is a good platforms where I can update my knowledge and skills.	237	3.38	1.23	Agree
3	I like using internet to teach my students.	237	3.39	1.31	Agree
4	Using e-learning tools can improve lecturers and students intellectuals through sharing of ideas and knowledge.	237	3.67	1.21	Agree
5	Participating using e-learning tools as a mode of instructional delivery would improve my ICT skills.	237	3.41	1.21	Agree
6	I believe that course materials delivered through e-learning tools can assist me in some area of difficulties or new courses introduced in my department.	237	3.40	1.27	Agree
7	E-learning tools as a mode of instructional delivery to the students is a way of encouraging pace learning.	237	3.46	1.25	Agree
8	Using my e-learning tools to deliver results to my students change my attitude towards it.	237	3.27	1.34	Agree
9	I always read assignment and projects of my students on e-learning tools.	237	3.16	1.35	Agree
10	E-learning tools safe in the instructional delivery process.	237	3.12	1.25	Agree

Decision mean 3.0

Table 3 shows mean and standard deviation of attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education. It was agree with the mean values ranging from 3.12 to 3.67. From the analysis, it was revealed that attitude of lecturers towards use e-learning tools for instructional delivery in Colleges of Education is positive. The implication is that, attitude

of lecturers towards use of e-learning tools for instructional delivery in Colleges of Education is positive, since all the ten items on attitude show agree based on decision mean of 3.0

Research Question Four: What are the mean of attitude of male and female lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education?

Table 4 Mean and standard deviation of male and female lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education

Gender	**N**	**Mean**	**Sd**
Male	149	34.80	9.13
Female	88	35.31	9.66

Table 4 shows the mean and standard deviation of the male and female lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education. From the result, it can be seen that mean and standard deviation of male and female are; male $\bar{X}$= 34.80, SD = 9.13 and $\bar{X}$= 35.31, SD = 9.66, the mean difference is 0.51 in favour of female lecturers attitude.

Hypothesis One: There is no significant difference between mean of male and female lectures awareness towards use of e-learning tools for instructional delivery in Colleges of Education

Table 5: ANOVA analysis of male and female lectures awareness towards use of e-learning tools for instructional delivery in Colleges of Education

Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**	
Between Groups	60.310	1	60.310	.664	0.42
Within Groups	21358.407	235	90.887		
Total	21418.717	236			

Table 5: shows the hypothesis that stated that no significant difference between mean of male and female lectures awareness towards use of e-learning tools for instructional delivery in Colleges of Education was tested. The finding in (table 6) showed f = 0.664 with p = 0.42 since p> 0.05, H01, was accepted. Therefore there was no significant difference between the mean of male and female lectures awareness towards use

of e-learning tools for instructional delivery in Colleges of Education in Niger State.

Hypothesis Two: There is no significant difference between mean of male and female attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education in Niger State.

Table 6: ANOVA analysis of male and female attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education.

	Sum of Squares	Df	Mean Square	F	P
Between Groups	14.286	1	14.286	.164	0.68

Within Groups	20458.676	235	87.058
Total	20472.962	236	

Table 6: shows the hypothesis that stated that no significant difference between mean of male and female attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education was tested. The finding in (table 6) showed f = 0.164 with p = 0.68 since p> 0.05, H02, was accepted. Therefore there was no significant difference between mean of male and female attitude of lecturers' towards use of e-learning tools for instructional delivery in Colleges of Education.

Discussion of Findings

There was no significant difference between between mean of male and female lecturers' on the level of awareness towards using e-learning tools for instructional delivery in Colleges of Education. The study is in support of Khalid (2016) who carried out study to evaluate English teachers' awareness and perceptions in using e-learning tools. The result of the study showed that English teachers are aware and familiar with popular e-learning tools and perceived its usefulness in teaching and learning. This is contrary to the study of Olibie et al (2014) who investigate the extent of awareness of virtual learning among students in two public universities. The findings revealed that there was significant differences between male and female students' awareness of what constitutes virtual learning and its benefits. It also disagreed with the study of Ugwu and Ohimekpen (2015) who carried out study on the level of awareness and use of e-learning resources by secondary school teachers. The result of the study showed that a number of the teachers are not computer literate and are not aware of e-learning resources.

There was no significant difference between mean of male and female lecturers' attitude towards use of e-learning tools for instructional delivery in Niger State Colleges of Education. This is in support of the study of Olafare et al (2017) who carried out study on information and Communication Technology (ICT) has transformed the global education system in the areas of teaching and learning to achieve the Sustainable Development Goals (SDGs). It was revealed that lecturers had positive attitude towards the use of ICT, no significant difference was established between male and female lecturers in their attitude. The study agree with the study of Akbarilakeh, Alireza and Hossein (2019) who examined the attitude of faculty members towards e-Learning at Shahid Beheshti University. The results of this study show that the attitude of faculty members is positive towards using appropriate e-learning. This is contrary to the study of Harisa (2020) who investigated the lecturers' attitudes towards online teaching in the learning process. The study revealed that the problem is that many lecturers in Tangerang City area are afraid of using technology and some of them are stuttered and technology illiterate. Also in disagreement with study of Edo (2016) who investigated attitude of academic staff towards utilization of e-learning in teaching and learning in the universities in Rivers State. The result indicated that academic staff attitude to e-learning is poor. This is because most of the academic preferred conservative mode of using chalkboard.

Conclusion

In this study, effort has been made to investigate the lecturers' awareness and attitude towards utilization of e-learning tools for instructional delivery in Colleges of Education in Niger State. From the findings of this study, it is concluded that, lecturers in colleges of education are having positive awareness and attitude towards utilization of e-learning tools for instructional delivery in Colleges of Education in Niger State. Majority of respondents favoured the use of e-learning tools for instructional delivery. More importantly, they believe that the use of e-learning tools will give room for learners to learn at their own pace. Also, most of the respondents agreed that the use of e-learning tools is a good platforms where knowledge and skills can be impacted. However, while there was no significant difference between male and female lecturers' in the level of awareness and attitude on the use of e-learning tools for instructional delivery in Colleges of Education in Niger State. Furthermore, based on the finding of this study, it is also concluded that lecturers are aware and had positive attitude on the use of e-learning tools for instructional delivery in colleges of education in Niger State.

Recommendations

The following recommendations are proffered based on the findings of this study:

i. E-learning training, particularly on the use of e-learning tools for instructional delivery in higher institution of learning should be organized by appropriate governments' agencies for the lecturers of colleges of education in Niger State. This will enable the lecturers to acquire basic skill needed on e-learning tools for effective and efficient instructions delivery.
ii. Governments should make available enough funds to maintain e-learning facilities so as to encourage lecturers in using the platform for instructional delivery.
iii. Both lecturers and students should be encouraged and taught on how to make their e-learning tools for educative purpose rather than entertainment. This will go a long way helping both lecturers and students in the instructional delivery process.

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CHALLENGES OF IMPLEMENTING FREE AND OPEN SOURCE SOFTWARE [FOSS] APPLICATION: NIGERIA EDUCATIONAL SETTING PERSPECTIVE

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Abstract

Information and communication technology has revolutionized the educational sector with advent of electronic learning and online programs. Almost all activities regarding school system can be done electrically from registration, examination and project supervision. An important ingredient for e-learning is availability of infrastructures, among which is appropriate software. Proprietary software are expensive and has many restriction hence, it may be out of reach for low income countries. It is in this regard that free and open source software (FOSS) came into rescue. Free and open source software are groups of software that have freedom of being used, modified, adapted, copied and re-designed because their source codes are made available for others who might want to use them. This study was a qualitative one where fifteen lecturers from six higher institutions of learning in Kwara State were interviewed. Results showed that all the lecturers were aware of FOSS and have used them at various times. The study shown that FOSS has advantage of being cheap, available, accessible and modifiable. Challenges that affect the implementation of FOSS in schools were also highlighted. They include software security issues, lack of warranty, intellectual property issue and hidden cost. Others are the lack of infrastructures, lack of adequate trained manpower and erratic power supply.

Keywords: Free and Open Software, Education, Application, ICT, Instruction

Introduction

The world can be described as a global village because distance and time are no longer barriers to interaction among people. This is more so in education sector as there is gradual collapse of four-wall classroom and advent of online classes. This is as a result of advances in information and communication technology (ICT) that give rise to electronic leaning (e-learning) and online distance learning. An important component needed for effective e-learning is availability of appropriate software to support the technology.

Many people may not be able to afford the purchase of proprietary software due to their high cost and other restrictions, hence, their consideration for Free and Open Source Software (FOSS). Free and Open Source Software (FOSS) is used to describe groups of software comprising free software and open source software which are freely licensed to be used, copied, studied, adapted, modified and re-designed by anybody in anyway (Gupta and Surbhi, 2018). The word “Free” here means that there is freedom granted to people to freely use the software and not necessarily “free” in term of cost, though majority of them are actually free in term of financial cost. The open source software similarly means that the developers of the software made available ‘source codes’ so that

anyone that is interested in using and modifying the software can easily do so (Mittal and Singh, 2013). This is with the understanding that anytime these software are modified, the 'source codes' would be made open and available for the benefit of others who might also want to use them (Gupta and Surbhi, 2018).

Free and Open-source software source codes are available for public inspection, modification, and enhancement. Normally, these software are created through community collaboration and maintained and updated on volunteer basis. The operation of FOSS can be said to stand on some basic principles are the following; (a) Transparency: this is very germane when developing FOSS. Information and materials such as the source code are made available and nothing is hidden. This is to ensure that subsequent people that will work on the project do not lack any necessary details to make their work easy. (b) Collaboration: several workers from different parts of the world partner to work on the same or similar software. This enhances their work as new discoveries and modifications are freely shared among the partners. It can, therefore, unlock new possibilities and solve problems that might be difficult to solve by an individual. (c) Another principle is inclusive meritocracy. Due to the fact that FOSS is being maintain by the community of people with similar interest, diverse perspectives can be harvested and the best ideas implemented (Gentile, 2010).

Many tertiary institutions of learning have keyed into the use of FOSS for their academic as well as administrative purposes. This is mainly because of its availability and affordability (Uzomba, 2015). Also because of the fact that source codes for FOSS are made available by the developers and owners of the software, they are easy to improve upon, have control over and their functions can be modified so as to match the expected needs of their users. Other benefits of FOSS are the fact that the servers are observed to work well with no or little need for maintenances. Their updates are inexpensive and also no royalty fee is required for their use. Free and open source software are mostly secured, and tend to have seamless ability to interphase well with other software (Mittal and Singh, 2013). Common examples of FOSS are GNU General Public License (GPL), GNU Lesser General Public License (LGPL), Apache License and Moxilla Public License. Others are Linux, Open Solaris, Free RTOS, Open BDS and Minix.

Use of Free and Open Source Software application is becoming more acceptable worldwide because of it adaptability, availability and affordability. Many businesses including educational institutions are using one or more FOSS product in their establishment even sometimes unknown to them (Thankachan and Moore, 2017).

At the University of Ilorin, Falade et al conducted a study on the readiness and perspectives the university lecturers on the use of FOSS in the teaching. Three hundred lecturers were purposively recruited into the survey. With the use of questionnaire, it was reported that lecturers at the University of Ilorin have positive perspective and attitude toward adoption of FOSS in the teaching and learning in the University. (Falade et al, 2021). In another study on the use of a Free and Open Source Software (FOSS) based learning package in teaching basic technology among Junior Secondary Schools students in Nigeria, Efuwape et al adopted a quasi-experimental design on 118 students of basic technology. The respondents were divided in experimental and control groups. Their result revealed that the experimental group who were taught basic technology with a FOSS

based learning package had a higher academic achievement than those taught with the traditional lecture method.

Based on the findings, they thus recommended that the use of Free Open Source Software based learning package should be adopted by teachers and school administrators to facilitate meaningful learning in basic technology. Also, computer assisted materials or packages be developed for topics that may need some extra support to teach.

Kolawole and Oladokun looked into the use of Koha software which is an example of FOSS in university libraries in Nigeria and found that it was very useful and ready to be adopted by the Liberians, however, lack of institutional support, inadequate information, and negative attitudes of librarians were some of the challenges facing Koha in Nigeria. (Kolawole LF and Oladokun TA, 2021.

Despite the initial fear by the educationists that ICT could have negative impact on students' performance, the reverse is now being observed. Improvement and advances in technology has made learning easy and some perceived difficult subjects can now be simplified with the use of multimedia instructional materials imbedded in many of the software being used for teaching these day. Accessibility of lecturers to students are also better because distance no longer create barrier to teaching and learning. Lecturers can deliver their lectures online and even supervision of students' projects are easier and faster because the materials can be exchanged electronically (Picha, 2018).

Despite the recognized advantages of FOSS, there are challenges and barriers hindering its implementation for educational purposes in low resource countries like Nigeria. These challenges include inadequate training of those that will adapt the FOSS. Though, FOSS are said to be secured, they are not completely safe from cyber-security risk. Fichtner et al recognized the following challenges; lack of security leading to cyber-attacks, issues of intellectual property rights, lack of warranty, operational insufficiencies and poor developer's practices (Fichtner, 2013). Poor power supply is also a recognized challenge, lack of institutional support and poor funding are other problems hindering the implementation of the use of FOSS in Nigeria Educational setting (Uzomba, 2015).

Lack of warranty is another problem usually listed by users of Free and Open Source Software. These software are without warranties as to its security, support, or content. Support for FOSS is done by volunteers, which is not regular hence its release is very unpredictable. When such support on security issues on FOSS is done, it is entirely voluntary, therefore, it is not liable for any faulty guidance.

Hidden costs has also be said to be another problem that discourage potential users from implementing the use of FOSS in schools. Though it is generally believed that FOSS applications are cheaper and sometime free when compare with proprietary software, but there might be hidden cost which are not too obvious before the decision to use the FOSSA application. These hidden cost include; need to set up new hardware in situation when the new software does not work with the hardware, cost of installing and configuring the software, there might be need to train the staff

on the use of the new software, there might be need to customized the software and cost of maintenance and support is also considered a hidden cost.

Unlike most proprietary software which already include free tech support because this has probably been paid for in the packages of obtaining the software, majority of FOSS companies charge for these service. Another hindrance to the use of FOSS application in education sector is lack of support staff that are grounded in the use of FOSS. None of the lectures interviewed had any specialized training on the use of FOSS organized or sponsored by the institution. The few that had training did so on their own volitions. Kumar et al reported similar situation in India where many teachers were not computer literate and lacked the expertise required in the implementation of FOSS for educational purposes (Kumar, 2019).

Methodology

In spite of the perceived advantages of using FOSS application in educational sector in terms of reduced cost of acquiring the software and its compatibility with many other software, the level of used of these software in higher institutions was still less than expected. Hence, this study aimed was investigated challenges hindering the implementation of FOSS in education sector.

The study was conducted in Kwara State which in the North-Central geo-political zone of Nigeria. There are many tertiary institutions of learning such as the universities, polytechnics and colleges of education. Some of these institutions are owned by the federal government (e.g. University of Ilorin), some by the state government (e.g. Kwara State University, Kwara State Polytechnics, College of Education, Ilorin etc.) while so many are private owned (Al-Hikma University, Crown Hill University, Igbo Owu Polytechnics, Nana Aisha College of Education, etc.)

Objectives of this study were (a). To examine the level of understanding of Kwara State higher institutions' lecturers on the use of FOSS in education (b). To find out the experience of higher institution lecturers in Kwara State about the use of ICT in teaching with emphasis on FOSS (c). To evaluate the perceived benefits of FOSS in education by the lecturers of higher institutions in Kwara State. (d). to find out the challenges against the implementation of FOSS for educational purposes by the lecturers of higher institutions of learning in Kwara State

The study was a qualitative research model where one-on-one interview was conducted using semi-structured interviewed protocol titled "Interview Protocol on Challenges of Implementing Free and Open Source Software for Instruction (IPCIFOSSI)" which was developed by the researchers and used to collect relevant information from the participants. The following research questions guided the questions which was asked during the collection of data;

i. How do lecturers of higher institution perceive the importance of using FOSS in educational sector?
ii. Are there factors related the FOSS application affecting it full implementation in tertiary institution?
iii. What are the contribution of financial resources and infrastructure on the implementation of FOSS in educational sectors?

The study was done in Kwara State. All the lecturers of the higher institutions in the state formed the study population. Stratifying sampling technique was used to select six (6) tertiary institutions that was used for the study. These institutions are, Al-Hikman University, Ilorin; Kwara State University (KWASU), Malete; Kwara State Polytechnics, Ilorin; Igbo Owu polytechnics, Ilorin; Kwara State College of Education, Ilorin and Kwara State College of Education, Oro. Purposive and convenience sampling techniques was used to select fifteen (15) lecturers from these institutions who were interviewed. Interview was conducted and recorded using IPCIFOSSI in quite locations devoid of distraction. The interviewees were assured of confidentiality, and they were also told of their right that they were at liberty to withdraw at any stage of the interview without fear of coercion or intimidation, if they so desire. Table 1 shows the demographic date of the respondents.

Table 1. Bio-Data of the respondents

Participant No	**Sex**	**Highest degree**	**Institution**	**Department**	**Years of experience**
Participant 1	Male	MSc	Polytechnic	Computer science	12 years
Participant 2	Female	PhD student	Polytechnic	Computer science	20 years
Participant 3	Male	PhD student	Polytechnic	Computer science	15 years
Participant 4	Male	MSc	Polytechnic	Computer/Mathematics	5 years
Participant 5	Male	MSc	College of Education	Computer Science	22 years
Participant 6	Male	PhD student	College of Education	Computer Science	15 years
Participant 7	Female	PhD student	College of Education	Computer Science	11 years
Participant 8	Male	MSc	College of Education	Mathematics	5 years
Participant 9	Male	MSc, PGDE	College of Education	Mathematics	10 years
Participant 10	Male	MSc	Polytechnics	Computer Science	5 years
Participant 11	Male	PhD	University	Computer Science	12 years
Participant 12	Male	PhD	University	Computer Science	8 years
Participant 13	Male	PhD	University	Computer Science	5 years
Participant 14	Male	PhD	University	Computer Science	6 years
Participant 15	Male	PhD	University	Computer Science	10 years

Data collected was analyzed using thematic approach. The outcome of the findings was discussed and recommendations was made based on the conclusion of the study.

Results

The study on the challenges faced by lecturers with the use of FOSS in Kwara State was done using qualitative research technique with the interview method. Fifteen lecturers from six higher institutions of learning in the state were interviewed. The institutions consisted of two universities, two polytechnics and two colleges of education. One of the universities was government owned and the second was a private university. One of the polytechnics was a government owned and the second was a private owned, while the two colleges of education were government owned colleges of education. The participants comprised of thirteen males and two females. They were from computer sciences, computer and mathematics and educational technology departments. The majority of the interviewees were male (13) and only two were females.

The minimum qualification of the participants was masters' degree. Some of the respondents were already doing their PhD while the rest were PhD holders. Just one interviewee had 2 years of experience as a lecturer another one respondent also had more than 20 years' experience as a lecturer. Majority of the respondents were, however, between 8 and 12 years of experience. All the respondents had good knowledge of internet and most of them used it on daily bases to assess news, for educational and research purposes and for social media usage. All the respondents had access to the internet through the use of various gadgets and devices like smartphones handsets, tablets, laptops and desktop computers. They had these devices at home and offices. Though in some instances, there were not enough computers' provision from the institutions, lecturers from the affected departments/institutions made use of their personal gadgets for official purposes.

All the participants agreed that there was problem with the electric power supply from the national grid in the country, however, the school managements in most instances usually support and augment the national grid with the use of power generating sets (power generators) and solar power system. In some instances, where the whole institution was not connected with these alternative power supply, the ICT units/departments were usually be connected. The participants also believed that they had fairly adequate exposure to the use of ICT generally by school authorities organizing workshops, seminars, training and tutorial. Though many of these trainings were not specifically for the use of FOSS, they were useful and equip them well for the use of software including FOSS. When lecturers wanted anything more specific and advanced, they might have to be responsible for this using their personal resources.

The interviewees also demonstrated fair understanding of FOSS. They were able to state the full meaning of FOSS as "Free and Open Source Software". Though they gave explanations of FOSS in different ways, they were essentially saying the same thing. For instance, participant 1 described FOSS 'as groups of software released by their copyright holders freely together with their source codes, for the use of people". Participant 2 described it as "software which can be access freely without payment, can be used for different purposes and their source code is provided to guide other users who might want to modify or adapt it". Participant 7 described it as "software

developed by collaborative community of developers, which were made free and their source codes are also released to the internet, example of which include Mozilla Firefox and chrome"

While discussing the features that make FOSS appealable to users, majority of the respondents said it was because of its openness and affordability. They believed that many of the FOSS were literarily free of any financial implications.

That the users would not pay anything to have them. The participants alluded that this was good for third world countries like Nigeria, where people might not be buoyant enough to pay for propriety software. They also believed that FOSS was open for modification and adaptation because of the fact that its source code was made available by the developers. Participant 9 stated that "our students can make use of its openness to develop their own software similar to the FOSS, by adapting its source code. After this, the students will also ensure that the source code is made available for the benefit of those who might want to improve on the newly developed software too".

The benefits that the participants derived from FOSS were related to the features that made the FOSS appealing to the users. Majority of the participants mentioned economic and financial benefits. The fact that FOSS were free or very cheap made it beneficial to the users when compared to propriety software. This, they said, helped those who ordinarily would not be able to pay for expensive software to have access to them. Another benefit that participants also mentioned was the fact that it could help other developers and students develop their similar software. For instance, participant 13 stated that one of the benefit he derived from FOSS was "ability to serve as template to develop, modify and amend your own software because its source code is made available". It was also considered to give users educational and learning opportunity.

While, many participants considered ease of use as a perceived benefit of using FOSS, some were of the opinion that FOSS was not easier to use than propriety software. They stated that some level of expertise and technical knowhow might even be required for their use. Participant 6 put it this way "Though FOSS is easily available and accessible, it sometimes might require some technical support before someone can get maximum benefit from it. The configuration might not be straightforward and one can be getting users error messages if one is not conversant with its operation, hence the need for technical support".

The participants highlighted challenges they usually encounter while using FOSS. These challenges were divided into four main categories which include; challenges arising from the software itself, those associated with the users, those associated with the infrastructure needed to effectively use the FOSS and lastly, those that have to do with security, copyright and privacy issues.

Challenges related to software were unstable nature of some software. Participant 1 stated that, "Some of these software could be unstable and prone to errors, because many developers would have worked on them, thereby altering their information". Another challenge mentioned by some of the respondents was the issue of cracked version of FOSS. By not getting the original version, these faked ones were prone to hacking and could even corrupt the system on which they were installed. This led to another problem which was untrusted sources of the software. The propriety

software has names and they could be trusted. This was because, if there was any problem, the company had name to protect, whereas, the FOSS did not have such name to protect.

The participants stated that there was a limit to features that they could access when using FOSS as against propriety software. Though, FOSS could give them some reasonable assess to some features, if they needed to assess advanced stage, it might not be able to do it, hence, they might be asked to pay certain amount of money before they could have access to such advanced or specialized tools/features. Those that had that kind of notion however, said that FOSS were enough to perform basic functions in most cases.

Compatibility between propriety software and FOSS was another challenge highlighted by the participants. They stated that, software from the same company were compatible and worked together easily. But since different developers were responsible for different FOSS, there might be problems of incompatibility. It would take experts and those with technical know-how to solve this kind of problem. Or when the community of developers develop FOSS that could work with each other.

The major problem related to infrastructure had to do with internet. Many places in the country were yet to have internet access. Where internet was provided outside big cities and metropolitan areas, the speed might be slow and therefore, the users might not enjoy steady access to connectivity. This might interrupt the use of FOSS in the country. In other places, there might be congestion and oversubscription. This would also affect steady access to internet. The participants also stated that the network providers were also not reliable. There were instances that the internet access would be disconnected without notification or warning. This usually prevented smooth running of FOSS in our environment.

Another challenge that almost all the participants mentioned was the cost of network data. Cost of data bundles for internet access was said to be on the high side as highlighted by the respondents. They concluded that even when FOSS were almost free, the cost of data to access them might be a big challenge to their use. The participants also noted as one of the challenges mitigating against the use of FOSS in Nigeria was that institutions failed to make available adequate devices like computers for staff and students. Many users had to be using their personal gadgets so as to get their work done. Many students who could not afford buying gadgets that have access to be used for internet connectivity might not benefit from FOSS.

Experience of the users was also noted to be essential when we considered the use of FOSS. It sometimes required technological expertise to be able to use, adjust and modify FOSS. When this was lacking, it would be hard to get maximum benefit from their use. To improve lecturers' knowledge and experience on the use of FOSS, school do organize trainings and lectures on the use of internet. One of the participants reported stated that "the school regularly organize training for teachers and students on the use of internet for online learning, especially during the covid-19 pandemic, but not specifically on FOSS. Lecturers that need to know more have to do that on his or her personal efforts".

Cyber security and privacy issues were other challenges that cropped up from almost all the participants during their interaction with the researchers. They had the believe that because the

FOSS did not have any particular developers who monitor these free and open source software regularly, and for the fact that their source codes were made open and available, they might be easy target of cyber malware like viruses, worms and Trojans. For the same reason, it might be easy to hack into the software and this could lead to cyber-crime such as identity theft. While discussing about the issue of copyright, participant 13 stated thus, "Privacy and copyright breaches can occur when the FOSS are released freely to the community, but some of their components have been copyrighted by another propriety software company. This usually happen when some parts or the whole software was cracked or stolen from propriety software". Participant 6 stated also that "Ordinarily, FOSS should not have privacy and copyright issue if the software is produced normally following all the rules and regulations required, using the released source code. However, when the developers use fake/pirated software in their development, this is when it could lead to copyright infringement".

Recommendations given by the respondents on solving the challenges confronting use of FOSS has to do with the type of challenges identified. "The users should ensure they only visited secured sites and use trusted FOSS in order to prevent cyber-attack" this is the recommendation of a participant in this study. "People should also use and regularly update anti-virus and firewall on their gadgets to prevent virus attacks" recommended by participant 4. Another participant stated that 'schools' management should make sure they acquire more computers for teachers' use in doing their official duties instead of individuals using their personal gadgets. Allowing personal gadget to be logging into the institution's system may also compromised the system and serve as point of entry for viruses". Another participant also recommended that "training of lecturers on the use of ICT should be one of the priority of school's authority. This will ensure that they have required expertise and technical knowhow about FOSS and other software and hardware". The participant recommendations to the government were that, government should ensure nation-wide spread of internet facility.

Government should also monitor the network providers through the National Communication Commission which is a regulatory agency over the network providers, to improve their internet spread, capability, and speed. The cost of data should be reviewed downward to make it cheaper especially if it is for educational purposes. And finally, the participants suggested that higher institutions of learning should subscribe to FOSS sites that were credible to avoid patronizing fake and pirated/cracked products.

Discussion

Uses and Advantages of FOSS in Education Sector

The use of Information and Communication Technology in educational sector is receiving acceptability due to the growth of ICT generally in all sphere of life. The current study found that all the higher institutions of learning used had ICT units and the lecturers had in make use of ICT devices for their daily activities. The institutions used ICT right from stage of seeking for admission through Joint Admission Matriculation Board (JAMB) that is conducting its examinations as Computer Based Test (CBT), checking of students results online, printing of admission letters and registering for the courses. Payment of school fees and other things like

obtaining school identity card are also done electronically through the use of ICT. Aside the physical classes, many classes are presently been conducted online, assignment could be done online and even examination are now be taken electronically through the use of ICT.

However, one big obstacle to the full implementation of the use of ICT in teaching and learning is the cost of acquiring the infrastructures needed for these laudable initiative. Lecturers may have to make use of their personal gadgets as those provided by the schools could not go round. In some institutions, number of computers were not sufficient for the students. Another major problem is the cost of proprietary software needed for the implementation. Getting these software might be out of reach of third world countries, Nigeria inclusive. There is also need for annual updates that also requires money and payment for licenses. This is where the Free and Open Source Software come to the rescue of people in the low-resource countries. Most of the respondents in this study stated that one of the major advantages of FOSS is that they are free or relatively very cheap, and there is no need for payment of royalty fee, no payment for updates and there is little need for maintenance and support. They can also be modified and adapted for other purposes unlike proprietary software that has to be used for specific functions and cannot be adapted or modified.

This was similar to the advantages enumerated by Danurduro and Walandari in their study among students in Malaysia (Danurdoro & Wulandari, 2016).

Other advantages mentioned by the participants are easy compatibility, ease of use, easy availability and accessibility. They therefore encouraged institutions to take the advantage of FOSS over the propriety software. Many other previous researchers had stated similar views. For instance, Al-Hajri et al stated that many countries are adopting Free and Open Source Software in all government sectors; and many educational institutions have also adopted FOSS and this has given them a comparative advantage over other institutions that are yet to implement its use (Al-Hajri, 2017). Different institutions may have different reasons for adopting FOSS, which may not be far from reduced total cost of ownership, freedom to make copies and distribute to others without being worried of software legality, reliability, performance and security issues (Shaame et al, 2013)

Challenges of Implementation

Notwithstanding the many benefits of using FOSS Applications, it is not without challenges and limitations that adversely affect their implementation in educational sector. These challenges may be divided into software related problems, government and policy makers problems as well as challenges emanating from the users and other stakeholders.

This study identified lack of cyber security as one of the major challenges confronting the use of FOSS. This is in an agreement with findings from previous work that noted that FOSS applications usually lacked legal obligations for the security of the software, therefore, necessary support on how to secure the software may be absent (Singh, 2013). This is because the developers of these software are not security experts, hence may not understand how to implement best security practices.

This study also highlighted that 'cracked" or fake copies of software were common among FOSS. This was considered as a challenge because of infringement and disregard for intellectual property issues. Even though one of the benefits of FOSS is availability of source code, it can also be a disadvantage. This is because free and open source software may be created by anonymous developers, hence, it might be difficult to verify that source code made available is original and not taken from a third-party source with established intellectual property rights. If this happened, one can be held responsible for infringement on intellectual property right (Vasudeva, 2012). Another challenge that was also identified by the participants was the problem of incompatibility of FOSS with propriety hardware. Handwiki explained that proprietary hardware need specialized drivers to run their programs, which are often only available from the equipment manufacturer. In a situation where an open source driver exists, it may not work with proprietary hardware or other software (Handwiki, 2022).

Infrastructure problem is one major hindrance to use of FOSS for educational purposes. An important requirement/perquisite before FOSS can be successfully implemented is adequate infrastructures. Nigerian educational system is still bedeviled with inadequate basic infrastructures in schools, such as conducive classroom, chairs and desks for the learners, chalkboard and others.

The introduction of ICT into learning will require provision of computers, servers, and other gadgets necessary for hitch-free teaching and learning. This will be a huge challenge because budgetary allocation to education in Nigeria is still inadequate when compare with UNESCO recommendation. Lack of adequate power supply is a major constraints affecting many businesses in Nigeria. Deployment of ICT and subsequent use of FOSS applications require regular power supply. Nigeria power supply is at best erratic but most often non-available. However, many institutions of learning in Kwara state are making use of alternative power sources such as solar power system and generating set specifically for their ICT units where the whole schools could not be covered. More efforts need to be put in place to ensure that other areas of school also enjoyed regular electric supply because for full implementation of digital class, not only the ICT units needed to enjoy regular power supply. Aviara noted that poor power supply do have negative impact on the use of FOSS application in teaching because there can be interruption in the teaching process any period that power is cut off. Servers may be down at such time and the electronic gadget required for the teaching will also be affected (Aviara, 2014).

Conclusion

The higher institutions of learning in Nigeria have embraced the use of FOSS in their academic system because of their advantages. However, there are challenges encountered in their use such as inadequate devices, lack of training and cost of data, which may limit the optimal benefits expected from these software. Solutions were also recommended.

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PRE-SERVICE SCIENCE EDUCATORS' PEDAGOGICAL SKILLS ACQUISITION AND THE USE OF OPEN TECHNOLOGY FOR INCLUSIVE CLASSROOM INTERACTION

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Abstract

Inclusive education is SDG4 and it is targeted at allowing special education needs (SENs) students spend enough time with their non-disabled colleague, to learn in the same environment and to be exposed to the same learning opportunities in an inclusive classroom environment. The problem associated with the ease of implementation has been identified as the deficiency in the Educator training program. This paper explores how to solve the problem of the policy of inclusive education in Nigeria. More specially, it considers how pre-service science educators could acquire pedagogical skills with the use of open technology for inclusive classroom interactions. The study adopted descriptive research method of the survey type. Five research questions were raised and answered, two research hypotheses were tested at 0.05 level of significance. The population for the study was all science education students in both public and private institutions of higher learning in Ilorin. Samples were drawn randomly, fifty respondents each from one federal university, one state university, one private university, one federal college of education, one state college of education, and one private college of education. This gives a total of 300 respondents. A researcher designed well-structured questionnaire was used to elicit information from the respondents. The 32 items questionnaire of 4 points Likert scale was titled "Pre-service Educators' Acquisition of Pedagogical Skills with the use of Open Technology for Inclusive Classroom Questionnaire (PEAPSOTICQ)".findings revealed that inclusive education in Nigeria is challenged by lack of knowledge on the part of classroom educators, attributed to poor training from the teaching schools, open technology can help pre-service educators acquire the pedagogical skills required to successfully implement inclusive education in Nigeria. This paper recommends that one way of overcoming the challenges is to improve on the Teachers' training program and enlighten educators on the use of open technology.

Keywords: Pre-Service Educators, Pedagogical Skills, Open Technology, Inclusive classroom

Introduction

Science plays an important role in a developing nation; it brings about civilization and technological advancement. Its importance cannot be overemphasized because it effects are felt in all ramifications. The word "science" is derived from Latin word "scientia" which means knowledge so, science as a discipline is termed to be a creative structure, built on facts. According to Abimbola (2013) science is defined as a body of knowledge, a way or method of investigating, and a way of thinking in order to understand nature.

In the submissions of Olorundare (2023), science is a self-criticizing, self-correcting and an improving activity which deals with facts relating to the natural phenomenon of the universe and how these are interpreted. The Business dictionary (2023) defined science as a body of knowledge comprising of measurable or veritable facts acquired through application of the scientific method and generalized into scientific laws or principles. The attitudes or values that underlie 'sciencing' is known as the spirit of science which includes longing to know, questioning of all things, search for data and their meaning, demand for verification, respect for logic, consideration of premises and consideration of consequences (Olorundare, 2023). Teachers who teach science are not scientists but science teachers who have undergone teachers' training in science education.

Science education is a field concerned with sharing science content and processes with individuals that are not traditionally considered part of scientific community. These individuals may be children, college students or adults within the general public. In the submissions of Abimbola (2013), the field of science education comprises science content, a bit of sociology and some teaching pedagogy. The goal of science teaching is to produce scientifically literate citizenry (Olorundare, 2023). Science is being taught at the senior secondary level of education by educators who received a form of training known as Teacher-education. Educators play a very crucial role in the education of children, they are mediators between the curriculum and the learners (Ernest, Christopher and kofi 2019). An educator is a person whose job is to teach in a school or college. The most basic definition of the Educator is that he/she is the person who does the teaching (Zincirili,2021). An educator in the opinion of Adedeji and Bello (2016) is a unique human being who has learnt to use himself effectively and efficiently to help a society achieve their own purpose of education. The teaching profession has the most effective role in the process of teaching the cognitive and psychomotor details of other professions.

In the conclusions of Ernest, Christopher and kofi (2019), the roles of educators cannot be displaced by any form of technology, they are the real mediators between curriculums and the learners. Educators have an important role in classroom behavior management, they spend one-third of their day at work in schools and in pursuit of the achievement of teaching aims which make an important contribution to students' academic success (Gelisi 2007). Thus, the poor quality of education and low achievement scores of students in school and external examination was attributed to the fast disappearing breed of educators with "missionary" spirit (Mavic, 2020). The researcher found out that educators whose professionalism has come to be seen as an integral part of their character; and who are deeply committed to making a difference in the lives of their people are very few. Zincirili (2021) categorized learners who are taught to become educators later in a near future may be referred to as pre-service educators which means educators in training.

Pre-services educators experience different difficulties during the teaching practice program, some of which are mostly associated with instructional delivery, acquisition and use of pedagogical skills and technologies. Nigeria as a nation is striving hard to change its classroom educator's attitude toward accommodation of students with special need in accordance with SDG4 for vision 2030 (UNESCO, 2023). In the submissions of Spalding, Klecka, Lin, Odell and Wang (2010) educators are expected to meet the needs of all students and move them towards attainment of their individual potential evenly and are sometimes pressured to prepare students for maximum

performance on high-stakes assessment tests. In a research conducted by Attah (2023), the researcher submitted that meeting the needs of all students has become difficult for educators because of the deficiency in their training program. The researcher submitted that special education is placed as a different body of knowledge or discipline known as special education which has formed the basis of excluding elements of inclusive education from the Educator training programs in Nigeria.

Inclusive classroom was defined by McManis (2023) as a class setting where all students, regardless of any challenges they may have, are placed in the same learning condition in an age-appropriate general education class that are in their own neighborhood schools to receive high-quality instruction, interventions, and supports that enable them to meet success in the core curriculum. The idea of inclusiveness in education in Nigeria was to allow special education needs (SENs) students spend most if not all of their time with their non-disabled colleagues in same class situations (Attah, 2023). Reaserchers (McManis, 2023; Attah, 2023; & Spalding, Klecka, Lin, Odell and Wang, 2010) opined that the success of inclusive education will depend primarily on accepting, understanding, and attending to student differences and diversity, which may include the physical, cognitive, academic, social, and emotional aspects when planning instructions .

Instruction that is well-planned moves students from their current level of competency toward explicit criteria for success (Marzano, Pickering, & Pollock, 2001). The essence of the use of different instructional delivery models is to enable the instructor or educator surmount the challenges on the organization and passage of the instruction to students who are assumed to have come from different backgrounds, therefore, possess different learning styles, pace and understanding the lessons based on their previous knowledge (Lukman, 2023). The future of a country is in the hands of its educators and their use of pedagogical skills to ensure effectiveness of teaching and learning in the classroom. Pre-service educators needs a high level of pedagogical skills in order to become effective educators in the future (Zincirili 2021).

Pedagogical skills was defined by The Indeed Editorial Team (2022) as educators' ability to instruct students and manage their classroom, learn the materials, understand their students, communicate with parents, collaborate with colleagues and form their own fair and consistent guidelines. In the opinion of Dew (2023) Pedagogical skills are linked to both helping students learn better, and ensuring students are well behaved. In the submissions Bolaji (2023), asking questions to find out the prior knowledge of students, rewarding their efforts, setting high expectations and spaced repetition are examples of pedagogical skills. According to Dew (2023) pedagogy is the art of teaching, it describes all the teaching strategies used by Educators. The researcher submitted that students need to be well behaved in order to learn more effectively. The Pedagogical skills, thus, include the capacity to plan, initiate, lead and develop education and teaching with the departure point in both general and subject-specific knowledge which can be acquired through open technology.

Open technology according to Buss (2015) may be defined as all forms of technologies that allows users access to platforms or systems with very few constraints or restrictions on use, reuse, retaining, revising, remixing and redistribution of materials. Open technology is essential for the acquisition of pedagogical skills because of the way it connects teaching to research in the subject

of interest (Bolaji, 2023). In the discussions of Umar (2022), connecting teaching to research rest solely on the use of latest technologies. Open Technology thrives and feeds on Open Standards and Open Source, and is better characterized as a process and attitude similar to the scientific process than by technological aspects (Scheerder & Koymans, 2023). In the submissions of Scheerder and Koymans (2023), an open technology project can be identified by how those tools and platforms are used: open participation, an ethic of sharing, and a willingness to adapt to the evolving needs of its participants. The challenges of inclusive classroom interactions in Nigeria as advanced by researchers (McManis, 2023; Savage & Erten 2015; & Attah, 2023) can be attributed to poor training of Educators from teaching schools. The researchers submitted that elements of inclusive education are lacking in the educator training programs. Therefore, this study wants to investigate pre-service Biology educators' acquisition of classroom pedagogical skills with the use of open technology for inclusive education.

Purpose of the Study

The main purpose of this study was to find out pre-service Science Educators' pedagogical skills with the use of open technology for inclusive classroom interaction.

Specifically, the study would seek to find out:

1. examine the level of awareness of pre-service science educators on open technologies.

   find out the usability of open technologies for inclusive classroom interactions.

2. determine the pedagogical skills used by pre-service science educators for inclusive classroom interactions.
3. investigate the influence of gender on pre service educators' pedagogical skills in an inclusive classroom environment.
4. examine the influence of gender on pre-service science educators' use of open technologies for inclusive classroom interaction.

Research Questions

The following questions were raised and answered;

1. What is the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state?
2. What is the level of usability of open technology for inclusive classroom by pre-service science educators in Ilorin, Kwara state?
3. What are the pedagogical skills used by pre-service science educators in an inclusive classroom environment?
4. Does gender influence the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state?
5. Does gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Research Hypotheses

HO1 Gender does not significantly influence the pedagogical skills for inclusive classroom interaction by pre-service science educators in Ilorin, Kwara state.

HO2 There is no significant difference in the level of usability of open technology for inclusive classroom by male and female pre-service science educators in Ilorin, Kwara state.

Methodology

The study adopted descriptive research method of the survey type. It investigated pre-service science educators' acquisition of pedagogical skills with the use of open technology for inclusive classroom interaction in Ilorin, Kwara state, Nigeria. The population for the study was all science education students in both public and private institution of higher learning in Ilorin. Samples were drawn randomly after the institutions had been stratified, fifty respondents each from one federal university, one state university, one private university, one federal college of education, one state college of education, and one private college of education. This gives a total of 300 respondents. A researcher designed questionnaire was used to elicit information from the respondents. Random sampling was chosen for this study because of its versatility and generalizability of results. The 32 items questionnaire of 4 points Likert scale was titled "Pre-service Educators' Acquisition of Pedagogical Skills with the use of Open Technology for Inclusive Classroom Interaction Questionnaire (PEAPSOTICIQ)" and it has four sections, section A, B, C and D. Section A deals with pre-service Educators' biography; it contains information on the respondents' school type, gender, current level and course of study. Section B contains a list of open technologies to check the level of awareness of pre-service teachers. Section C contains a list of open technologies to check the level of usability by pre-service teachers. Section D deals with items on pedagogical skills Pedagogical Skills with the use of open technology for inclusive classroom interaction.

To ensure face and content validity of the instruments, Pre-service Educators' Acquisition of Pedagogical Skills with the use of Open Technology for Inclusive Classroom Interaction Questionnaire (PEAPSOTICIQ) was given to researcher's supervisor, two experts in Educational Technology Department and two experts in Information and Communication Technology to check whether the instrument will measure what it supposed to measure. Institutions and students participating in this research work were not exposed to any of risk as it was made known to them that their responses will be treated confidentially and their identities will not be revealed to anyone. Benefits from the study was stated on the informed consent form and plagiarism test was carried out to determine if this work is not an existing work written by another researcher.

The researcher collected a letter of introduction from the Head of department of Science Education, Al-Hikmah University, Ilorin. The researcher personally visited the institution of learning where the study was carried out and sought the permission from authorities on the need to engage their students for the research study. Copies of an informed consent form was attached to the google forms for students to indicate their willingness for voluntary participation in the study. The researcher made it clear to the participating colleges and students that their effort, contributions will be treated confidentially and for the purpose of this study only. The researcher would seek the respondents' sincerity in their responses. The questionnaires were administered to the selected

students through google forms and responses were automatically retrieved immediately for data analysis. The data obtained was analyzed and interpreted using descriptive statistics and inferential statistics. Percentages was used to analyze the personal information provided by the respondents. Mean scores was used to answer the research questions, t-test was used to test the hypotheses.

Results

Demographic data of Respondents

Table 1: Demographic Characteristics of Pre-service Science Educators

Variables	Options	Numberof respondents	Percentage %
Gender	Male	124	41.33
	Female	176	58.67
Academic level	Year 2	260	86.67
	Year 3	40	13.33
School Type	Public	200	66.67
	Private	100	33.33
Course	Agric. Edu.	56	18.67
	Biology Edu.	72	24.00
	Chemistry Edu.	51	17.00
	PHE	50	16.67
	Physics Edu.	28	9.33
	Maths Edu.	43	14.33

Table 1 showed that the sample included 300 respondents, 260 respondents (86.67%) were year 2 students while 40 (13.33%) respondents were year 3 students, 124 males (41.33%) and 176 females (58.67%), 200 respondents (66.67%) attends public schools while 100 responddents (33.33%) attend private schools. 56 respondents (18.67%) are studying Agricultural science education, 72 respondents (24.00%) studying Biology education, 51 respondents (17.00%) studying chemistry education, 50 respondents (16.67%) studying PHE, 28 respondents (9.33%) studying physics education, and 43 respondents (14.33%) are studying mathematics education

Analyses of Data to Answer the Research Questions

Research Question One: What is the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state?

S/N	Item Statements	X	SD	Remark
1.	Mozilla Firefox	3.52	0.80	Aware
2.	WordPress	3.11	0.87	Aware

3.	LibreOffice	3.05	0.99	Aware
4.	GNU Compiler Collection	2.29	0.35	Unaware
5.	GIMP	2.32	0.51	Unaware
6.	VLC Player	3.31	0.91	Aware
7.	Shotcut	2.03	0.48	Unaware
8.	Brave	2.15	0.39	Unaware
9	Linus	2.01	0.47	Unaware
10	Python	3.23	0.91	Aware
11	PHP	2.12	0.42	Unaware
	Weighted average	2.34	0.57	Unaware

Table 2: Mean and standard deviation of responses on the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state.

Table 2 revealed that the respondents indicated their awareness of Mozilla Firefox (mean=3.52), WordPress (mean=3.11), LibreOffice (mean=3.05), VLC Player (mean=3.31), and Python (mean=3.23) as open technologies that can be used for instructional delivery. They declared that they are unaware of GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP with means between 2.03 and 2.32 which is lower than the 2.5 benchmark for awareness on the four point scale.

Research Question Two: What is the level of usability of open technology for inclusive classroom by pre-service Science Educators in Ilorin, Kwara state?

Table 3: Mean and standard deviation of responses on the level of usability of open technology for inclusive classroom by pre-service Science Educators in Ilorin, Kwara state.

S/N	**Item Statements**	X	SD	**Remark**
1.	Mozilla Firefox	3.12	0.82	Usable
2.	WordPress	3.21	0.78	Usable
3.	LibreOffice	3.45	0.91	Not Usable
4.	GNU Compiler Collection	2.15	0.59	Not Usable
5.	GIMP	2.23	0.51	Not Usable
6.	VLC Player	3.07	0.91	Usable
7.	Shotcut	2.17	0.84	Not Usable
8.	Brave	2.05	0.58	Not Usable
9.	Linus	2.26	0.97	Not Usable
10.	Python	3.53	0.91	Usable
11.	PHP	2.09	0.42	Not Usable
	Weighted average	**2.67**	**0.75**	**Usable**

Table 3 revealed that the respondents indicated that Mozilla firefox (mean=3.12), Word Press (mean=3.21), Libre Office (mean=3.45), VLC Player (mean=3.07), and Python (mean=3.53) are usable open technologies that for instructional delivery in an inclusive classroom environment. They indicated that GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP with means between 2.05 and 2.26 which is lower than the 2.5 benchmark for awareness on the four point scale are not usable for instructional delivery.

Research Question Three: What are the pedagogical skills used by pre-service science educators in an inclusive classroom environment?

Table 4: Mean and standard deviation of responses on the pedagogical skills used by pre-service teachers during teaching practice.

S/N	Item Statements	X	SD	Remark
1.	It is important for teachers to speak slowly and clearly enough that students can hear them.	3.46	0.85	Agreed
2.	It is necessary to emphasize keywords and alternate tones to engage listeners.	2.93	0.93	Agreed
3.	Changing the classroom layout maybe necessary to improve learning.	3.08	0.97	Agreed
4.	Reshuffling students sitting arrangement to ensure low scorers aren't sitting together is a good initiative	2.52	1.05	Agreed
5.	Encouraging students may improve their performance	2.89	0.99	Agreed
6.	Rewards and punishment may encourage better performance	2.42	1.10	Disagreed
7.	Providing support while students are learning a new concept is not important.	3.20	0.95	Agreed
8.	Using different formative assessment strategies can enhance learning	3.27	0.91	Agreed
9.	Paced repetition of keywords may not necessarily make learning easier for students	2.28	0.94	Disagreed
10.	Teachers should constantly scan through the whole class with their eyes to identify student who need help.	2.95	1.04	Agreed
	Weighted average	2.90	0.97	Agreed

Table 4 revealed that the respondents agreed that speaking clearly is an important pedagogical skill for pre-service teachers during teaching practice (mean = 3.46), they also agreed on alternating tones to engage learners (mean = 2.93). In addition, the respondents agreed that changing classroom layout may improve learning (mean = 3.08), so is reshuffling students sitting arrangements (mean = 2.52). The respondents agreed that encouraging students may improve their performance (mean = 2.89), agreed to providing support while students are learning a new concept (mean = 3.20), and use different formative assessment strategies to enhance learning (mean = 3.27). Respondents agreed that they scan through class with their eyes to identify who needs help among the students (mean = 2.95). Though the respondents disagreed with using rewards and punishment to encourage better performance (mean = 2.42). Same way they disagreed with not using paced repetition (mean = 2.28). All the 10 items has a standard deviation ranges from 0.85 to 1.17 which are below the fixed value of 1.96. This means that the responses of the respondents

are not wide spread as it is close to the mean. Overall, all the constructs in the Table 4 are the pedagogical skills used by pre-service Biology teachers in Ilorin during the teaching practice program. This was supported by an average mean and standard deviation of 2.91 and 1.00 (mean = 2.90, SD = 0.97).

Research Question four: Does gender influence the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state?

Table 5: Mean and standard deviation of responses on the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state.

Gender	N	M	SD
Male	124	73.46	15.31
Female	176	78.21	16.25

Table 5 revealed the mean scores of the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state based on gender, with female pre-service educators having marginal higher mean (M=78.21, SD=16.25) when compared with male pre-service educators (M=73.46, SD=15.31).

Hypothesis 1: Gender does not significantly influence the pedagogical skills for inclusive classroom interaction by pre-service science teachers in Ilorin, Kwara state

Table 6: t-test analysis of the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state.

Gender	N	M	SD	T	df	Sig
Male	124	73.46	15.31			
			.34	300	.74	
Female	176	78.21	16.25			

p>0.05

The t-test statistics result (t(300)=0.34, p=0.74) showed that there was no significant difference in the pedagogical skills for inclusive classroom interaction by pre-service science teachers in Ilorin based on gender as shown in Table 5. Hence, hypothesis 1 was not rejected as the p-value 0.74 was greater than 0.05 alpha level. This implies that the pedagogical skills employed by pre-service science educators for inclusive classroom interaction during teaching practice did not differ based on gender.

Research Question five: Does gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Table 7: Mean and standard deviation of responses on the influence of gender on pre-service science educators' use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Gender	N	M	SD
Male	124	73.91	15.01
Female	176	76.21	16.20

Table 7 revealed the mean scores of gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, with female pre-service educators having marginal higher mean (M=76.21, SD=16.20) when compared with male pre-service educators (M=73.91, SD=15.01).

Hypothesis 2: There is no significant difference in the level of usability of open technology for inclusive classroom by male and female pre-service science educators in Ilorin, Kwara state.

Table 8: t-test analysis of the level of usability of open technology for inclusive classroom by male and female pre-service science educators in Ilorin, Kwara state.

Gender	N	M	SD	T	Df	Sig
Male	124	73.91	15.01			
				.32	300	.71
Female	176	76.21	16.20			

p>0.05

The t-test statistics result (t(300)=0.32, p=0.71) showed that there was no significant difference in the usability of open technology for inclusive classroom by male and female pre-service science educators during teaching practice based on gender. Hence, hypothesis 2 was not rejected as the p-value 0.71 was greater than 0.05 alpha level. This implies that the usability of open technology by pre-service science educators during teaching practice did not differ based on gender.

Discussions

The most popular open technology used by respondents for planning, preparing and instructional delivery were Mozilla Firefox (a web browser), VLC Player (a cross-platform multimedia player) WordPress (a content management system) LibreOffice (an office productivity suite) and Python (a computer programing language that can be used to automate tasks and analyze data) while the respondents indicated that they are not aware of GNU Compiler Collection (an application software that optimizes and supports various programming languages), GIMP (a cross-platform image editor), Linux (an operating system), Brave (a web browser), Shotcut (a cross-platform video, audio, and image editing), and PHP (a general purpose server-side scripting language). It could be argued that the popularity of Mozilla Firefox and VLC Player could be attributed, amongst other reasons, to accessibility as all the pre-service teachers had VLC Player on their smartphones.

Conclusions

Pre-service teachers recognize the need use pedagogical skills to achieve success during the teaching practice program and in their career as teachers in the future. They acknowledge that open technology comes in handy to improve the quality of instruction delivery. It affords pre-service teachers the opportunity to plan, prepare and deliver quality and engaging lessons that will arouse students' interest in science. This will make it possible for classroom interactions to be inclusive, engaging students with photos, videos and document that can make learning fun and clear misconception and/alternative conception when teaching makes it easy to carry all students along. Given this and in light of the main findings listed above, the following specific conclusions was made; Respondents were aware of few open technologies. The vast majority of respondents were making use of one or more of the open technologies for instructional delivery and confirmed the usability. The respondents' pedagogical skills and usability of open technology were not different based on gender

Recommendations

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

1. Pre-service educators should ensure the use of pedagogical skills like communication, Adaptability, Collaboration, Inclusivity and Compassion.
2. Pre-service educators should keep themselves up to speed with the latest open technologies that could be used for instructional delivery.
3. Pre-service educators should be taught to use open technology for instructional delivery during the educators' training program.
4. The educator's training curriculum should be reviewed to accommodate the use of technology
5. In-service educators should be inducted into using open technology too, this will make the SDG4 achievable.

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TOWARD A MORE INCLUSIVE EDUCATION SYSTEM IN EKITI STATE: STRATEGIES FOR ADDRESSING BARRIERS AND FOSTERING EQUITY IN THE CLASSROOM

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Abstract

Inclusive education can be achieved through a combination of teacher training, curriculum modification, and the provision of appropriate accommodations and supports. Addressing the barriers to inclusive education requires a multifaceted approach, providing resources, promoting positive attitudes towards students with disabilities, and ensuring physical accessibility. By implementing these strategies, schools can create an inclusive education system that supports equal student opportunities. Similarly, this paper reviews some strategies that can be employed to address these barriers such as; Universal Design for Learning, Collaborative Team Teaching, Peer-Mediated Instruction, Assistive Technology and Positive Behaviour Supports. However, for all children to have the chance to realise their full potential, encouraging equity in the classroom within an inclusive education system is crucial. The study was a cross-sectional research design. It traces the academic records of the students from their third term results. A sample of 550 respondents was adopted and two measuring instruments were utilized. The finding shows that teachers can contribute to developing a more just and equitable society by recognising and eliminating prejudices and fostering a positive learning environment.

Keywords: Inclusive, Education System, Barriers, Fostering Equity, Classroom, Ekiti State

Introduction

In recent years, more people have realized that our educational system needs to be more equitable and accessible. All children should have access to a top-notch education that fulfills their requirements and enables them to succeed through inclusive education, regardless of where they are from, what they are capable of, or who they are. Hence, know of their backgrounds, skills, or identities, all students may receive an excellent education that fulfills their needs and equips them for success in the real world through inclusive education. However, achieving true inclusivity in education is difficult, and many barriers must be addressed. These can include systemic discrimination, bias in teaching practices, lack of resources and support for students with special needs, and cultural and linguistic barriers. Incorporating culturally sensitive teaching methods, providing specialized support and accommodations for students with disabilities or language barriers, and encouraging a sense of community and belonging among all students are just a few strategies and approaches educators and policymakers need to develop.

According to Cole and Bagley (2020), a more inclusive education system is necessary to ensure all students have equal access to education regardless of their background, abilities, or disabilities, granting special consideration and assistance to students with disabilities and valuing the diversity of all students. Creating culturally sensitive teaching strategies and curricula considering all

students' experiences and viewpoints is also necessary for a more inclusive educational system. In addition, a more inclusive education system can lead to improved academic outcomes and greater equity in education. The need for a more inclusive education system has been widely recognized in the literature (Bunch, 2020; Slee, 2018). Conversely, inclusive education is a system that values diversity, respects differences, and provides equal opportunities for all learners, regardless of their background, abilities, or identities (Alur & Timmons, 2021; UNESCO, 2020). Such a system requires systemic policy changes, curriculum, pedagogy, and teacher training (Mittler, 2022). One of the key benefits of inclusive education is the promotion of social justice and human rights (Ainscow & Miles, 2021; Booth & Ainscow, 2018). Inclusive education can also improve all learners' academic achievement, social skills, and well-being (Hehir, 2020; Mendez & Bell, 2019). However, implementing inclusive education can be challenging and requires collaboration and support from all stakeholders, including teachers, students, families, and policymakers (Avramidis & Norwich, 2021; Florian & Black-Hawkins, 2019). According to Finkelstein and Rice (2020), implementing a more inclusive education system can benefit students with disabilities, including increased academic achievement, better social skills, and improved self-esteem. They also emphasize the importance of collaboration among educators, families, and community members in creating a more inclusive and supportive learning environment. However, a more inclusive education system is essential for creating a fairer and more equitable society where diversity is celebrated and all learners can thrive. Even if there are many challenges to be solved, the data points to the value of inclusive education. In other words, a more inclusive educational system guarantees that every student can flourish and realize their full potential regardless of background or circumstances. We can build a more just and equal society by collaborating and adopting a proactive, evidence-based strategy. Alquraini and Gut (2012) provide an insightful discussion on the advantages of inclusive education and the barriers that must be overcome to implement it successfully. They argue that inclusive education can bring academic and social benefits for all students, including those with disabilities, and promote critical cultural competence in culturally diverse classrooms. Their finding also highlights several barriers to inclusive education, such as negative attitudes towards disabilities, lack of teacher training, and limited resources, and provides strategies for overcoming them. It, therefore, emphasized the importance of establishing a welcoming and inclusive learning environment for all students. A system known as inclusive education gives all students, regardless of their backgrounds, skills, or impairments, equal opportunity to learn. However, implementing inclusive education faces various barriers that must be addressed to ensure its success. This review will discuss strategies for addressing these barriers in the inclusive education system. Lack of teacher support and training is one of the biggest obstacles to inclusive education. Teachers must be well-versed in their subjects to effectively teach children with different needs. They can be achieved by providing professional development opportunities, mentoring, and coaching programs focusing on inclusive teaching strategies (Cook & Friend, 2019). Another barrier is the lack of resources and accommodations for students with disabilities. Schools must provide reasonable accommodations, such as assistive technology and modified curriculum, to support students with disabilities. Schools can also collaborate with community resources and agencies to provide additional support services to students with disabilities (National Council on Disability, 2019). Another significant barrier is the negative attitudes and beliefs toward students with disabilities. Schools must create an inclusive culture by

promoting positive attitudes toward students with disabilities can be achieved through awareness campaigns, peer mentoring programs, and promoting disability representation in the curriculum (Pijl & Frostad, 2019). Similarly, schools must ensure their physical environment is accessible to all students, including providing wheelchair ramps, accessible restrooms, and modifying classrooms to meet the needs of students with physical disabilities (Lindsay, 2020). One approach that has been suggested is to provide teachers with professional development; this will enable them to have the skills and knowledge necessary to address the needs of all pupils, including those with disabilities. (Hendrick & Jordan, 2020). Additionally, using assistive technology and other supportive devices can help address barriers to learning. Another strategy is to foster a collaborative approach between teachers, parents, and other stakeholders in the education system. It can help identify each learner's needs and develop individualized education plans (IEPs) to cater to them (McLeskey & Waldron, 2021). Furthermore, promoting a positive and inclusive school culture can address barriers to inclusive education; it involves creating a safe and supportive learning environment that values diversity and promotes acceptance (Sapon-Shevin, 2019). Inclusive education is essential for promoting equity and access to education for all learners. However, several barriers hinder its realization. By employing strategies such as professional development for teachers, assistive technology, a collaborative approach, and promoting an inclusive school culture, these barriers can be addressed, leading to the realization of an inclusive education system.

Statement of Problem

The current education system is not fully inclusive, and many students face barriers to accessing high-quality education and achieving their full potential. These barriers may include economic and social inequality, discrimination, lack of access to resources, and other factors. These barriers contribute to persistent achievement gaps and leave many students behind, particularly those from marginalized or underrepresented communities. There is a need for effective strategies and best practices to address these barriers and create a more inclusive education system that promotes equity and provides all students with the support they need to succeed.

Research Questions

1. What are the most effective strategies for addressing barriers and promoting equity in the classroom, and how can these strategies be implemented in different school settings?

2. How can technology be leveraged to promote equity and inclusion in the classroom, and what are the potential risks and challenges associated with using technology in this way

Literature Review

Inclusive education is essential to creating a more equitable society, but it can also be challenging to implement successfully. Fortunately, there are various strategies that educators and policymakers can use to address the barriers that prevent inclusive education from being fully realized. According to Gargiulo and Metcalf (2015), these strategies include:

Universal Design for Learning (UDL): This approach involves designing curricula and instruction accessible to all students, regardless of their backgrounds or abilities.

Collaborative Team Teaching: This involves bringing together teachers with different areas of expertise to work together in the same classroom. For example, a special education teacher might work with a general education teacher to support students with disabilities.

Peer-Mediated Instruction: This strategy involves using peers to help students with disabilities participate in the classroom. For example, a student without a disability might assist a student with a disability in completing a task.

Assistive Technology: refers to tools and devices to help students with disabilities participate in the classroom. For example, a student with a visual impairment might use a screen reader to access digital materials.

Positive Behavior Supports: This approach involves teaching students appropriate Behavior and providing positive reinforcement when they exhibit it; this can help prevent problem behavior and create a positive classroom environment.

By implementing these strategies, educators and policymakers can work to address the barriers that prevent inclusive education from being fully realized. Inclusive education aims to provide all students, including those with disabilities, equal learning opportunities and participation in regular classrooms. However, implementing inclusive education can present several barriers that must be addressed to ensure its effectiveness. Several strategies have been proposed to address these barriers; for instance, some researchers suggest that schools should implement universal learning design (UDL), which involves creating learning environments that are accessible and flexible enough to meet the diverse needs of all students (Rose & Meyer, 2002).

Another strategy is to provide adequate teacher training and professional development opportunities to ensure that teachers have the necessary skills and knowledge to support all students in the classroom (Kalyanpur & Harry, 2012), involving training teachers on inclusive pedagogy, differentiated instruction, and assistive Technology. Additionally, schools can promote positive attitudes towards diversity and inclusion by fostering a culture of respect and acceptance among students, teachers, and staff; this may involve celebrating diversity through cultural events, promoting positive role models, and addressing bullying and discrimination (Bunch, Abramson, & Desjean-Perrotta, 2015). In summary, implementing UDL, providing adequate teacher training, and promoting a culture of respect and acceptance are some strategies that can address barriers in inclusive education systems.

According to Turner and Kolb (2022), promoting equity in the classroom is crucial to creating an inclusive education system. Know their race, ethnicity, gender, sexual orientation, socioeconomic background, or ability; all students should feel appreciated, respected, and supported in an inclusive learning environment. In addition, Turner and Kolb (2022) argue that promoting equity in the classroom requires educators to create a culturally responsive curriculum, provide differentiated instruction, and adopt a positive behavior support system.

Furthermore, Turner and Kolb (2022) emphasize the importance of teacher training in promoting equity in the classroom. Teachers must be aware of their biases and stereotypes and willing to confront them to create a safe and inclusive learning environment. In addition, Turner and Kolb

(2022) suggest that educators must involve families and communities in promoting equity in the classroom. This collaboration can help create a sense of belonging and promote a shared responsibility for student success.

One of the keys to promoting equity in the classroom in an inclusive education system is to recognize and embrace the diversity of the student population (Gay, 2018). It can be achieved by creating a classroom culture that values and celebrates differences and implementing instructional strategies considering students' diverse learning needs and styles (Tomlinson, 2014). In other ensuring that policies and practices are inclusive and accessible and that funding and resources are available can help to address systemic barriers in the education system. Inclusive education is crucial to ensuring all students have access to quality education regardless of their backgrounds, abilities, or circumstances. However, various barriers can hinder the implementation of inclusive education systems, such as inadequate resources, lack of teacher training, and negative attitudes toward specific groups of students.

Moreover, attaining equality ensures all students have equal educational opportunities, resources, and support. (Banks, 2015). It can be achieved by providing accommodations and modifications for students with disabilities or other special needs and addressing systemic educational barriers, such as poverty and discrimination (Losen & Skiba, 2010). It is essential to recognize and address the implicit biases that can affect teaching and learning in the classroom (Staats et al., 2015). Teachers can work to overcome their biases by engaging in ongoing professional development and seeking diverse perspectives and experiences. Promoting equity in the classroom in an inclusive education system requires valuing diversity, ensuring access to educational opportunities, and addressing implicit biases in teaching and learning. These measures allow students to benefit from a more fair and inclusive learning environment. Promoting fairness in the classroom has received more attention recently in inclusive educational systems (Kahraman, 2021). This approach involves creating a learning environment that is responsive to the diverse needs of students and ensures that all learners have access to high-quality education, regardless of their race, ethnicity, gender, language, or ability (UNESCO, 2020). One key aspect of promoting equity in the classroom is using culturally responsive teaching practices, which aim to incorporate students' cultural backgrounds and experiences into the curriculum (Gay, 2018). This approach enhances students' engagement and motivation and helps create a sense of belonging and inclusivity. Another critical strategy for promoting equity in the classroom is providing individualized support and accommodations for students with disabilities or other special needs (Salend, 2020). It may involve the use of assistive technologies, modifications to the curriculum, or personalized learning plans.

Promoting equity in the classroom is an essential component of creating an inclusive education system that ensures all learners have an equal opportunity to succeed (Kahraman, 2021). Education professionals can contribute to creating a welcoming and encouraging learning environment for all students by utilizing culturally responsive teaching techniques and offering individualized support. One potential review on promoting equity in the classroom within an inclusive education system could be as follows: Inclusive education systems strive to create classrooms where all students feel valued and supported regardless of their backgrounds or abilities. Promoting equity

within these classrooms is crucial in ensuring students have an equal opportunity to succeed. To achieve this goal, teachers must know each student's unique needs and adapt their instruction to meet them. It may involve:

• Using various teaching strategies and materials.

• Providing additional support such as assistive Technology or individualized accommodations.

• Creating a classroom culture that values diversity and inclusion.

Top of Form

Research Methodology

The current study was a cross-sectional research design to examine educational inclusiveness from the respondent's point of view. However, a descriptive research method was used to interpret the study's results and determine the systemic discrimination, bias in teaching practices, and lack of resources and support for students with special needs. The study population consisted of all public secondary school teachers in Ekiti State, and the secondary school results in the external examination for one year. The sample constituted five hundred and fifty (580) students. Both male and female students in each class were selected for this study. Ten (10) Public secondary schools were selected with simple random sampling in Ekiti State. A purposive sampling technique was used to determine 28 respondents from each school. The researcher examined the inclusive education system involving various strategies to address barriers and promote equity in the classroom in each school and compared it with the previous performance of students in the school in external examinations, particularly in the Junior Secondary School Examination (JSSE) results. Five hundred fifty questionnaires were retrieved from the teachers participating in the research data. The researcher designed the instrument. This instrument contains Four sections: Sections A, B, C, and D. Section A captured the bio-data information such as the school's name, class, sex, age, and religion. While Section B was designed to check the level at which participants collaborate with team teaching, it consists of (9) Assistive Technology participant visits per hrs, daily and weekly. Section C was designed to measure the level of secondary school students' response to Positive Behaviour Supports. It consists of (20) items, and the respondents are to choose from the items on a 4 – point Likert Scale of Very Often, Often, Sometimes, and Never; this is considered appropriate because of the respondent's age, level of education, and maturity. Section D was designed to measure the level of Peer- Mediated Instruction. It consists of (10) items, and the respondents are to choose from them on a 4 – point Likert Scale of Strongly Agree, Agree, Disagree, and Strongly Disagree; this is considered appropriate because of the age, level of education, and maturity of the respondents. The senior university researcher validated the instrument. A reliability test was conducted using Cronbach's alpha, and a reliability coefficient of 0.82 was obtained, which showed that the questionnaire was reliable.

Data Analysis

The data collected were analysed using descriptive survey tool of distribution table, mean statistic and standard deviation (SD) to answer the research questions that examine the strategies for addressing barriers and fostering equity in the classroom in Ekiti-State.

Results

The result of the study were presented in accordance with research questions.

Research Question One

What are the most effective strategies for addressing barriers and promoting equity in the classroom, and how can these strategies be implemented in different school settings?

Table 1: Most effective strategies for promoting equity and implementation in school settings

S/N	ITEMS	SA	A	D	SD	Mean	S.D
1	Using assistive technology and other supportive devices can help address barriers to learning.	112 20.5%	382 69.5%	16 2.9%	39 7.1%	3.033	.714
2	Collaborative approach between teachers, parents, and other stakeholders in the education system can help identify each learner's needs	118 21.5%	332 60.3%	85 15.5%	15 2.7%	3.333	.657
3	Promoting a positive and inclusive school culture can address barriers to inclusive education	142 25.8%	166 30.2%	152 27.6%	90 16.4%	3.167	.853
4	Addressing barrier involves creating a safe and supportive learning environment that values diversity and promotes acceptance	145 26.4%	221 40.2%	171 31.1%	13 2.3%	2.533	.923
5	Inclusive education is essential for promoting equity and access to education for all learners.	101 18.4%	356 64.7%	56 10.2%	37 6.7%	1.933	.430

As shown in Table 1, the results of the data present the most effective strategies for promoting equity and implementation in school settings. Findings showed that majority of the teachers 382 (69.5%) agreed with the statement using assistive technology and other supportive devices can help address barriers to learning. while 16 (2.9%) of the respondents disagreed with this statement. Also, 332 (60.3%) of the respondents agreed that Collaborative approach between teachers, parents, and other stakeholders in the education system can help identify each learner's needs while 85 (15.5%) of the respondents disagreed with this statement. Furthermore, 166 (30.2%) agreed with the statement Promoting a positive and inclusive school culture can address barriers to inclusive education while 152 (27.6%) of the respondents disagreed with that statement. In addition, 221 (40.2%) agreed with the statement that involves creating a safe and supportive learning environment that values diversity and promotes acceptance while 171 (31.1%) disagreed with the statement. In addition, 356 (64.7%) agreed with the statement that Inclusive education is

essential for promoting equity and access to education for all learner while 56 (10.2%) disagreed with the statement.

It could be inferred that majority of the respondents agreed that assistive technology, collaborative approach, school culture, supportive learning environment are effective strategy for promoting equity in educational inclusiveness.

Research Question Two

How can technology be leveraged to promote equity and inclusion in the classroom, and what are the potential risks and challenges associated with using technology in this way.

Table 2: Potential Risks and Challenges Associated with using Technology in an equity environment.

S/N	CHALLENGES FACING TEACHERS IN USING TECHNOLOGY	SA	A	D	SD	Mean	S.D
1	My colleagues motivate me to respect and promote equity when using technology in the classroom.	123 22.4%	128 23.3%	254 46.2%	55 10.0%	3.443	.883
2	Most of the teachers cannot inclusively monitor the activities of students in the classroom for long hours.	106 19.3%	245 44.5%	178 32.4%	21 3.8%	2.167	.573
3	Many teachers do visit resource center regularly to solve some learning problems.	102 18.54%	131 23.8%	21 3.8%	56 10.2%	3.513	.843
4	My challenges in school is to cater for needs different category of learners	78 14.2%	267 48.5%	95 17.3%	110 20.0%	3.443	.930
5	Teachers can work to overcome their biases by engaging in ongoing training and seeking diverse perspectives and experiences	102 18.5%	215 39.1%	196 35.6%	37 6.7	3.332	.834

As shown in Table 2, the results of the data presents the information on challenges facing teachers of secondary. Finding showed that majority of the teachers 254 (46.2%) disagreed with the statement that my colleagues motivate me to respect and promote equity when using technology in the classroom while 128 (23.3%) of the respondents agreed with this statement. Also, 245 (44.5%) agreed with the statement that most of the teachers cannot inclusively monitor the activities of students in the classroom for long hours. while 178 (32.4%) of the respondents disagreed with this statement. Furthermore, 131 (23.8%) agreed with the statement that many teachers do visit resource center regularly to solve some learning problems while 21 (3.8%) of the respondents disagreed with this statement. Also, 267 (48.5%) agreed with the statement that my challenges in school is to cater for needs different category of learners while 95 (17.3%) of the

respondents disagreed with this statement. In addition, 215 (39.1%) agreed with the statement that teachers can work to overcome their biases by engaging in ongoing training and seeking diverse perspectives and experiences while 196 (35.6%) of the respondents disagreed with this statement. It could be inferred that majority of the respondents agreed that potential risks and challenges associated with using technology in an equity environment.

Discussions

Through a combination of teacher development, curriculum revision, and the provision of suitable supports, the study examined inclusivity in education. Based on the results, technology continues to be one of the techniques that instructors can use to promote equity and implementation in educational settings. Promoting equity in the classroom within an inclusive educational framework typically entails appreciating diversity, enabling access to educational opportunities, and eliminating unconscious biases in both teaching and learning. These steps contribute to a more equitable and welcoming learning environment for students. By encouraging a climate of respect and acceptance among students, teachers, and staff, schools can encourage positive attitudes toward diversity and inclusion. This may involve celebrating diversity through cultural events, highlighting positive role models, and addressing bullying and discrimination (Bunch, Abramson, & Desjean-Perrotta, 2015).

Conclusion

Based on the study in Hendrick and Jordan's (2020) book, "Inclusive Education: An Evidenced-Based Approach," it is evident that removing obstacles and fostering fairness in the classroom need for an all-encompassing strategy. This entails offering assistance and resources to children with disabilities, building a supportive and welcoming classroom environment, and implementing research-supported technological practices that place a premium on differentiated instruction and personalized learning.

It is crucial that educators and policymakers place a high priority on equity and diversity in all facets of teaching and learning in order to build a truly inclusive educational system. Making sure that all students have access to the tools and assistance they need to achieve requires understanding and resolving systemic barriers and prejudices that may exist in the educational system.

Recommendation

Its stand meaningful to analyze inclusion in the classroom critically and suggest tactics for removing obstacles and advancing fairness in the educational system. They contend that in order to create a more inclusive educational system, people need to change their perspective from seeing diversity as a flaw that needs to be rectified to seeing it as a strength and an asset. Additionally, they advise instructors to put an emphasis on fostering relationships with children and their families, fostering student agency and voice, and adopting a variety of instructional strategies to address the various needs of kids. These techniques can help teachers foster an inclusive classroom climate and advance equity in the educational system.

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ACCESS AND UTILIZATION OF FREE AND OPEN SOURCE SOFTWARE (FOSS) ON BIOLOGY CONCEPT AMONG STUDENTS IN SECONDARY SCHOOL

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Abstract

The search for ways to bring about effective teaching and learning of biology in secondary schools has provided the impetus for this study. Therefore, the study investigated the access and utilization of free and open sources software (FOSS) on biology concept among students in secondary schools. The target population is all biology students in Ilorin metropolis, 450 secondary school students were randomly selected from 15 schools, 3 Secondary schools from each local government from the 5 local government area of Ilorin metropolis. The study adopted descriptive research method of the survey type. Three research questions were raised and answered. A questionnaire was designed to elicit information from the respondents. The 30 items questionnaire with three sections and 4 points Likert scale was titled "Access and utilization of free and open souse software among students. (AUFOSSAS)" The mean scores and standard deviation were used to answer the research question. The result shows that the free and open software are usable for learning Biology but students should be granted access and after adequate awareness on the availability of FOSS.

Keywords: Access, Utilization, Free and Open Source Software, Students, Biology concepts.

Introduction

Education is a lifelong process that improves the mental, psychological, and social growth of an individual. Developed and developing nations around the world are constanly improving their education system. Nigeria as a nation is also reforming education, and for this reason, the philosophy of education is ‘education is a tool for national growth, economic and social transformation (National Policy on Education, NPE, 2013). According to Jekayinfa (2010), education is a process that stars from the womb and ends in the grave. Ogunyinka, Okeke and Adedoyin (2015) define education as a weapon for defense against ignorance, struggle, sickness and poverty to actualize a clear information processing tools that will secure manipulative abilities to assist the coordination and transformation of conceptual ideas, emotions and feelings into existence through scientific means.

Science is important in a developing nation, it is the foundation of civilization and the basis of technological advancement. The word “science” is derived from Latin word “scientia” which means knowledge this explains why science as a discipline is termed to be a creative structure, built on facts. Abimbola (2013) defined science as a body of knowledge, a way or method of investigating, and a way of thinking in order to understand nature. The Business dictionary (2023) defined science as a body of knowledge comprising of measurable or veritable facts acquired through application of the scientific method and generalized into scientific laws or principles. The attitudes or values that underlie ‘sciencing’ is known as the spirit of science which includes longing to know, questioning of all things, search for data and their meaning, demand for verification, respect for logic, consideration of premises and consideration of consequences (Olorundare, 2023).

Teachers who teach science are not scientists but science teachers who have undergone teachers' training in science education.

Science education is a field concerned with sharing science content and processes with individuals that are not traditionally considered part of scientific community. These individuals may be children, college students or adults within the general public. Abimbola, (2013) submitted that the field of science education comprises science content, a bit of sociology and some teaching pedagogy. The goal of science teaching is to produce scientifically literate citizenry (Olorundare, 2023). Science is being taught at the senior secondary level of education The important science subjects in the senior secondary level of education in Nigeria are Physics, Chemistry, Mathematics, Agriculture and Biology.

Biology is a science subject taught at the secondary school level that focuses on the study of living organisms, their interactions with each other and their environment. It covers a wide range of concepts, such as cell structure and function, genetics, evolution, ecology, and anatomy and physiology. Sarojini (2010) defined biology as the study o living things. The teaching of Biology could prepare students for further education and careers in fields such as medicine, veterinary science, and environmental science, among others. Ahmed (2012) submitted that biology helps an individual to understand the parts of his body and their functions enabling such individual to question superstition due to certain interest arising from comprehension of causes and events bringing into focus the need to maintain good health. Biology educates a child on the anatomy and physiology of his body therefore making him understand and cope with the natural changes that accompany adulthood; this would be if the subject is well taught. The goal of teaching Biology in secondary school is to provide students with a foundational understanding of the natural world and help them develop critical thinking skills and scientific inquiry

Free and open-source software (FOSS) is an encompassing term used to refer to groups of software consisting of both free software and open-source software (Gunter, 2013). Bridgewater (2013) is of the opinion that free and open source software offers to everyone a free license to use, copy, study, and change the software in any way, and the source code is also openly shared so that people are encouraged to voluntarily improve the design of the software. This is quite opposite to proprietary software, where the software is under restrictive copyright licensing and the source code is usually hidden from the users. Grunter (2013) gave examples of free and open-source software (FOSS) to include Fedora Linux 36 running the KDE Plasma 5 desktop environment, Firefox, Dolphin file manager, VLC media player, LibreOffice Writer, GIMP, and KCalc. Feller et al. (2005) apply them to any software products distributed under terms that allow users to use, modify, and redistribute the software without requiring that they pay the author(s) of the software a royalty or fee for engaging in the listed activities (Gunter 2013).

FOSS has many other benefits and uses over proprietary software which includes but are not limited to decreased software costs, increased security and stability, protecting privacy, education, and giving users more control over their own hardware. Free and open-source operating systems such as Linux and descendants of BSD are widely utilized today, powering millions of servers, desktops, smartphones, and other devices. Casson and Ryan (2006) submitted that Free-software licenses and open-source licenses are used by many software packages. The free software

movement and the open-source software movement are online social movements behind widespread production and adoption of FOSS, with the former preferring to use the terms FLOSS or free/libre. Free and open-source software (FOSS) is an umbrella term for software that is simultaneously considered both free software and open-source software. Bridgewater (2013). In a concise definition of the terms "free software" and "open source software. Claburn (2007) opined that there is almost a complete overlap between free-software licenses and open-source-software licenses, there is a strong philosophical disagreement between the advocates of these two positions hence, the name FOSS. There is need to know if students can access FOSS for learning biology.

Purpose of the Study

The main purpose of this study was to find out access and utilization of free and open source software (FOSS) on biology concept among students in secondary schools in kwara state

Specifically, the study would seek to find out:

1. determine the free and open source software (FOSS) available on biology concepts.
2. examine students' access to free and open source software (FOSS) on biology concepts
3. find out the usability of free and open source software (FOSS) on biology concepts.

Research Questions

The following questions were raised and answered;

1. What are the free and open source software (FOSS) available on biology concepts?
2. Do students have access to free and open source software (FOSS) for learning biology concepts in secondary school in Kwara state?
3. What is the level of usability of free and open source software (FOSS) on biology concepts by secondary school students in Kwara state?

Methodology

The study adopted a descriptive research method, it investigated the access and utilization of free and open sources software (FOSS) on biology concept among students in secondary schools. The target population was all biology students in Ilorin metropolis, 450 secondary school students were randomly selected from 3 Secondary schools selected from each 5 local government area of Ilorin metropolis. Three research questions were raised and answered. A researcher-designed questionnaire was designed to elicit information from the respondents. The 30 items questionnaire of 4 points Likert scale was titled "Access and utilization of free and open source software among students (AUFOSSAS) and it has three sections, section A, B, and C . Section A deals with students' biography; it contains information on the respondents' school type, gender, current class and department. Section B contains a list of free and open source software to check the access of students to them. Section C contains a list of free and open source software to check the level of usability by students.

To ensure face and content validity of the instruments, "Access and utilization of free and open source software among students (AUFOSSAS) was given to researcher's supervisor, two experts in Educational Technology Department and two experts in Biology education Department to check whether the instrument will measure what it supposed to measure. Benefits from the study was stated on the informed consent form and plagiarism test was carried out to determine if this work is not an existing work written by another researcher. The researcher collected a letter of introduction from the Head of department of Science Education, Al-Hikmah University, Ilorin. The researcher personally visited the schools where the study was carried out and sought the permission from authorities on the need to engage their students for the research study. Copies of an informed consent form was attached to the questionnaires for students to indicate their wiliness for voluntary participation in the study. The researcher informed the participating students that their contributions will be treated confidentially and for the purpose of this study only. The researcher sought the respondents' sincerity in their responses. The questionnaires were administered to the selected students personally and retrieved immediately for data analysis. The data obtained was analyzed and interpreted using descriptive statistics and inferential statistics. Percentages was used to analyze the personal information provided by the respondents. Mean scores was used to answer the research questions.

Results

Demographic data of Respondents

Table 1: Demographic Characteristics of Pre-service Science Educators

Variables	Options	Number of respondents	Percentage %
Gender	Male	214	47.56
	Female	236	52.44
Class	SSS 2	279	62.00
	SSS 3	171	38.00
School Type	Public	317	70.44
	Private	133	29.56

Table 1 showed that the sample included 450 respondents, 214 students were males (47.56%) and 236 females (52.44%), 279 respondents (62.00%) were SSS 2 students while 171 (38.00%) respondents were SSS 3 students, 317 respondents (70.44%), respondents attends public schools while 133 (29.56%) private schools.

Research Question One: What are the free and open source software (FOSS) available on biology concepts?

Table 2 shows a list of application softwares which are free and open software (FOSS) for learning biology which are available on Google play store, Huawei store and Apple store.

List of application software
Complete Biology
Biology Note with Pictures
Biology Textbook
Biology Book
Elvisier SurviveMed
Biology Lectures
Academy of Biology
Membrane Biology
Biology PK2
Offline Biology
Biology Dictionary

Research Question Two: Do students have access to free and open source software (FOSS) for learning biology concepts in secondary school in Kwara state?

Table 3: Mean and standard deviation of responses on the level of accessibility of students to free and open source software (FOSS) for learning biology concepts in secondary schools in Kwara state.

S/N	**Item Statements**	X	SD	**Remark**
1.	Complete Biology	2.42	0.80	Not Accessible
2.	Biology Note with Pictures	2.11	0.87	Not Accessible
3.	Biology Textbook	3.05	0.99	Accessible
4.	Biology Book	2.29	0.35	Not Accessible
5.	Elvisier SurviveMed	2.32	0.51	Not Accessible
6.	Biology Lectures	3.31	0.91	Accessible
7.	Academy of Biology	2.03	0.48	Not Accessible
8.	Membrane Biology	2.15	0.39	Not Accessible
9.	Biology PK2	2.01	0.47	Not Accessible
10.	Offline Biology	2.23	0.91	Not Accessible
11.	Biology Dictionary	2.12	0.42	Not Accessible
	Weighted average	**2.37**	**0.57**	**Not Accessible**

Table 3 revealed that the respondents indicated that they have access to Biology textbook (mean=3.05), Biology lectures (mean=3.31), as free and open system software that can be used for learning Biology. They declared that they are unaware of and don't have access to all other items on the list with means between 2.03 and 2.42 which is lower than the 2.5 benchmark for accessibility on the four point scale.

Research Question Three: What is the level of usability of free and open source software (FOSS) on biology concepts by secondary school students in Kwara state

Table 4 revealed that the respondents indicated that the items that are not usable for learning biology at secondary school level are Biology Book (mean=3.05), Elvisier SurviveMed (mean =2.23), Academy of Biology (mean=2.17), Membrane Biology (mean=2.01), Biology PK2 (mean=2.26), The weighted mean average was 2.76 which is more than the 2.5 benchmark for accessibility on the four point scale.

Table 4: Mean and standard deviation of responses on the level of usability of free and open source software (FOSS) on biology concepts by secondary school students in Kwara state.

S/N	**Item Statements**	X	SD	**Remark**
1.	Complete Biology	3.12	0.82	Usable
2.	Biology Note with Pictures	3.21	0.78	Usable
3.	Biology Textbook	3.45	0.91	Usable
4.	Biology Book	2.15	0.59	Not Usable
5.	Elvisier SurviveMed	2.23	0.51	Not Usable
6.	Biology Lectures	3.07	0.91	Usable
7.	Academy of Biology	2.17	0.84	Not Usable
8.	Membrane Biology	2.05	0.58	Not Usable
9.	Biology PK2	2.26	0.97	Not Usable
10.	Offline Biology	3.53	0.91	Usable
11.	Biology Dictionary	3.09	0.42	Usable
	Weighted average	**2.76**	**0.75**	**Usable**

Conclusions

Students declared that they have more access to Biology Textbook and Biology Lectures before they were shown the apps. They concluded and indicated that most items on the instrument are not accessible to them. On seeing the apps, they indicated that Biology Book, Elvisier SurviveMed, Academy of Biology, Membrane Biology, Biology PK2, were advanced and are not usable for

learning secondary school Biology. The respondents indicated that they all other items are usable for learning Biology. Respondents not having access to free and open system software may be due to the fact that mobile phones are not allowed in secondary schools. Some students do not have phones, some do not have internet enabled phones and most schools do not give students access to internet enabled devices for learning.

Recommendations

1. Based on the findings of the study, the following recommendations are made:
2. Secondary school students should be encouraged to use free and open system software for learning Biology
3. Schools should provide internet-enabled devices that would give students access to FOSS
4. Parents should also provide internet-enabled devices that would give students access to FOSS at home

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AWARENESS AND PERCEPTION OF UNIVERSITY EDUCATION LECTURERS ON THE UTILIZATION OF OPEN EDUCATIONAL RESOURCES FOR INSTRUCTIONAL DELIVERY IN KWARA STATE

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Abstract

This study investigates the awareness and perception of education lecturers regarding the utilization of Open Educational Resources (OER) for instructional delivery in Kwara State. The aim is to explore the current level of awareness among lecturers and examine their perceptions and utilization of open educational resources OER for instructional delivery. The study employs a descriptive research design, utilizing a survey questionnaire. The sample consists of education lecturers from universities in Kwara State. The findings highlight the need for enhanced awareness and professional development opportunities specific to OER in education. Furthermore, the study reveals lecturers' positive perceptions regarding the utilization of OER, such as means to improved instructional delivery and enhanced student engagement. However, concerns related to OER quality, copyright issues, and the time required for evaluation and adaptation of resources are also identified. The outcomes of this study can inform educational policymakers, institutions, and professional development programs to develop strategies that support the effective utilization of OER in education, leading to improved instructional practices and broader access to quality educational resources.

Keywords: Open Educational Resource, Education Lecturers, Awareness, Perception and Utilization

Introduction

Students' ability to comprehend ideas and exercise critical thinking is greatly influenced by their exposure to education. Open Educational Resources (OER), which have become increasingly important due to the fast growth of technology, can improve the way that scientific lessons are delivered. OER stands for openly available resources for learning that may be shared, utilized, and updated by both educators and students. The use of open educational resources in the scientific classroom has a great deal of potential to raise the standard and accessibility of teaching materials. But little is known about how scientific education lecturers feel about integrating and adopting open educational resources.

Different instructors in education are more or less aware of the use of OER. According to a Smith and Casserly (2019) study, while some instructors were aware of OER and its resources, many others were unaware of these advantages. Lack of knowledge can be linked to chances for professional development that aren't appropriate for OER in education.Open Educational Resources (OER) in scientific education must be widely known in order to be used and integrated

into teaching strategies. Studies show that many scientific instructors are unaware of open educational resources (OER) and their potential advantages. While some instructors were familiar with open educational resources (OER), Smith and Casserly (2019) discovered that a sizable portion were either unaware of the materials' existence or had just a cursory understanding of them. This lack of awareness can be attributed to the limited emphasis on OER in pre-service teacher education programs and the absence of ongoing professional development opportunities specific to OER in education (Conole, 2012).

The institutional environment and regulations have a big influence on scientific educators' understanding of OER. Adams et al. (2020) emphasized the value of institutional actions in raising awareness of OER. The awareness of educators is typically higher in institutions that actively promote OER, offer training programs, and include OER into curriculum requirements. On the other hand, universities with less recognition and support for OER may have a lower degree of awareness among their scientific instructors. Professional groups and networks are essential for encouraging OER adoption in scientific education and for creating awareness of its benefits. Online communities and collaborative platforms enable resource discovery and knowledge exchange. In a study by Belikov and Bodily (2021), participation in online communities was found to positively influence educators' awareness and utilization of OER. Engaging with colleagues and accessing OER repositories through professional networks can expand educators' knowledge about available resources and potential implementation strategies.

The accessibility and availability of OER repositories have an influence on how well-informed educators are about and use OER in scientific education. The National Science Digital Library (NSDL), for example, offers a unified platform for educators to find and access pertinent information. Science-specific OER repositories. Educators who were aware of science-specific OER sources were more likely to integrate OER into their educational methods, according to a research by Friesen et al. (2020). Teachers' understanding of and acceptance of OER in scientific education are influenced by their attitudes and views. According to a research by Johnson et al. (2021), educators who subscribed to constructivism and believed that open educational resources (OER) were useful tools for fostering student involvement and collaborative learning were more likely to be aware of and use OER. Teacher beliefs, therefore, play a significant role in shaping their awareness and perception of OER.

OER perceptions among education professors are impacted by a number of things. In a study by Johnson et al. (2021), lecturers emphasized the potential of OER to enhance student engagement, improve instructional delivery, and promote collaborative learning. OER materials' dependability and quality, as well as the time needed for finding, analyzing, and modifying resources, were also subject to criticism. Understanding how teachers see the use of open educational resources (OER) can help with their uptake and incorporation into teaching strategies. OER are frequently highlighted for their potential advantages in educators' viewpoints of education. OER can improve the quality of education by giving students access to current and varied learning resources (Johnson et al., 2021). Educators perceive OER as a means to promote active and engaged learning, foster collaboration among students, and facilitate personalized instruction (AlAbdullah & Dabbagh, 2015; Hilton, 2016).

OER provides advantages that educators are aware of, however there are questions about its trustworthiness and quality. Teachers are concerned about the suitability and correctness of OER materials for scientific instruction (Butcher, 2015). They doubt the validity of OER sources and lament the lack of strict quality assurance procedures (Ng'ambi, 2013). These issues underscore the necessity for educators to thoroughly assess and curate open educational resources (OER) before incorporating them into their teaching methods. Another aspect that affects educators' opinions is how much time and effort they believe it takes to properly use OER in scientific instruction. Concerns regarding the time needed to look for, assess, and modify OER materials to fit their educational objectives are frequently voiced by educators (Butcher, 2015; Ng'ambi, 2013). The perceived additional workload associated with OER utilization can act as a barrier to their adoption.

OER is seen by educators as a motivator for teamwork and information sharing among peers (Hilton, 2016). They understand that open educational resources (OER) have the ability to build a community of support and collaboration where teachers may exchange materials, knowledge, and best practices (Belikov & Bodily, 2021). In order to suit the unique demands of their students and instructional environments, educators embrace the flexibility of open educational resources (OER) (Ng'ambi, 2013). OER's place in scientific education is frequently seen in light of the bigger objectives of open education. Teachers are aware of OER's potential to advance open access to scientific resources and information, encourage innovation, and democratize education (Pitt, 2015). By facilitating the sharing of scientific research, data, and experiments, open educational resources (OER) in education can encourage students to actively engage in scientific inquiry and discovery. (Belikov & Bodily, 2021).

The effective application of OER in education is hampered by a number of obstacles. Key obstacles were a lack of institutional incentives and support, copyright issues, and the unavailability of a comprehensive OER library specifically designed for scientific education (Adams et al., 2020). Additionally, lecturers' readiness and capacity to incorporate OER into teaching procedures may be impacted by their technological proficiency and familiarity with OER platforms. The absence of institutional support and incentives is one of the main obstacles to OER use in education. In their 2020 paper, Adams, Hollands, and Hilton emphasize the significance of institutional measures in fostering OER adoption. Teachers could be reluctant to commit time and effort in incorporating OER into their teaching methods if educational institutions do not provide them with the necessary financing, training, and recognition.

Significant obstacles prevent OER from being used in education because to copyright and licensing issues. Teachers could be unsure about the legal ramifications of utilizing and remixing OER materials, especially when it comes to information that is scientific (Ng'ambi, 2013). To solve these challenges and make sure instructors feel confidence using OER, clear standards and help surrounding copyright and license issues are required. Another major obstacle to their use in scientific education is the scarcity of OER that are relevant to the subject of science. Although there are generic OER repositories, there may not be as many subject-specific materials available for science disciplines (Butcher, 2015). Teachers could have a difficult time locating high-quality, pertinent OER resources that go along with certain science themes, which could deter their

adoption. Educators' technological skills and familiarity with OER platforms and tools can impact their willingness and ability to integrate OER into instructional practices. Lack of technical proficiency and training in utilizing OER platforms can act as a barrier, particularly for educators who are less comfortable with technology (AlAbdullah & Dabbagh, 2015). Providing training and support for educators to develop their technological skills is crucial for overcoming this barrier. Lastly, the evaluation and adaptation of OER materials to meet specific instructional needs can be time-consuming and challenging. Educators may lack the necessary guidance and resources to assess the quality, accuracy, and relevance of OER materials for their science classrooms (Butcher, 2015). Furthermore, adapting OER materials to align with specific learning objectives, pedagogical approaches, and assessment requirements can be demanding. Support and resources for effective evaluation and adaptation of OER can help address this barrier.

Statement of Problem

Open Educational Resources (OER) use has the potential to improve the quality of instruction provided in university-level scientific courses. But little is known about how university scientific education teachers feel and are aware of the use of open educational resources (OER). As a result, it is necessary to look into the knowledge and opinions of university scientific education lecturers on the use of OER and the variables that affect their acceptance in teaching methods.

OER are becoming more widely available, however it is unclear how much university scientific education instructors are aware of them or how they may be used to improve the quality of instruction. dearth of awareness may be caused by the scant attention given to OER in programs for pre-service teachers and by the dearth of chances for continuous professional development that are specifically geared toward OER in scientific teaching. The ineffective incorporation of OER into teaching methods and the constrained access to high-quality materials that can improve student learning experiences may be caused by this lack of understanding. The perspective of university scientific education lecturers toward the use of OER in the delivery of teaching is also still unknown. In determining how they use educational resources, educators' views and attitudes are a major determining factor.

Lecturers' attitudes of the value, applicability, and appropriateness of OER for scientific education may affect how eagerly they accept and incorporate OER into their lesson plans. For the purpose of removing any obstacles and advancing the successful application of OER in education, it is crucial to comprehend their perspectives. Investigating university scientific education lecturers' knowledge of and opinions on the use of open educational resources (OER) for the delivery of teaching is vital. Educational institutions and policymakers can create focused strategies to increase awareness, provide necessary training and support, and promote the successful integration of OER into university education by identifying the knowledge gaps and comprehending the factors influencing lecturers' perceptions.

Research Objectives

The research objectives of this study are as follows:

1. To find out the awareness of Open Educational Resources (OER) for instructional delivery.
2. To examine the perception of university education lecturers towards the utilization of OER in their teaching practices.
3. To investigate the utilization of Open Educational Resources (OER) for instructional delivery among university education lecturers.

Research Questions

1. What the awareness of Open Educational Resources (OER) for instructional delivery.
2. What is the perception of university education lecturers towards the utilization of OER in their teaching practices.
3. What is the utilization of Open Educational Resources (OER) for instructional delivery among university education lecturers.

Methodology

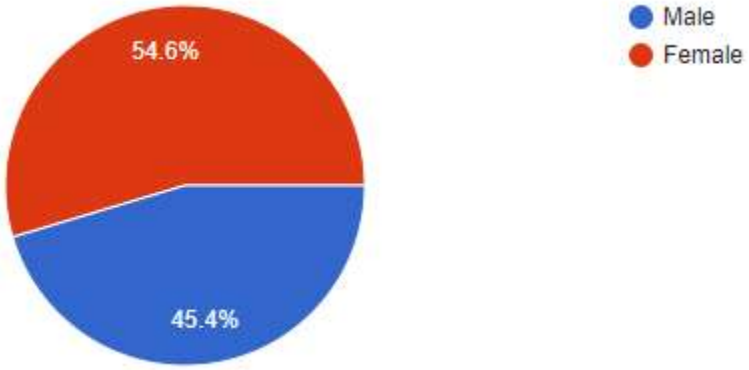
The research design that was adopted for this study was a descriptive survey type. A descriptive research design is a scientific method which enables the researcher to observes and describes the behavior of a subject without influencing it in any way. Therefore, the descriptive design of survey type which allows for the use of the questionnaire was considered as being appropriate for this research which aimed at finding out the awareness and perception of university education lecturers on the utilization of open educational resources for instructional delivery

The population of the study comprises of all university lecturers in Kwara State. The target population consisted of university education lecturers in Kwara State.Purposive sampling techniques was adopted for this study in deciding the sample size of the population. University of Ilorin, Kwara state university and Alhikmah university was randomly selected for this study.120 university science lecturers was randomly selected across the three Universities for this study.

The researchers used a researcher designed questionnaire titled awareness and perception of university education lecturers on the utilization of open educational resources for instructional delivery (APUSELUOER) The instrument comprises of section A for demographic data and section B for the awareness and perception of university education lecturers on the utilization of open educational resources for instructional delivery items to elicit informations from respondents on their views on the study. The instruments was validated by experts in education faculty before the administration. The instrument was tested using Cronbach alpha value of instrument at 0.05 of significant which yielded 0.85.

Results

Demographic of respondents



Fourty five point four (45.4%) of the respondents were male respondents while fifty four point six (54.6%) of the respondents were female among university education lecturers

Research Question One:

What is the Awareness of Open Educational Resources (OER) for instructional delivery

Table 1: Awareness of Open Educational Resources (OER) for instructional delivery

S/N		Aware	Not aware
1.	OpenStax	97 (81%)	23(19%)
2.	Open Textbook Library	94(78%)	26(22%)
3.	BCcampus OpenEd	85(71%)	35(29%)
4.	MIT OpenCourseWare	95(79%)	25(21%)
5.	OpenLearn	75(62%)	45(38%)
6.	Open Yale	80(67%)	40(33%)
7.	Khan Academy	85(71%)	35(29%)
8.	TED-Ed	70(58%)	50(42%)
9.	Open Education Consortium	90(75%)	30(25%)
10.	Saylor Academy	46(38%)	74(62%)

Table 1, Revealed the responses of the respondents among science lecturers, 97 (81%) agreed are aware of OpenStax (OER), while 23(19%) are not aware. 94 (78%) are aware of Open Textbook Library (OER) for Instructional delivery, while 26(22%) were not aware. 85 (71%) agreed on their awareness of BCcampus OpenEd (OER) for Instructional delivery, while 35(29%) were not aware. 95(79%) are aware of MIT OpenCourseWare OER while, 25(21%) were not aware. 75(62%) were aware of OpenLearn while 45(38%) were not aware. 80 (67%) were aware of Open Yale while, 40(33%) were unaware of it. 85(71%) were aware of Khan Academy, while 35(29%) were not aware of it. 70(58%) ware aware of TED-Ed, while 50(42%) were not aware of it. 90(75%) were aware of Open Education Consortium (OER),while 30(25%) were not aware of it. 46(38%) were aware of Saylor Academy (OER), while 74(62%) were not aware of it. Which implies that large number of the respondents among education lecturers are aware of Open Educational Resources

Research Question One: what is the Perception of university education lecturers towards the utilization of OER in their teaching practices.

Table 2 : Perception of university education lecturers towards the utilization of OER in their teaching practices.

S/N	SA	A	D	SD

1.	Integrating Open Educational Resources (OER) in my teaching practices enhances student engagement and participation.	65(54%)	25(21%)	20(17%)	10(8%)
2.	Open Educational Resources (OER) provide relevant and up-to-date content for education instruction.	55(47%)	45(37%)	15(12%)	5(4%)
3.	The use of Open Educational Resources (OER) allows for more flexibility and customization in my education teaching practices	47(39%)	38(31%)	21(17%)	14(12%)
4.	Open Educational Resources (OER) help in bridging resource gaps and providing access to educational materials for education.	64(53%)	20(17%)	15(12%)	21(18%)
5.	I feel confident in my ability to effectively incorporate Open Educational Resources (OER) into my education teaching practices.	72(60%)	30(25%)	14(12%)	4(3%)
6.	Open Educational Resources (OER) support the development of critical thinking and problem-solving skills in education.	60(50%)	32(27%)	19(16%)	9(7%)
7.	The utilization of Open Educational Resources (OER) has a positive impact on student learning outcomes in education.	50(42%)	40(33%) 25(21%)	24(20%)	6(5%)
8.	Open Educational Resources (OER) encourage collaboration and knowledge sharing among education instructors.	80(67%)	26(22%)	10(8%)	5(4%)
9.	Incorporating Open Educational Resources (OER) in my teaching practices saves time in developing instructional materials for education.	84(70%)	26(22%)	8(7%)	2(1%)
10.	Open Educational Resources (OER) contribute to the overall quality of education instruction in universities.	76(63%)		10(8%)	8(7%)

In table above, it was revealed that the largest number of the respondents 90 (75%) agreed on the statement: Integrating Open Educational Resources (OER) in my teaching practices enhances student engagement and participation., while 30(25%) respondents, disagreed with the statement. 100 (83%) respondents agreed on the statement : Open Educational Resources (OER) provide relevant and up-to-date content for education instruction, while 20(17%) of respondents disagreed on the statements, furthermore, 85 (70%) of the respondents agreed on the statement: The use of Open Educational Resources (OER) allows for more flexibility and customization in my education teaching practices, while 35 (29%) respondents disagreed on the statement. 84(70%) respondents agreed on the statement: Open Educational Resources (OER) help in bridging resource gaps and providing access to educational materials for education, while 36 (30%) disagreed with the statement. 102(85%) respondents agreed on the statement: I feel confident in my ability to effectively incorporate Open Educational Resources (OER) into my education teaching practices, while 18(15%) disagreed on the statement. 82(77%) respondents agreed on the statement: Open Educational Resources (OER) support the development of critical thinking and problem-solving skills in education, while 38(23%) disagreed on the statement. 90(75%) respondents agreed on the statement: Resources (OER) has a positive impact on student learning outcomes in education, while 30(25%) disagreed on the statement. 105(88%) respondents agreed on the statement: Open Educational Resources (OER) encourage collaboration and knowledge sharing among education instructors, while 15(12%) disagreed on the statement. 110(92%) respondents agreed on the statement: Incorporating Open Educational Resources (OER) in my teaching practices saves time in developing instructional materials for education, while 10(8%) disagreed on the statement. 102(85%) respondents agreed on the statement: Open Educational Resources (OER) contribute to the overall quality of education instruction in universities, while 18(15%) disagreed on the statement. This implies that the majority of the respondents among the science lecturers have positive perception towards the utilization of OER in their teaching practices.

Research questions Three:

What is the utilization of Open Educational Resources (OER) for instructional delivery among university education lecturers.

Table 3: Utilization of Open Educational Resources (OER) for instructional delivery among university education lecturers.

S/N		SA	A	D	SD
1.	I actively incorporate Open Educational Resources (OER) into my instructional delivery for education courses.	65(54%)	40(34%)	10(8%)	5(4%)
2.	Open Educational Resources (OER) provide valuable supplementary materials for my education instruction.	50(42%)	50(42%)	12(10%)	8(6%)

3.	I find it easy to locate and access relevant Open Educational Resources (OER) for my education courses.	45(38%)	60(50%)	10(8%)	5(4%)
4.	Open Educational Resources (OER) offer a wide range of multimedia resources (e.g., videos, simulations) that enhance my instructional delivery.	78(65%)	30(26%)	10(8%)	2(1%)
5.	I believe that Open Educational Resources (OER) align well with the learning objectives of my education courses.	84(70%)	20(17%)	12(10%)	4(3%)
6.	Incorporating Open Educational Resources (OER) into my instructional delivery allows for greater customization and adaptation to meet the needs of my students.	90(75%)	15(13%)	10(8%)	5(4%)
7.	Open Educational Resources (OER) support the development of critical thinking and problem-solving skills in my education instruction.	48(40%)	30(25%)	35(29%)	7(6%)
8.	The utilization of Open Educational Resources (OER) saves me time in developing instructional materials for my education courses.	94(79%)	16(14%)	8(6%)	2(1%)
9.	Open Educational Resources (OER) provide opportunities for collaboration and sharing of instructional resources among education instructors.	84(70%)	30(26%)	4(3%)	2(1%)
10.	I believe that the utilization of Open Educational Resources (OER) improves the overall quality of my education instructional delivery.	60(50%)	34(28%)	23(19%)	3(2%)

Research question 1, sought to find out the Awareness of Open Educational Resources (OER) for instructional delivery. The study revealed that large number of the respondents among education lecturers are aware of Open Educational Resources.

Research question 2, sought to find the Perception of university education lecturers towards the utilization of OER in their teaching practices. The study revealed that majority of the respondents among the science lecturers have positive perception towards the utilization of OER in their teaching practices.

Lastly, Research question 3, sought to find out the Utilization of Open Educational Resources (OER) for instructional delivery among university education lecturers. The study also revealed that majority of the respondents among the education lecturers utilize Open Educational Resources (OER) for instructional delivery.

Recommendations

I. University education lecturers should have access to professional development opportunities to help them learn more about OER and its potential advantages for teaching. Lecturers can be introduced to various OER platforms, license choices, and best practices for incorporating OER into their instruction through workshops, seminars, and training sessions.

II. Administrators of the school should create institutional or subject-specific OER repositories that are tailored to the requirements of university scientific education teachers. These repositories ought to offer an expertly selected selection of OER resources of the highest caliber that are pertinent to the science curriculum. Faculty members can contribute their own OER works and collaborate on resource sharing with their peers.

III. Lecturers ought to provide clear norms and standards that support the usage of open educational resources (OER) for teaching purposes. These recommendations should list the advantages of OER, speak to copyright and licensing concerns, and offer assistance to academics who want to use OER in their lessons. Provide academics with frequent updates on the policies and make them easily available.

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TECHNOLOGY INTEGRATION FOR INSTRUCTIONAL DELIVERY IN EDUCATIONAL INSTITUTIONS: AN APPROACH THAT VACCINATES EDUCATION IN THE FACE OF PANDEMIC SITUATION

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Abstract

The methods of imparting and acquiring knowledge had been diversified through which learning acquisition is boundless. Technology integration in education inspires positive changes in teaching/learning process. This paper deals with technology integration for instructional delivery in educational institutions with special attention to purpose of integrating technology in education, how classroom can be integrated with technology and place of learning management system (LMS) and virtual learning environment (VLE) in instructional delivery. Possible challenges with LMS such as data migration, security and stability as well as scalability appeared as threat to LMS in education. The far reaching recommendation which includes that educational institution should not relent in the adoption of technology integration in education to further enhance instructional delivery beyond pandemic era.

Keywords: Technology integration in education, Teaching/learning process, Learning Management System, Virtual Learning Environment and Instructional Delivery

Introduction

The purpose of education globally has changed from that of producing a literate society to that of producing a learning society. The functions of education is to teach individual to think intensively and to think critically and useful to the society. These purpose and function were almost thwarted when coronavirus (Covid-19) ensued in 2020. In all over the world human activities were affected and education sector was left out. The advances in technologies are continuing to change the mentality of education in terms of both teaching/learning and institutional activities. Technology has always been at the forefront of human education and this can be traced to the era of carving figures on rock walls till today. This unprecedented event has changed the world and has brought it into a new era which known to be the time of online learning or e-learning. This function of technology has alleviated what might have resulted to education collapsed during pandemic era. Pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people (CDC, 2021). A pandemic is a disease outbreak that spreads across countries or continents. It affects more people and takes more lives than an epidemic (Robinson, 2020). The World Health Organization (WHO) declared COVID-19 to be a pandemic

when it became clear that the illness was severe and that it was spreading quickly over a wide area. Coronavirus disease (Covid-19) is the disease caused by a new coronavirus called SASS-CoV-2 (WHO, 2021). It was first learned by WHO on 31 December, 2019, following a report of a cluster of cases of viral pneumonia in Wuhan, China. Today we do not need to go any further than our own home, office, any place or even room, before learning can takes place. In today's society, people as consumers of ICT, all strive for the one dream that is the dream of a connected life. Technology provides numerous tools that teachers can use in and out of the classroom to enhance student learning (SMU, 2021). The form of technology innovation in education is the utilization of information and communication technologies (ICTs) to facilitate teaching and learning process. Teaching becomes easy using audio-visual presentations, projectors, computer presentations and virtual learning environment.

Technological innovations are having a significant impact on educational systems at all levels. Online courses, teaching aids, educational software, social networking tools, and other emerging technologies are disrupting the traditional classroom environment (Stanford CEPA, 2021). Innovating learning processes through technology involves a thorough renewal of the way we use and produce information and knowledge (Kampylis, Bocconi & Punie, 2012). Integration of technology in education simply refers to the use of technology to enhance the student learning experience. Utilizing different types of technology in the classroom, including a virtual classroom, creates learners who are actively engaged with learning objectives and the implementation of technology also creates pathways for differentiated instruction to meet the unique needs of students as individual learners within a broader classroom climate (Drexel University School of Education, 2021). Technology integration is the blending of computer-related learning activities into curriculum to have students acquire, organize, demonstrate, and communicate information (TECHNOHELLA, 2021). Technology integration is the use of technology tools in general content areas in education in order to allow students to apply computer and technology skills to learning and problem-solving. Technology integration is defined as the use of technology to enhance and support the educational activities. Integrating technology provides students with the opportunity to develop skills that are essential for lifelong learners, such as research, collaboration, communication, critical thinking, and problem solving. Technology integration also assists students in acquiring information, media, and technology literacy, which is crucial for our rapidly changing media and technology driven world (DAVIDLEEEDTECH, 2021).

Why is Technology Integration in Education Important?

The invention of the computer, Internet, email, chat, cell phones, video game systems, and hand-held music players can be recognized as era that brought technology to education where learning activities had been digitalized. The children in this era are referred to as Digital citizen. Digital citizen is a person who develops the skills and knowledge to effectively use the Internet and other digital technology, especially in order to participate responsibly in social and civic activities (Dictionary.com, 2019). Digital citizen generally refers to a person who utilizes technology in order to involve in different kinds of activities including society, marketing, politics, entertainment, and all others. Digital citizenship in 21st century denotes the individuals having skills and basic knowledge with good experience in accessing the internet through computers,

tablets, mobile phones etc. A digital citizen is nothing but a person who is aware of his technological surroundings. The question is that WHO'S Exempted from this era, the answer is NO. Therefore, technology integration in education cannot be overemphasized for its plethora advantages in education. The students are familiar with technology and because of this fact they do things differently than people did it in the past. They regularly use the Internet instead of a book to research. They send an email or use chat instead of picking up the phone to call a friend. Moreover, they frequently use the computer to type a document instead of writing it out by hand. Technology is seamlessly integrated into their daily lives (TECHNOKIDS, 2021).

Drexel University School of Education (2021) identified some of the reasons for technology integration in education is important, these include;

Keeping students engaged: Active engagement is a key part of any lesson plan. Whether students are working independently or collaboratively, technology engages students because it is interactive.

Helps students with different learning styles: Not all students learn and retain information in the same way or at the same speed. Technology is an opportunity for teachers to differentiate instruction to modify information for the appropriate learning capabilities of their students. The use of technology can also allow students to work at their own paces.

Prepare students with life skills: Technology has become its own form of literacy because of how often it is used in everyday life. Allowing students to learn and refine these skills prepares them for life beyond the classroom.

The responsibility of a teacher is to prepare students adequately with relevant skills and knowledge they need to be responsive and successful in life. It is important to realize that the workplace has dramatically transformed since the invention of the technology through computers. Today, workers rely on computers to complete their job duties. With the aid of Internet, people are no longer tied to a physical location to complete or carry out their works, instead, wireless technology can be used to check email, research information, and access files from a mobile device such as a laptop or cell phone are relevance in this regards. Students need the skills to thrive in their studies and future workplaces. Base on the aforementioned, teachers are required to present learning opportunities that can assist students expand their knowledge and skills to broaden their understanding of how technology can be utilized.

How to Integrate Technology in the Classroom for Effective Instructional Delivery

There are two models identified in which technology can be integrated for effective instructional delivery. These include SAMR Model and TPACK Framework. The two models have been recognized as an effective way to integrate technology for instructional delivery in any level of institutions.

SAMR (Substitution, Augmentation, Modification, Redefinition) Model

The SAMR model was developed by Dr. Reuben Puentedura, founder of the consulting firm Hippasus, and it presents a choice of four levels of technology integration. Tech newbies might

start at the most basic level, which is substitution, and as their confidence with technology tools grows, they aim for higher levels until they reach the modification and redefinition levels. At those two levels, teachers are using technology in ways that allow students to create content for themselves, share that content with each other, explore subject matter, and communicate with one another in ways that aren't possible in a more traditional environment (Best, 2021). The diagram below shows the arrangement and effective ways technology can be integrated into the classroom instruction.

Source: Best (2021). The SAMR Model Explained

Substitution

At the substitution level, teachers are not changing the lesson itself, but they might make one aspect of it digital. Technology acts as a direct tool substitute, with no functional change (Fastiggi, 2021). A teacher in his class may be teaching by allowing the students to copy everything down with pen and paper. Once the school started getting classroom computers, tablets, and others technologies tools, teacher may began placing notes, resources and worksheets on his website and having students download the documents and complete notes and summary activities in a Word document.

Examples of Substitution

- Having students type their work instead of handwriting it
- Using online quizzes and programs instead of pen and paper
- Uploading a worksheet in PDF for student access, as opposed to photocopying
- Using a digital interactive whiteboard as opposed to a traditional whiteboard and saving the results as a document (Best, 2021).

Augmentation

In the augmentation level, teachers use technology to make a functional improvement in an existing task. Technology acts as a direct tool substitute with functional improvement. Augmentation means that the learning process can become more efficient and engaging. Images can be added, text can be hyperlinked and changes to the text itself can be made quickly.

Examples of Augmentation

- Students give more informative and engaging oral presentations accompanied by a PowerPoint or Prezi containing multimedia elements.
- Students use the internet to independently research a topic, as opposed to relying on teacher input.
- Teacher instruction is supplemented with a video that clarifies a particularly hard to explain concept (Best, 2021).

Modification

At this level, technology not only enhances the learning activity, it also significantly transforms it. By this stage teachers are redesigning tasks via technology. For example, students setting up a blog in which they open up their work to a worldwide audience. The blog means that students are much more accountable for the learning activities. In this way, both student learning and literacy improve (Fastiggi, 2021).

Examples of Modification

- Students produce podcasts summarising a topic, which can then be accessed by other students as a revision resource.
- Students create an informative video presentation in place of a standard oral presentation. They can use their voice alongside a broader variety of creative multimodal components.
- Students use a technological tool that makes an abstract concept visible in a hands-on, responsive way (Best, 2021).

Redefinition

This level requires the teacher to think about learning activities that were preciously inconceivable without the use of technology (Fastiggi, 2021). Redefining learning has the potential to connect learning with the real world and produce authentic outcomes. It also gives students strong technological soft skills such as digital collaboration, communication, technological literacy, and the ability to adapt to new systems and processes (Best, 2021). Teachers create tasks that would be impossible without technology, and they also put technology in the hands of the students.

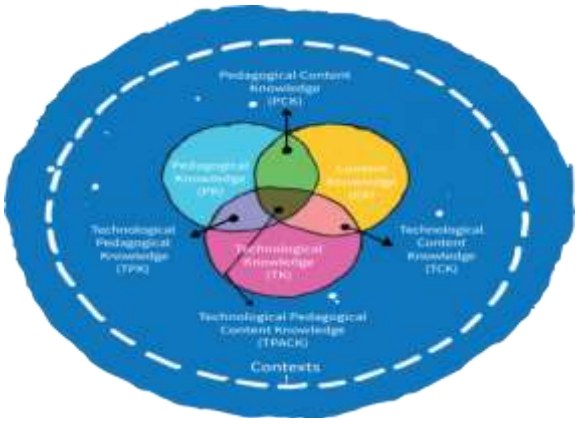
Examples of Redefinition

- connecting your students with other people around the world as part of the learning journey
- having students publish their work online where it can be viewed by peers and the broader community
- recording students as they deliver a presentation or practice a physical skill, then using this recording to prompt student reflection
- experimenting with tasks that use extensive multimodal elements (e.g. producing documentaries or short films, webpages, print documents with creative layouts). (Best, 2021).

TPACK Framework

The TPACK framework was introduced by Punya Mishra and Matthew J. Koehler of Michigan State University. TPACK identifies three primary forms of knowledge: content knowledge (CK) (what you teach), pedagogical knowledge (PK) (how students will learn it best), and technological knowledge (the digital tools and resources appropriate for the lesson, activity, or unit).

The intersection of those three forms of knowledge represents a full understanding of how to effectively teach with technology so that educators do not teach with technologies just for technology's sake. If one chooses to start with TPACK, look at your curriculum, pedagogy, and technology to determine how these domains intersect. An example is a third grade math lesson in which the content is area and perimeter, the pedagogy is project-based learning through an inquiry-based activity, and the technical support is Google Suite for Education and a 3D CAD design tool called Tinkercad (The Learning Counsel, 2021). Students have to design a park to scale and insert items like a flower garden and playground as well as specific shapes. Rather than doing the task with pencil, the students build a 3D model with Tinkercad. Then they use Google Docs to write a letter to an imaginary town stating why that town should choose their park design.



Source: Rodgers (2018). The TPACK Framework Explained

Learning Management System (LMS) for Educational Learning Delivery

Technology provides numerous tools that teachers can use in and out of the classroom to enhance student learning. Teaching online, whether in a hybrid course or a wholly-online course, requires different techniques and different tools. There are also numerous online resources about using technology to enhance teaching in a number of different ways and one of the resources is Learning Management System. A Learning Management System (LMS) is a platform that helps instructors manage and organize educational materials online and conduct online courses. Learning management systems help streamline the learning process by providing a central location for accessing material online and developing content (TrustRadius, 2021). LMS software benefits administrators, teachers, and students. Students and teachers can access and upload course material such as calendars, syllabi, assignments, and grades. The platforms also allow instructors and administrators to track student progress on an individual basis and at the aggregate level. This software also helps minimize the use of paper materials and supports remote learning. Centralizing educational data provides several advantages. It allows educators and administrators to more easily

access student data and curricula. It also saves money by avoiding duplicate systems and information repositories. It also allows educators to scalability personalize education and student engagement.

Common Features of Learning Management System (LMS)

The features of LMS are operating on unique and different operation. The common features are discussed below.

i. Course creation and management: Instructors can create and manage structured learning content and set user permissions to control how students access content. With an LMS, instructors can add a variety of media to enhance their syllabus, including text, images, videos, links, interactive tests, slideshows, and more. Teachers can upload entire courses and modules, enroll students or enable self-enrollment, and see individual reports on each student. These learning materials can be uploaded all at once, allowing students to follow along with content for the course's length synchronously or asynchronously.
ii. Course calendars: Instructors can set all upcoming course activities on a calendar for student access. This allows students to stay on top of all assignments and upcoming tests, and to see real-time updates when due dates change.
iii. Online assessment: Instructors can create and customize tests for students to access and submit online. Most platforms will support a variety of question types, such as multiple choice, drag and drop, essay, true or false, and agreement scale. From there, instructors can grade assignments and post scores online for students to access. Additionally, in-person assessments can also be uploaded and graded on the LMS.
iv. Attendance management: Some LMS products allow instructors to track student attendance for classes and events, whether the student was late or absent. These attendance reports can then be viewed online by students to see where they stand in the class.
v. Discussion boards: Instructors and students can create discussion topics for the purpose of completing specific assignments, continuing in-class discussions, or soliciting end-of-semester feedback. Students can respond to individual threads and edit their comments. Instructors can also set time limits on discussion access, which motivates students to respond within the given timeframe. Discussion boards give teachers one more tool to assess overall student competency in a particular subject.
vi. Gamification: Certain LMSs contain gaming elements, which may include badges and leaderboards. The gamified environment is designed to create a more engaging learning experience for students and promote social learning. In addition to tracking their grades, students are encouraged to work toward acquiring various pieces of digital approval directly in the system.
vii. Teacher communications: Instructors can send messages to students directly within the LMS or via email, which usually integrates with the LMS. This allows teachers and students to have 1:1 discussions related to student performance or further discussion of class topics. Teachers can also set reminders and notifications to alert students of upcoming deadlines whenever they access the LMS.

viii. Dashboards: Dashboards allow instructors to organize all relevant information and keep it clean for viewing and tracking specific data. These interfaces can be customized to suit user needs and could include data such as average class grade, student attendance, assignment submission statistics, and student access time.

ix. Reporting: All LMS products contain some type of reporting feature. These reports are either prebuilt (in which case the user has only a limited number of offerings that are already in existence) or customizable. These may include reports on participation, learner progress, access time, quizzes, course activity, and more.

x. Student profiles: Students can create and manage their own user profile within the LMS, which helps build social relationships with classmates during discussions and helps instructors to recognize their students more easily. These profiles can also contain contact information if teachers or classmates need to reach out to them.

The Benefits of Learning Management System (LMS)

An LMS provides a centralized repository for digital content, allowing students and instructors to access and manage all required course materials in one place, from any device. These tools allow for automation of the assessment process and tracking of student progress while facilitating collaboration and communication among students, teachers, and parents.

Consolidate digital content: The primary reason to use an LMS is that it is a living repository for all digital learning content that the organization offers. It enables teachers to upload documents, create presentations, and share all course material directly through the application.

Assess student progress: Instructors can track student progress by uploading grades and assignment scores. The LMS gives them a single place where they may create, distribute, and grade assessments and assignments for their courses. Most platforms include automatic grading functions that allow instructors to mark student work and input the scores directly into a gradebook.

Distribute content: Instructors can create new content or upload existing content as needed within the application. This lets students immediately see exactly what they need to study, without having to wait until the next class session.

Facilitate communication: Typically, LMS platforms come with standard communication features that allow instructors to send messages to students or parents and vice versa. Instructors communicate information about upcoming assignments to an entire class, or they message an individual student about their progress or any concerns. Mass notification features allow instructors to get in touch with many members of the school community with one click.

Encourage collaboration: An LMS helps create a digital community that fosters meaningful collaboration among peers, both for teachers and students. Instructors use an LMS to share lesson plans and materials, tell colleagues about an instructional strategy they are trying out, or ask a question to the community. Students use discussion forums built into LMS platforms to participate in online discussions, work together on group projects, or seek help with an assignment.

Challenges with Learning Management System (LMS)

The following are challenges of LMS

i. Integrations: LMS products often have integrations with a variety of other education software, which allow for improved communication and sharing of data. Particularly when using a proprietary LMS, users may find a frustrating lack of supported integrations with their other tools.

ii. Data migration: It is significantly harder to move from a proprietary LMS to another LMS product, due to the exclusivity of the vendor's hosted platform. Users may face difficulty in migrating their data successfully to and from a proprietary LMS.

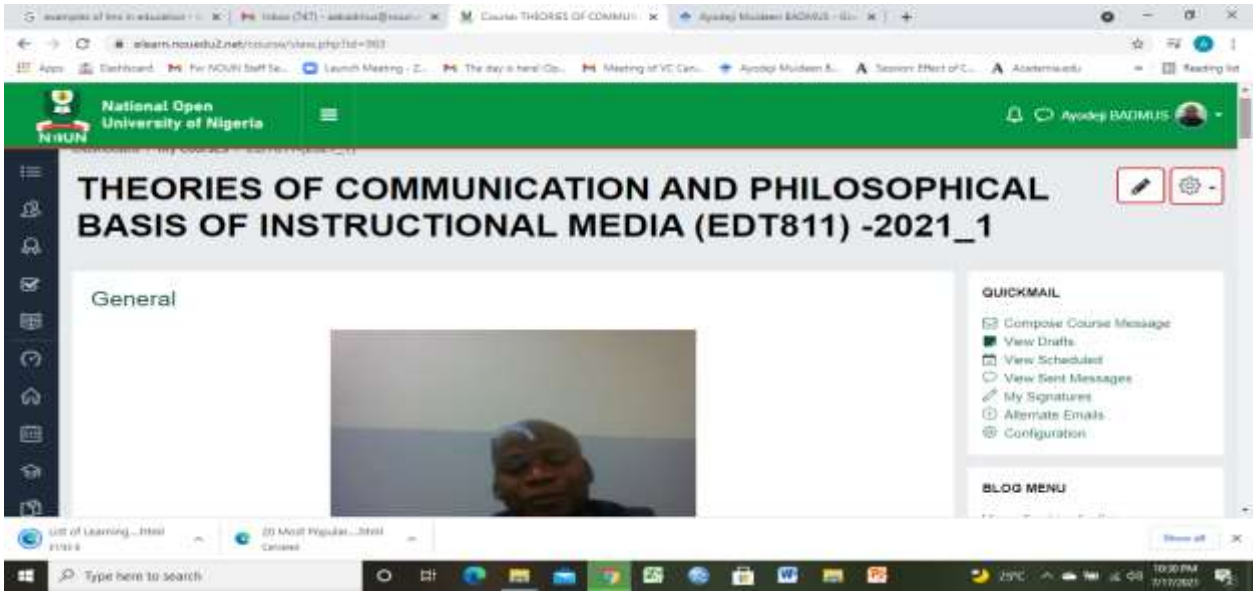
iii. Security and stability: Proprietary LMS vendors take full ownership of the security and stable hosting of their product. Users are therefore at the mercy of vendors to keep the servers operational, and to ensure data breaches do not occur. If a proprietary LMS platform suddenly shutters, users would have little recourse to retrieve all their data safely and efficiently.

iv. Scalability: Proprietary LMS products charge per user, and having to add users as time goes on will incur additional registration and maintenance fees. Open-source LMS products, on the other hand, are often free and allow for smooth scaling up to tens of thousands of users.

The Use of Virtual Learning Environments (VLE) for Instructional Delivery

The term 'virtual learning environment' or virtual classroom, is often used synonymously with LMS. These two terms essentially refer to the same products, but emphasize different aspects of the software. Virtual classrooms typically have a larger focus on the collaborative aspect of learning. VLE consists of a set of focused teaching and learning process electronic tools, so it is an alternative mean, useful to mediate the teaching and learning process. VLE is a web-based learning platform, which is a reality in the education world, that integrates the conventional education concept with the virtual method. Abdullah, Noh, Yusuff, and Mansor (2013), referred VLE as an online classroom and a social space in schools that contains a calendar, social networks, shared workspace and online assessment. Virtual Learning Education, also known as VLEs, may have a de facto role as authoring and design environments for teachers and instructors who edit them. Almost all higher education institutions during the COVID-19 have tried using different VLEs to support instructional delivery process and enhance learners' knowledge.

National Open University of Nigeria, NOUN has been using it as mode of imparting and acquiring knowledge for years and it has been successful. Several trainings were given to the academic staff on VLE while students as well were equally participated on how VLE can be used to support them in their learning. The figure below is a typical dashboard of a course facilitated using VLE in National Open University of Nigeria.



Source: Badmus, A. M. (2021). VLE on EDT811 and

Conclusion

Education is an essential right for children and any person who desire to learn at any point in time. This must be a priority from the very beginning of any emergency responses. To this extent, integrating technology in education for instructional delivery is an important because of its plethora potentials to facilitate instructional process in enhancing educational system. LMS and VLE have been proved effective to disseminate knowledge at any levels of educational system. The world over have embraced this fact as an approach to be used for instructional delivery at any pandemonium situation like Covid-19.

Recommendations

Based on the importance of technology integration in education, the following recommendations are raised.

1. Educational institutions should not relent in the adoption of technology integration in education to further enhance instructional delivery beyond pandemic era.
2. Training should be given to all teachers at all level of education on LMS and VLE for the awareness of potential embedded in these technologies.

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CROWDSOURCING PLATFORM EFFICACY: A TOOL TO UPSCALE UNDERGRADUATES' LEARNING OUTCOMES IN NIGERIAN UNIVERSITIES

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Abstract
This study investigates the efficacy of crowdsourcing platforms: a tool to upscale undergraduates' learning outcomes in Nigerian universities. Through a quantitative research approach, purposive sampling technique was used to select respondents, using questionnaire, data was collected to assess the impact of crowdsourcing platforms as a tool to upscale undergraduates' learning outcomes in Nigerian universities. The findings provide insights into Nigerian universities should consider integrating crowdsourcing platforms into their educational practices to enhance learning outcomes and also the potential benefits and challenges of integrating crowdsourcing platforms in the Nigerian higher education system.

Keywords: Efficacy, Crowdsourcing platforms, Mathematics undergraduates

Introduction

Crowdsourcing is the practice of obtaining ideas, services, or content from a large group of people, often facilitated through digital platforms or online communities. It involves harnessing the collective intelligence, skills, and efforts of a diverse crowd to solve problems, generate ideas, or contribute to projects. Crowdsourcing involves engaging a diverse crowd through online platforms to leverage their collective wisdom, skills, and contributions for problem-solving, idea generation, or content creation. Crowdsourcing is a collaborative approach that involves outsourcing tasks, ideas, or problem-solving to a large group of people, typically facilitated through an online platform It harnesses the collective intelligence, skills, and contributions of a diverse crowd to address complex challenges, generate ideas, or produce content.

Estellés-Arolas and González-Ladrón-de-Guevara (2012) define crowdsourcing as "the act of taking a task traditionally performed by an employee or contractor and outsourcing it to an undefined, generally large group of people in the form of an open call." This definition highlights the transfer of tasks from traditional hierarchical structures to a distributed network of individuals. Howe (2006) describes crowdsourcing as a concept that "represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call." This definition emphasizes the engagement of a broader network of individuals beyond the boundaries of an organization.

Crowdsourcing is ingrained in research on open innovation and co-creation and is concerned with whether a wide number of individuals – the "crowd" – can take part actively in a company's innovation processes (Chui, Manyika, Bughin and Dobbs, 2012), thereby allowing the company

access to intelligence and knowledge that is otherwise dispersed among a great many users or stakeholders (Chanal and Caron-Fasan, 2010; Schenk and Guittard, 2011). In 2006, Howe introduced the word "crowdsourcing," which he described as "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call." This might be peer production (where the task is carried out cooperatively), but it is also frequently carried out by lone persons (either experts or beginners). Using an open call and a vast network of potential workers is a vital precondition (Howe, 2006).

With new opportunities to improve teaching and learning processes, educational technology has made great strides in the last several years (Spector, 2019). One such technical advancement is the introduction of crowdsourcing platforms, which have drawn attention for their ability to access the aggregate knowledge and skills of a wide range of people (Brabham, 2008). A lot of the time through online communities or platforms, crowdsourcing platforms allow for the solicitation of ideas, services, or content from a huge number of people (Howe, 2006). Although crowdsourcing platforms have been widely used in a number of different industries, their potential effects on education, particularly in the context of Nigerian institutions, have not been fully examined.

Oluwatayo and Omoniyi (2021) note that Nigeria, a nation with a sizable and diversified higher education student body, faces many difficulties in providing its undergraduate students with a high-quality education. Having trouble getting the best learning results is a result of a lack of resources, crammed classrooms, and a lack of skilled teachers (Anunobi&Lawal, 2020). As a result, there is a pressing need to investigate cutting-edge strategies that can improve undergraduate students' academic performance and learning experiences.

The use of crowdsourcing platforms in education has the ability to solve some of these issues and encourage more effective and engaging learning environments. Crowdsourcing systems can give a variety of viewpoints, encourage collaboration, and make it possible to create shared knowledge by utilizing the collective expertise and contributions of a broader community (Estellés-Arolas& González-Ladrón-de-Guevara, 2012). The effectiveness of crowdsourcing platforms in the context of Nigerian universities is, however, not the subject of sufficient empirical research.

According to Alonso (2012), crowdsourcing platforms are becoming recognized as useful resources in a number of sectors, including education. According to Estellés-Arolas and González-Ladrón-de-Guevara (2012), these platforms let teachers and students draw on the knowledge and experience of a broader community to solve problems together, share information, and create new content. Platforms that encourage active involvement, engagement, and knowledge co-creation have the potential to improve learning outcomes in the educational setting (Dillahunt, 2012).

The effectiveness of educational interventions is primarily determined by learning outcomes and academic success. According to research, a variety of factors, including instructional strategies, learning settings, and the use of technology, can have a big impact on how well students learn (Gikandi, Morrow, & Davis, 2011). Crowdsourcing systems give students exceptional chances to actively participate in the learning process, collaborate with peers, and apply knowledge to real-world issues, which may enhance academic performance (Chen & Liu, 2012).

The efficiency of crowdsourcing platforms in improving learning outcomes is influenced by a number of factors. Student involvement and participation may be impacted by the platform's design and features, such as the user interface, accessibility, and task diversity (Feng, Lazar, &Preece, 2012). Additionally, how much students gain from crowdsourcing exercises depends on their unique learner traits, such as motivation, self-control, and digital literacy abilities (Nov, Arazy, & Anderson, 2013).

A systematic review and meta-analysis on the effects of crowdsourcing in education were carried out in 2020 by Wang, Li, and Wang. Crowdsourcing platforms improved student engagement, problem-solving skills, and critical thinking, according to their analysis of numerous research studies. Additionally, Liu, Y., Lee, and Bonk, C. J. (2020) investigated how crowdsourcing platforms could be used in a mixed learning setting. Their study revealed that the implementation of crowdsourcing activities promoted collaborative learning, raised student engagement, and promoted the growth of higher-order thinking abilities.

Dillahunt, T. R. (2012) looked into crowdsourcing as a method for tackling issues in a variety of fields, including education. The study emphasized the potential of crowdsourcing platforms to involve a significant community of contributors in providing answers, generating ideas, and producing educational content. In their 2012 study, Alonso et. al examined the usage of learning object repositories, which are a type of crowdsourcing platform and knowledge management systems in mathematics education. Their research highlighted the benefits of leveraging crowd-contributed learning objects for collaborative learning and knowledge sharing.

There have been important studies looking at the effect of crowdsourcing platforms on learning outcomes, while research on these topics is still in its infancy. For instance, Wang, Li, and Wang (2020) discovered that the utilization of a crowdsourcing platform enhanced students' capacity for problem-solving and critical thought. In a similar vein, Liu, Lee, and Bonk (2020) investigated the incorporation of crowdsourcing platforms in a blended learning environment and noted improved engagement and collaborative learning among students. This study intends to close this gap by analyzing how well crowdsourcing platforms might improve undergraduate students' learning outcomes in Nigerian universities. This study aims to give educators, policymakers, and other stakeholders in higher education in Nigeria useful information by analyzing the effects of crowdsourcing platforms on students' academic success, knowledge acquisition, engagement, and overall learning experiences.

Statement of Problem

There is a sizable knowledge vacuum regarding crowdsourcing platforms' effectiveness in the context of undergraduate education in Nigerian universities, despite the potential advantages they may have in improving learning outcomes. With little study particularly examining their impact on learning outcomes among Nigerian undergraduate students, the extant literature on crowdsourcing platforms in education primarily emphasizes global perspectives. Because of this, it's yet unknown whether and how much using crowdsourcing platforms may increase academic performance, knowledge acquisition, and participation in Nigeria's higher education system.

In addition, Nigerian institutions encounter particular difficulties in providing high-quality instruction due to a lack of funding, packed classrooms, and a lack of trained teachers. These elements lead to the urgent need for novel strategies that might address these difficulties and improve undergraduate students' learning results. In this particular educational setting, it is vital to investigate the possibilities of crowdsourcing platforms as a workable approach to improve learning experiences and outcomes.

Therefore, the following issue is what this study seeks to solve: How well do crowdsourcing platforms improve undergraduate learning outcomes in Nigerian universities? By examining this issue, the study seeks to provide empirical evidence and insights into the impact of crowdsourcing platforms on learning outcomes, thus informing educational stakeholders, policymakers, and educators about the potential benefits and challenges associated with integrating crowdsourcing platforms into the Nigerian higher education system.

Purpose of the Study

The main purpose of this study was to find out the awareness and accessibility levels of crowdsourcing among undergraduates in Nigeria, as well as determining the efficacy of it to enhance learning outcomes. Specifically, the sought to:

i. Find out the awareness level of undergraduates' on crowdsourcing platforms for learning.
ii. Examine the accessibility level of crowdsourcing platforms for learning among undergraduate students in Nigeria.
iii. Determine the efficacy of crowdsourcing platforms for learning among undergraduates in the Nigerian.

Research Questions

To achieve the objectives of this study, the following research questions were raised:

i. What is the awareness level of undergraduate on crowdsourcing platforms for learning in Nigerian universities?
ii. What is the accessibility level of undergraduate on crowdsourcing platforms for learning in Nigeria universities?
iii. What is the efficacy of crowdsourcing platforms for learning among undergraduates in the Nigeria universities?

Methodology

This study adopts descriptive research of survey method, the survey was conducted to collect the data on the efficacy of crowdsourcing platforms in enhancing learning outcomes among undergraduate students in Kwara state Nigerian. The participants in this study was undergraduate students enrolled in selected Nigerian universities in Kwara State. A purposive sampling technique was used to select participants who have experienced the utilization of crowdsourcing platforms as part of their academic activities. The sample size was determined based on saturation, ensuring that a sufficient number of participants who are Ict inclined are included to provide rich and diverse perspectives. The survey instrument was be designed to gather information on demographic,

utilization of crowdsourcing platforms. The Likert scale was utilized to measure participants' perceptions and experiences. Quantitative data collected through surveys was analyzed using descriptive statistical techniques. Descriptive statistics, such as frequency count and percentages, was used to summarize participants' responses.

Results

Table 1: Demographic Distribution of Respondents

Variables	**Frequency**	**Percentage (%)**
Gender		
Male	79	52.67
Female	71	47.33
Total	150	100.0

Table 1 revealed that 71 respondents (47.33%) were female, while 79 (52.67%) were male. This implies that the majority of the undergraduates' students that responded to this study were Males.

Research Question One:

What is the awareness of crowdsourcing platforms for learning among undergraduate students in Nigerian universities?

Table 2: Awareness of crowdsourcing platforms for learning among undergraduate students in Nigerian universities

S/N		**Aware**	**Not aware**
1.	TeachAde	97 (65%)	53(35%)
2.	PrepClass	104(69%)	46(31%)
3.	MySchoolGist	95(63%)	55(37%)
4.	StudyLocal Nigeria	91(61%)	59(39%)
5.	Coursera	130(87%)	20(13%)
6.	ExamPastQuestions	97(65%)	53(35%)
7.	Nigerian Scholars	77(51%)	73(49%)
8.	FlashLearners	59(33%)	91(67%)
9.	Tuteria	81(54%)	69(46%)
10.	TED-Ed	135(90%)	15(10%)

Table2, shows that a more than average number of the respondents 97 (65%) are aware of TeachAde crowdsourcing platform, while 53(35%) are not aware of it. 104 (69%) of the respondent are aware of PrepClass crowdsourcing platform, while 46(31%) are not aware of it. 95 (63%) of the respondents are aware of MySchoolGist crowdsourcing platform, while 55(37%) are

not aware of it. 91 (61%) of the respondents are aware of StudyLocal Nigeria crowdsourcing platform, while 59(39%) are not aware of it. 130 (87%) of the respondents are aware of Coursera crowdsourcing platform, while 20(13%) are not aware of it.97 (65%) of the respondents are aware of ExamPastQuestions crowdsourcing platform, while 53(35%) are not aware of it. 77 (51%) of the respondents are aware of Nigerian Scholars crowdsourcing platform, while 73(49%) are not aware of it. 59 (33%) of the respondents are aware of FlashLearners crowdsourcing platform, while 91(67%) are not aware of it. 81 (54%) of the respondents are aware of Tuteria crowdsourcing platform, while 69(46%) are not aware of it. 135 (90%) of the respondents are aware of TED-Ed crowdsourcing platform, while 15(10%) are not aware of it. Which implies that large number of the respondents are aware of the crowdsourcing platforms.

Research Question Two:

What is Accessibility crowdsourcing platforms for learning among undergraduate students in Nigeria?

Table 2: Accessibility crowdsourcing platforms for learning among undergraduate students in Nigeria.

S/N		Accessible	Not Accessible
1.	TeachAde	82 (55%)	68(45%)
2.	PrepClass	100(67%)	50(33%)
3.	MySchoolGist	94(63%)	56(37%)
4.	StudyLocal Nigeria	88 (59%)	62(41%)
5.	Coursera	125(83%)	25(17%)
6.	ExamPastQuestions	76(51%)	74(49%)
7.	Nigerian Scholars	70(47%)	80(53%)
8.	FlashLearners	57(38%)	93(62%)
9.	Tuteria	68(45%)	82(55%)
10.	TED-Ed	134(89%)	16(11%)

Table 3, shows that 82 (65%) of the respondents have access to crowdsourcing platform, while 68(45%) do not have access to it. 100 (67%) of the respondent have access to PrepClass crowdsourcing platform, while 50(33%) do not have access to it. 94(63%) of the respondents have access to MySchoolGist crowdsourcing platform, while 56(37%) do not have access to it. 88 (59%)of the respondents have access to StudyLocal Nigeria crowdsourcing platform, while 62(41%) do not have access to it. 125 (83%) of the respondents have access to Coursera crowdsourcing platform, while 25(17%) do not have access to it. 76 (51%) of the respondents have access to ExamPastQuestions crowdsourcing platform, while 74(49%) do not have access to it. 70 (47%) of the respondents have access to Nigerian Scholars crowdsourcing platform, while 80(53%) do not have access to it. 57 (38%)of the respondents have access to FlashLearners crowdsourcing

platform, while 93(62%) do not have access to it . 68 (45%) of the respondents have access to Tuteria crowdsourcing platform, while 82(55%) do not have access to it. 134 (89%)of the respondents have access to TED-Ed crowdsourcing platform, while 16(11%) do not have access to it. Which implies that most of the crowdsourcing platform listed for this study are accessible for learning for learning among undergraduate students in Kwara state, Nigeria.

Research question three:

What is the efficacy of crowdsourcing platforms for learning among undergraduates in Nigeria?

Table 4: Efficacy of crowdsourcing platforms for learning among undergraduates in Nigeria

S/N		SA	A	D	SD
1.	Using crowdsourcing platforms for learning has enhanced my engagement and participation in academic activities	70(47%)	40(27%)	30(20%)	10(7%)
2.	Collaborating with other students on crowdsourcing platforms has improved my understanding of course materials.	60(40%)	60(40%)	20(13%)	10(7%)
3.	Crowdsourcing platforms have provided me with access to a diverse range of knowledge sources that complement my learning experience	44(29%)	56(37%)	32(21%)	18(12%)
4.	Engaging with crowdsourcing platforms has improved my critical thinking and problem-solving skills.	68(45%)	30(20%)	20(13%)	32(21%)
5.	Crowdsourcing platforms have fostered collaboration and knowledge sharing among students in my academic pursuits.	74(49%)	50(33%)	18(12%)	8(5%)
6.	Using crowdsourcing platforms has expanded my understanding of subject matter beyond what is covered in traditional classroom settings	64(43%)	56(37%)	20(13%)	10(7%)
7.	Crowdsourcing platforms have positively influenced my overall learning outcomes and academic performance.	50(33%)	60(40%)	10(7%)	30(20%)
8.	Crowdsourcing platforms have provided me with opportunities for creativity and innovation in my academic work.	70(47%)	30(20%)	30(20%)	20(13%)
9.	I feel confident in my ability to effectively navigate and utilize	58(39%)	40(27%)	32(21%)	20(13%)

	crowdsourcing platforms for academic purposes.				
10.	Incorporating crowdsourcing platforms into the curriculum can enhance learning outcomes for undergraduate students in Nigerian universities	74(49%)	40(27%)	20(13%)	16(11%)

In table 4 above, it was revealed that the largest number of the respondents 110(74%) agreed on the statement: Using crowdsourcing platforms for learning has enhanced my engagement and participation in academic activities, while 40(26%) respondents, disagreed with the statement. 120 (80%) respondents agreed on the statement :Collaborating with other students on crowdsourcing platforms has improved my understanding of course materials, while 30 (20%) of respondents disagreed on the statements, furthermore, 100 (65%) of the respondents agreed on the statement: Crowdsourcing platforms have provided me with access to a diverse range of knowledge sources that complement my learning experience, while 50 (35%) respondents disagreed on the statement. 98(64%) respondents agreed on the statement: Engaging with crowdsourcing platforms has improved my critical thinking and problem-solving skills, while 52 (36%) disagreed with the statement.124(82%) respondents agreed on the statement: Crowdsourcing platforms have fostered collaboration and knowledge sharing among students in my academic pursuits, while 26(18%) disagreed on the statement. 120(80%) agreed on the statement: Using crowdsourcing platforms has expanded my understanding of subject matter beyond what is covered in traditional classroom settings, while 30(20%) respondents, disagreed with the statement. 110 (73%) respondents agreed on the statement :Crowdsourcing platforms have positively influenced my overall learning outcomes and academic performance, while 40 (27%) of respondents disagreed on the statements, furthermore, 100 (65%) of the respondents agreed on the statement: Crowdsourcing platforms have provided me with opportunities for creativity and innovation in my academic work, while 50 (35%) respondents disagreed on the statement. 98(64%) respondents agreed on the statement: I feel confident in my ability to effectively navigate and utilize crowdsourcing platforms for academic purposes, while 52(36%) disagreed with the statement. 114(76%) respondents agreed on the statement: Incorporating crowdsourcing platforms into the curriculum can enhance learning outcomes for undergraduate students in Nigerian universities, while 36(24%) disagreed on the statement. This implies that majority of the respondents among undergraduate students agreed on the Efficacy of crowdsourcing platforms for learning among undergraduates in Kwara State, Nigeria.

Discussion

Research question 1, sought to investigate the awareness of crowdsourcing platforms for learning among undergraduate students in Kwara State, Nigeria the study revealed that large number of the respondents among undergraduates' students are aware of various crowdsourcing platforms. Research question 2, further sought to examine the accessibility crowdsourcing platforms for learning among undergraduate students in Kwara State, Nigeria. The study revealed that most of the crowdsourcing platforms are accessible for learning for learning among undergraduate students in Kwara state, Nigeria. Finally, Research question 3, sought to find out the efficacy of

crowdsourcing platforms for learning among undergraduates' in the Nigeria. The study revealed that majority of the respondents among undergraduate students agreed on the Efficacy of crowdsourcing platforms for learning among undergraduates in Kwara State, Nigeria.

Recommendations

Nigerian universities should consider integrating crowdsourcing platforms into their educational practices to enhance learning outcomes. This integration can provide opportunities for active student engagement, collaborative problem-solving, and knowledge sharing.

Educators should receive training and support in effectively utilizing crowdsourcing platforms in their teaching practices. This includes providing guidance on designing tasks, facilitating student participation, and providing feedback to optimize the learning experience.

The inclusion of crowdsourcing activities should be incorporated into the curriculum design to ensure alignment with learning objectives and subject-specific requirements. This will allow students to engage with crowdsourcing platforms in a structured and meaningful way.

To maximize the benefits of crowdsourcing platforms, strategies should be developed to enhance student engagement and motivation. This can include creating clear expectations, providing incentives for participation, and fostering a supportive and collaborative learning environment.

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ASSESSMENT OF COVID-19 IMPACT ON TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING IN KWARA STATE OPEN TECNOLOGY AS PNACEA.

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Abstract

Before the breakout of COVID-19 pandemic, authors reported that the availability and adequacy of educational resources in technical and vocational education and training (TVET) institutions will undoubtedly lead to the production of skilled manpower which will help the country to meet its industrial needs. Sadly, till the emergence of the pandemic, these educational resources remain unavailable, which had crippled academic achievements of many students in these institutions. In view of this, this study presumed that if the situation was abysmal before the pandemic, is there any significant change during the pandemic? And what are the way forward to bridging the existing gaps. Therefore, to provide answers to these questions, this study specifically assessed the impact of COVID-19 pandemic on TVET in Kwara State, while raising four (4) other purposes. The study adopted a multistage sampling technique to sample size 216 TVET teachers across the 3 Local Government Areas in Ilorin, Kwara State. A validated researcher-designed questionnaire with a reliability value 0.87 was employed to gather relevant data for this study. Both frequency distribution and mean were used to answer the research questions while, t-test was used to test all the hypotheses at 0.05 level of significance. The study found out that both before and during the COVID-19 lockdown, TVET teachers had access to technological resources but at varying level. Also, COVID-19 had positive impacts on TVET teachers, and there was no gender-biasness in the assessment of the impact of COVID-19 on TVET in Kwara State. The study therefore concluded that COVID-19 pandemic has changed the narrative of how TVET teachers can now appropriately adopt technological resources for TVET teaching in Nigeria. Therefore, the study recommends that TVET educators should be encouraged to utilise technological resources in order to engage students in an engaging, open, and self-paced manner. This is because, one of the primary purposes of technological resources in learning is to make education for all citizenry.

Keywords: TVET; Technological Resources; COVID-19; Impact; Pandemic.

Introduction

In less than two years, Coronavirus (COVID-19) changed the world of work and educational structure of the world. It challenged all humans to adapt to new modalities in all spheres of life, especially the use of face shield, nose mask, hand sanitizers and social distancing. These modalities provided new approaches to all phase of education including technical and vocational education

and training (TVET). In this regard, within the span of two years, TVET educators and experts examined and provided insights on the role of TVET in response to COVID-19 pandemic. In response to the ravaging situation across the world especially in Nigeria where unemployment rate keeps increasing and worsened., especially during the COVID-19 lockdown, TVET can be well-placed to develop important skills needed to mitigate the impacts of the pandemic. TVET's focus on practical skills, and its potential to deliver short-term, targeted and modular training can be harnessed to rapidly empower, reskill and upskill individuals to live successfully in the new normal.

The institutional lockdown due to COVID-19 did not exempt TVET learning centers. Thus, teaching and learning moved from classrooms to remote means, facilitated by the internet, television, radio, or print materials, but the degree to which learning hands-on courses or subject such as TVET remotely especially among low-income and vulnerable students remains particularly challenging. In Nigeria, TVET systems face challenges in responding quickly and adequately to the demands placed by the new shift. To help address the substantial economic disruptions caused by the pandemic, it will be especially important that that training programs and skill development systems are appropriately reimagined, reset and reworked, as well as examinations on the views and reactions of population towards restructuring the TVET system to fit into the new normal and emerging community.

The Nigeria National Policy of Education (Federal Republic of Nigeria, FRN, 2014) described TVET as the educational process involving the study of technologies and related sciences and acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Other authors such as Momoh (2012) defines TVET as a form of education whose primary purpose is to prepare persons for employment in recognized occupation. In the same vein, Okoye and Arimonu (2016) described TVET as a skill-based program which is designed for skill acquisition and focus on specific vocations for entry into defined workplace and provides general technical knowledge.

Technical Vocational Education and Training (TVET) as defined by the United Nations Education Scientific and Cultural Organization (UNESCO) in Badawi (2013) is a comprehensive term referring to those aspects of the educational processes involving, in addition to general education, the study of technologies and related sciences and the acquisition of skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. In the same vein, Adepoju (2014) defines TVET as an educational training which encompasses knowledge, skills, competencies, structural activities, abilities, capacities, and all other structural experiences for securing jobs in the various sectors of the economy or even enabling one to be self-dependent by being a job creator.

The importance of TVET underlines the fact that changes in any nation's economy is required to prepare young people for the jobs of the future of which technical and vocational education have crucial roles to play (Nuru, 2007). Most analysts Yang (2008) and Okoye and Arimonu (2016) agree that employers of labour today demand more skills than they did in the past. Furthermore, Raimi and Akhuemonkhan (2014) opined that for Nigeria to meet up with industrialized nations,

it must deploy adequate human and material resources into TVET as a viable education orientation to meet up the right skilled manpower need of the industries.

Ojerinde (2015) submitted that TVET helps in the preparation of local manpower for the nation's industries, thereby cutting down on over-dependence on foreigners for the industrial development of Nigeria. Asogwa and Diogu (2007) and Ojimba (2012) argued that TVET is very much still neglected in Nigeria. This is evidence in the number of meagre resources allotted to TVET in Nigeria, which consequently are robbing the country of the economic development to be contributed by graduates of technical/vocational education. With the realities set by the new normal, there is an urgent need for Nigeria's attention to be redirected towards self-reliant and sustainable means of livelihood which TVET provides. Kazaure (2020) explained that as far back as 2016, TVET sector in Nigeria had prepared for situtaions of emergencies by implementing the adoption of Open Distance and Flexible eLearning (ODFeL). This was informed based on the need to expand access to TVET in view of the large number of secondary school leavers seeking for entrance into Nigeria tertiary institutions.

Kazaure (2020) stated further that TVET sector cannot cater for up to 50% of those wanting to enroll. As a result, National Board for Technical Education (NBTE) partnered with private organization to achieve the goals of ODFeL. Perhaps, with the outbreak of COVID-19, questions such as: was the effect of ODFeL experienced during the lockdown? Are the strategies and resources implemented impactful before and during the lockdown? These are questions that needed adequate responses to achieve the goals of TVET in Nigeria.

Similarly, Abdullahi (2018) reports that TVET education is targeted at the technological advancement of Nigeria by producing skilled professionals for all aspects of human endeavor. TVET centers such as Polytechnics are technology institutions that produce skilled technicians and technologists for the industries (Owo, 2020). Although, the ideals of the Nigerian TVET system as seen in the previous statements of experts are superb as they are all geared towards the economic and technological advancement of Nigeria, however, either pre-COVID-19 as posited by Onyesom and Ashibogwu (2013) or post-COVID-19 as posited Owo (2020), TVET system in Nigeria has continuously been faced with diverse challenges which affected its progress in diverse perspectives. Kazaure (2020) further revealed that these challenges include but not limited to inadequate funding, poor budgetary allocation to TVET, inadequate supply of training facilities to TVET institutions, poor educational planning, poor research and development funding, lack of synergy between TVET institutions and the industries, among others. All these negative encounters hamper TVET's contributions to the growth of Nigeria's economy. These identified factors and many more serve as constraints to effective TVET in Nigeria.

Statement of the Problem

The main essence of TVET in Nigeria is to offer required technical and vocational education to citizens that will revolutionize the improvement of the nation's industries through the acquisition of lifelong skills that are relevant to human endeavors in line with the demands of the labour market, thereby supporting the country in its quest to achieve economic recovery. Studies before the COVID-19 pandemic such as the study of Owo (2018) reported that the availability and

adequacy of educational resources in TVET institutions will undoubtedly lead to the production of skilled manpower which will help the country to meet its industrial needs. Sadly, till the emergence of the pandemic, these educational resources remain unavailable, which had crippled academic achievements of many students in these institutions. In view of this, this study presumed that if the situation was abysmal before the pandemic, is there any significant change during the pandemic? And what are the way forward to bridging the existing gaps. Therefore, to provide answers to these questions, the main purpose of this study was to assess the impact of COVID-19 pandemic on TVET in Kwara State. Specifically, the study focused on:

i. determining TVET teachers' access to technological resources for teaching TVET subjects before COVID-19 pandemic in Kwara State.
ii. examining TVET teachers' access to technological resources for teaching TVET subjects during COVID-19 pandemic lockdown in Kwara State.
iii. assessing the impact of COVID-19 pandemic on TVET in Kwara State.
iv. determining the gender difference in the assessment of assessed the impact of COVID-19 pandemic on TVET in Kwara State.

Research Questions

In this study, the following research questions were answered:

i. Do TVET teachers have access to technological resources for teaching TVET subjects before COVID-19 pandemic in Kwara State?
ii. Do TVET teachers have access to technological resources for teaching TVET subjects during COVID-19 pandemic lockdown in Kwara State?
iii. What is the impact of COVID-19 pandemic on TVET in Kwara State?

Research Hypotheses

The following research hypotheses were tested in this study at 0.05 level of significance:

H01: There is no significant gender difference in the assessment of assessed the impact of COVID-19 pandemic on TVET in Kwara State.

Methodology

This study adopted a quantitative research design of a survey type, while targeting TVET subject teachers in secondary schools in Kwara State. Multistage sampling technique was employed to select the sample size; namely: a stratified sampling technique was employed to select 3 local government areas (LGAs) in Kwara State (Ilorin East, Ilorin South and Ilorin West); then, purposive sampling technique was employed to select the 24 schools per LGA, making a total of 72 secondary schools; the last stage involved simple random sampling technique to sample 216 TVET teachers across the sample locations.

The instrument for this study included a validated researcher-designed questionnaire with a reliability value 0.87 to gather relevant data for this study. The questionnaire contained three sections (A, B and C); Section A elicited demographic information of respondents: Section B contained items to examine TVET teachers' access to technological resources for teaching TVET

subjects before and during COVID-19 pandemic in Kwara State; and Section C contained items to assess the impact of COVID-19 pandemic on TVET in Kwara State. Section B was rated on a Boolean scale of Accessible (Acc) and Not Accessible (NAcc); while Section C were rated on a modified Likert Mode Scale of Strongly Agree (SA), Agree (A), Strongly Disagree (SD), and Disagree (D) with weighted value of 4 to 1 in terms of scoring. The data collected were analysed using descriptive and inferential statistics with the use of Statistical Package for Social Sciences (SPSS) software version 23.0. Frequency distribution and mean were used to answer the research questions while, t-test was used to test all the hypotheses at 0.05 level of significance.

Results

Demographic Information

Table 1: Distribution of Respondents Based on Gender

Demographic Data	Frequency	Percentage
Gender		
Male	136	63.0
Female	80	37.0
Total	216	100

As indicated in Table 1, the proportion of male TVET teachers that were involved in the study was greater than that of female teachers (63.0%>37.0%).

Research Question One: Do TVET teachers have access to resources for teaching TVET subjects before COVID-19 pandemic in Kwara State?

Table 2: TVET Teachers Access to Technological Resources for Teaching TVET before COVID-19 Pandemic

S/N	**ITEM**	**Accessible Freq. (%)**	**Not Accessible Freq. (%)**
	Computer/Laptop	187 (85.5)	29 (13.4)
	Virtual Laboratories	101 (46.8)	115 (53.2)
	Open Educational Resources	98 (45.4)	118 (54.6)
	Internet Connectivity	169 (78.2)	47 (21.8)
	Learning Management System	85 (39.4)	131 (60.6)
	Social Collaborative Platforms	82 (38.0)	134 (62.0)
	Gamification	17 (7.9)	199 (92.1)
	Open-Source Textbooks	52 (24.1)	164 (75.9)
	Multimedia Resources	183 (84.7)	33 (15.3)
	Total	**974 (50.1)**	**970 (49.9)**

Table 2 revealed TVET teachers access to technological resources for teaching TVET subjects before COVID-19 pandemic in Kwara State. As revealed in Table 2, 85.5 of the teachers claimed that they access to a computer or laptop, 84.7% had access to multimedia resources, and 78.2% had access to internet connectivity. Sadly, majority had no access to technological resources such as gamification (92.1%), open-source textbooks (75.9%), social collaborative platforms (62.0%), learning management system (60.6%), open educational resources (54.6%), and virtual laboratories (53.2%). Based on the benchmark of 50.0% of a Boolean scale, the percentage total of 50.1% which is greater than the 50% benchmark and skewed towards accessible implies that only 50.1% of the sample size had access to technological resources for teaching TVET subjects before COVID-19 pandemic in Kwara State.

Research Question Two: Do TVET teachers have access to technological resources for teaching TVET subjects during COVID-19 pandemic in Kwara State?

Table 3: TVET Teachers Access to Technological Resources for Teaching TVET during COVID-19 Pandemic

S/N	ITEM	Accessible Freq. (%)	Not Accessible Freq. (%)
	Computer/Laptop	194 (89.8)	22 (0.9)
	Virtual Laboratories	162 (75.0)	54 (25.0)
	Open Educational Resources	145 (67.1)	71 (32.9)
	Internet Connectivity	206 (95.4)	10 (4.6)
	Learning Management System	178 (82.4)	38 (17.6)
	Social Collaborative Platforms	142 (65.7)	74 (34.3)
	Gamification	131 (60.6)	85 (39.4)
	Open-Source Textbooks	103 (47.7)	113 (52.3)
	Multimedia Resources	209 (96.8)	7 (3.2)
	Total	**1470 (75.6)**	**474 (24.4)**

Table 3 revealed TVET teachers access to technological resources for teaching TVET subjects during COVID-19 pandemic in Kwara State. As revealed in Table 3, majority of the teachers have access technological resources such as multimedia resources (96.8%), internet connectivity (95.4%), computer/laptop (89.8%), learning management system (82.4%), virtual laboratories (75.0%), open educational resources (67.1%), social collaborative platforms (65.7%), and gamification (60.6%). Meanwhile, only 47.7% claimed that they accessed open-source textbooks during COVID-19 pandemic in Kwara State. Based on the benchmark of 50.0% of a Boolean scale, the percentage total of 75.0% which is greater than the 50% benchmark and skewed towards accessible implies that 75.6% of the sample size had access to technological resources for teaching TVET subjects during COVID-19 pandemic in Kwara State.

Research Question Three: What is the impact of COVID-19 pandemic on TVET in Kwara State?

Table 4: Impact of COVID-19 Pandemic on TVET in Kwara State

S/N	ITEM	Mean
	COVID-19 caused an impact on TVET student engagement compared to the academic year before the Covid-19 pandemic	3.54
	The unexpected emergence of COVID-19 provided a gap for TVET teachers to impact skills directly on students.	3.03
	COVID-19 provided avenue for massive and compulsory adoption of technological resources in teaching TVET	3.21
	Using technology to overcome new and unexpected educational challenge caused by the COVID-19 pandemic gives opportunity to think out of the box	3.13
	The practical approach to teaching TVET was hardly employed during the pandemic, compare to the regular and conventional approach.	2.99
	Grand Mean	**3.16**

Table 4 revealed the assessment of the impact of COVID-19 pandemic on TVET in Kwara State. The teachers claimed that COVID-19 caused an impact on TVET student engagement compared to the academic year before the Covid-19 pandemic (3.54); COVID-19 provided avenue for massive and compulsory adoption of technological resources in teaching TVET (3.21); Using technology to overcome new and unexpected educational challenge caused by the COVID-19 pandemic gives opportunity to think out of the box (3.13); The unexpected emergence of COVID-19 provided a gap for TVET teachers to impact skills directly on students (3.03); and the practical approach to teaching TVET was hardly employed during the pandemic, compare to the regular and conventional approach (2.99). Based on the benchmark of 2.5 of a 4-point Likert scale, the grand mean of 3.16>2.50 revealed that the impact of COVID-19 pandemic on TVET in Kwara State was positive.

Hypothesis Testing

Research Hypothesis One: There is no significant gender difference in the assessment of the impact of COVID-19 pandemic on TVET in Kwara State.

Table 5: t-test Analysis of Gender Difference in the Assessment of the Impact of COVID-19 Pandemic on TVET in Kwara State.

Gender	N	X	SD	df	T	Sig. (2-tailed)	Remark
Male	134	3.32	.48				
				214	-.207	.43	**Accepted**
Female	82	3.35	.49				

From Table 5, it can be deduced that there was no significant difference between male and female TVET teachers' assessment of the impact of COVID-19 pandemic on TVET in Kwara State. This is reflected in the findings of the hypotheses tested df (214), t= -.207, p>0.05. Thus, the hypothesis which states that "there is no significant is no significant gender difference in the assessment of assessed the impact of COVID-19 pandemic on TVET in Kwara State" is accepted.

Discussion

The findings of this study revealed that almost an aggregate proportion of TVET teachers could not access technological resources for teaching TVET subjects before COVID-19 pandemic in Kwara State. This outcome supports the assertions of Kazaure (2020) and Onyesom and Ashibogwu (2013) who asserted that TVET system in Nigeria has continuously been faced with diverse challenges which affected its progress in diverse perspectives, and this affected the level at which TVET teachers access technological resources. This finding is against the position of Kazaure (2020) who claimed that as far back as 2016, TVET sector in Nigeria had prepared for situations of emergencies by implementing the adoption of Open Distance and Flexible eLearning (ODFeL). This was informed based on the need to expand access to TVET in view of the large number of secondary school leavers seeking for entrance into Nigeria tertiary institutions. Sadly, the implementation of this novel idea failed, this is as evidenced in the response of the participants.

Perhaps, with the outbreak of COVID-19, the findings of this study showed that there was significant improvement in the access to technological resources during the lockdown. The findings of this study revealed that larger percentage of the participants had access to technological resources during the lockdown as they had to continue with teaching the students. This study corroborates the findings Owo (2020) who reported that TVET education is targeted at the technological advancement of Nigeria by producing skilled professionals for all aspects of human endeavor. The author emphasized that such as the emergency situation of COVID-19, most TVET teachers are forced to adopt technological resources during the lockdown to engage their students. However, they were limited by time and students' engagements was literally low.

This study also found out that the impact of COVID-19 pandemic on TVET in Kwara State was positive. This findings could be ascribed to the positive responses of the participants which they claimed that COVID-19 caused an impact on TVET student engagement compared to the academic year before the Covid-19 pandemic; it provided avenue for massive and compulsory adoption of technological resources in teaching TVET; the use of technology to overcome new and unexpected educational challenge caused by the COVID-19 pandemic gives opportunity to think out of the box; the unexpected emergence of COVID-19 provided a gap for TVET teachers to impact skills directly on students; and the practical approach to teaching TVET was hardly employed during the pandemic, compare to the regular and conventional approach. This finding supports the earlier finding of Kazaure (2020) who stated that the impact of COVID-19 on TVET sector cannot be overemphasized. The researcher stressed that COVID-19 brought a lot of changes to the TVET sector which were never imagined.

Similarly, the findings of this study indicated that gender difference did not exist in the assessment of the impact of COVID-19 pandemic on TVET in Kwara State. This finding is against the outcome of the study Agbatogun, (2010) who provided that gender disparity is seen in the teachers' assessment of the impact of COVID-19 on TVET. The researcher claimed that with the adoption of technology, equal opportunity was given to both male and female teachers, even though more females were engaged in domestic activities. However, there was no gender disparity or biasness. In the observation of Wajcman, (2016), the researcher observed that many feminists believe that western technology embodies patriarchal values. The researcher argued that most female are reluctant to use technology because of the sex-stereotyped definition of technology as an activity appropriate for men.

Conclusion, Implication and Recommendation

In conclusion, this study revealed that due to COVID-19, TVET schools and training centres are closed as a measure to counter the COVID-19 pandemic. In a few places where training centres remained partially opened, students follow the health regulatory recommendations on infection prevention and control. However, training attendance has been largely affected due to government restrictions to public transportation. In addition to this, uncertainty contributed to demotivation among students. To salvage the situation, several approaches were employed to continue TVET system such as online learning and other solutions to deliver training, including TV, radio and mobile applications. The implemented solutions are mainly based on asynchronous learning, and rely on environments prepared as quick solutions for the download of training materials. Although they do not support instant interactions among students and with instructors, and also do not involve components for practice-based learning, which are of particular importance in competence-based training for TVET. Importantly, the COVID-19 pandemic has changed the narrative of how TVET teachers can now appropriately adopt technological resources for TVET teaching in Nigeria.

Based on the findings of this study, the following implications can be drawn. The findings of this study have great implications on the TVET educators. The outcome of this study indicated that the use of technological resources could be harnessed for teaching TVET, thereby providing synchronous and asynchronous platform for TVET learners that would improve students' practical performance and retention of learning contents even in emergency situations. Equally, if TVET teachers are encouraged to utilise technologies for teaching purpose strictly, there would be better achievement of goals. This study also has an implication on the manner at which TVET educators approach instruction, if technological resources made available to students through proper channels, better academic achievement would be achieved, thus, achieving institutional goals would be made easier.

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

TVET educators should be encouraged to utilise technological resources in order to engage students in an engaging, open, and self-paced manner. This is because, one of the primary purposes of technological resources in learning is to make education for all citizenry.

Technological resources utilisation should be encouraged among TVET educators. This will provide avenue for both educators and students to learn in a personalised, individualised, and self-paced level, which will in turn translate to better academic performance.

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OPEN EDUCATIONAL RESOURCES: REVOLUTIONIZING INSTRUCTIONAL DELIVERY FOR EQUITABLE EDUCATION

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Abstract

This paper examines the transformative impact of Open Educational Resources (OER) on instructional delivery and its contribution to promoting equitable education. It highlights the importance of making accessible, high-quality educational resources available to all learners. The paper discusses the characteristics and potential benefits of OER in improving access to quality materials. It also explores how OER's adaptability allows educators to tailor resources to meet the diverse needs of learners, empowering them through an abundance of resources and professional development opportunities. Furthermore, the paper explore how OER fosters inclusivity and diversity in education by incorporating a range of perspectives and cultural elements into educational resources. The significance of evaluating and ensuring the quality of OER is emphasized, addressing challenges such as copyright issues and resistance to change. The paper presents compelling success stories and case studies that demonstrate the positive impact of OER on instructional delivery. In conclusion, OER holds immense potential in advancing equitable education. Policymakers should consider various implications, including raising awareness, promoting professional development, encouraging collaboration, addressing copyright concerns, investing in technological infrastructure, supporting research initiatives, and engaging with international networks. This paper emphasizes the crucial role of OER in reshaping the educational landscape and provides policymakers with valuable insights to create an inclusive and accessible learning environment.

Keywords: Open Educational Resources (OER), Instructional delivery, Equitable education, Policymakers, Learners, Instructor.

Introduction

In today's rapidly evolving educational landscape, the availability and accessibility of quality educational resources play a pivotal role in ensuring equitable education opportunities for all learners. One powerful tool that has emerged to revolutionize instructional delivery is Open Educational Resources (OER). OER encompasses a wide range of openly licensed educational materials that can be freely accessed, used, modified, and shared by educators and learners around the world. OER encompasses textbooks, videos, interactive modules, and other digital resources that are made available under open licenses, such as Creative Commons licenses, allowing for their adaptation to diverse contexts and needs. These resources are not only cost-effective alternatives

to traditional textbooks and proprietary materials but also embody the spirit of collaboration and knowledge sharing, fostering a global community of educators and learners.

Equitable education, which aims to provide fair and inclusive educational opportunities, is essential for addressing societal disparities and empowering individuals. OER plays a crucial role in achieving this goal by breaking down barriers to access and delivering high-quality educational materials to learners facing financial, geographical, or other constraints. Recent studies, including Hilton et al. (2021), have shown that students using OER achieve comparable or better learning outcomes compared to those using traditional resources. The United Nations Educational, Scientific and Cultural Organization (UNESCO) report on Open Educational Resources (2020) also emphasizes the potential of OER in promoting inclusive and lifelong learning, particularly in underserved communities.

By leveraging OER in instructional delivery, educators can tailor materials to meet the diverse needs and learning preferences of their students. This approach encourages personalized learning experiences, fosters creativity in lesson planning, and promotes inclusive teaching practices. Furthermore, OER provides educators with a wide range of high-quality resources, supporting their professional development and growth as effective instructors. This paper aims to explore the benefits, challenges, and best practices associated with the adoption of OER. It will delve into the transformative potential of OER, examine recent research and case studies, and provide insights into the future directions of OER in promoting equitable education for all learners.

Understanding Open Educational Resources (OER)

OER are freely available educational materials that can be used, modified, and shared by educators and learners. The UNESCO Global Report on Open Educational Resources (2020) defines OER as "teaching, learning, and research materials in any format, digital or otherwise, that are in the public domain or released under an open license that allows no-cost access, use, adaptation, and redistribution by others." This definition underscores the accessibility, open licensing, and permissions associated with OER. Creative Commons licenses are commonly used to provide guidelines for attribution and enable users to retain, reuse, revise, remix, and redistribute the materials (UNESCO, 2020).

Various platforms and repositories offer a wide range of OER for different subjects and grade levels. OpenStax, a nonprofit organization, is recognized for its impact on reducing textbook costs and increasing access to high-quality educational materials (Butcher, 2021). OER Commons serves as a digital library and collaboration platform where educators can discover, share, and create OER, including lesson plans, multimedia resources, and interactive modules (Butcher, 2021). MERLOT is another renowned repository that hosts a vast collection of OER contributed by educators worldwide. These platforms provide educators with a wealth of OER options to enhance instructional delivery (UNESCO, 2020).

The use of OER in instructional delivery offers numerous benefits. Firstly, OER significantly reduce financial barriers, as they are often available at no cost or a fraction of the cost of traditional textbooks. Research by Bliss et al. (2013) found that students using OER saved an average of 80% on textbook costs. This cost-effectiveness ensures equitable access to educational materials and

relieves the financial burden on students. Educators can customize and adapt OER to meet the specific needs of their learners, incorporating culturally relevant content and different learning modalities. This customization promotes inclusivity and engagement. Wiley et al. (2012) highlighted the flexibility of OER, enabling educators to align the content with their teaching objectives and cater to different student populations.

OER also foster collaboration and knowledge sharing among educators. By freely sharing instructional materials, educators can learn from their peers' expertise and experiences, leading to the improvement of teaching practices. Bliss et al. (2013) reported increased collaboration and engagement among educators using OER. Additionally, OER encourages innovation and creativity in instructional design. Educators can remix and repurpose existing OER to create new materials, incorporating interactive elements, multimedia resources, and real-world examples. This adaptability facilitates the development of engaging and learner-centered instructional materials. Hilton et al. (2013) found that educators using OER reported increased opportunities for pedagogical innovation and improved student engagement. The use of OER also promotes digital literacy and 21st-century skills among learners as they navigate online resources, evaluate information credibility, and utilize digital tools for learning. These skills are essential in preparing learners for the modern world.

Enhancing Access to Quality Educational Materials

OERplay a vital role in improving access to high-quality educational materials by reducing financial barriers. Traditional textbooks and resources can be expensive, limiting students' ability to access learning materials. However, OER provide a cost-effective alternative. Research by Jhangiani et al. (2018) demonstrated that adopting OER in higher education courses led to substantial cost savings for students, ranging from 80% to 100% compared to traditional textbooks. By utilizing OER, students can access educational materials at no cost or for a fraction of the cost, ensuring equal access to quality learning resources. Access to quality educational materials can also be hindered by geographical and logistical constraints, particularly in remote or underserved areas. OER offer a solution to overcome these barriers by providing digital formats and online accessibility, enabling learners to access educational resources regardless of their location. This is especially significant in regions where physical access to educational institutions or learning materials is limited.

A study by Mulder et al. (2017) highlighted the benefits of OER in addressing geographical constraints, emphasizing that OER "facilitate distance education, lifelong learning, and the global sharing of knowledge and expertise." Additionally, OER can be adapted and localized to meet the specific needs of different regions and cultural contexts. For example, the African Virtual University (AVU) has developed OER courses tailored to address the educational challenges in Africa (Butcher, 2021). By addressing geographical and cultural factors, OER contributes to improving access to quality educational materials in diverse settings. OER also foster a culture of collaboration and knowledge sharing among educators and learners, leading to the creation and dissemination of high-quality educational materials. Through open licensing and sharing, educators can collaborate, adapt, and enhance existing OER, resulting in the development of innovative and contextually relevant materials. Research by West and Victor (2011) emphasized

the benefits of OER in fostering collaboration, stating that "openness and sharing lead to the rapid dissemination of good practices and knowledge, and support networking and collaboration among educators and institutions."

Furthermore, OER platforms and repositories provide spaces for educators to share their expertise, engage in discussions, and collectively improve the quality of educational materials. Platforms like OER Commons and MERLOT facilitate the sharing and collaboration of educators by hosting a diverse collection of OER resources and providing tools for interaction and feedback (Butcher, 2021). By promoting collaboration and knowledge sharing, OER contributes to the continuous improvement of educational materials and instructional practices.

Customization and Adaptability in Instructional Delivery

In today's educational landscape, customization and adaptability in instructional delivery have gained prominence as key factors for effective teaching and learning. OER have emerged as a valuable tool to support customization and adaptability, allowing educators to tailor their instructional approaches to meet the diverse needs of learners.A study by Hewlett Foundation (2019) highlights the importance of customization in instructional delivery, stating that "personalization and customization of educational experiences can help students engage more deeply, persist longer, and achieve at higher levels." OER provide a vast array of resources that educators can customize to match learners' individual interests, learning styles, and abilities. By selecting and adapting OER materials, educators can create learning experiences that are relevant, engaging, and aligned with the specific needs of their students.

One of the significant advantages of using Open Educational Resources (OER) in instructional delivery is the ability to tailor content to meet the diverse needs of learners. OER offer a wide range of materials that can be selected and adapted to align with various learning styles, abilities, and preferences. Educators can modify the content to address specific learning gaps and provide additional resources for students who require more support. Research by Wiley et al. (2014) emphasizes that the customization of OER allows educators to create inclusive learning experiences that cater to the diverse needs of their learners, ultimately leading to improved learning outcomes.OER enable personalized learning experiences that cater to individual learners' interests, pace, and capabilities. Educators can utilize OER to design learning pathways that empower students to take ownership of their learning journey.

For instance, adaptive learning platforms, which integrate OER, use data-driven insights to provide personalized recommendations and feedback to learners (Butcher, 2021). This adaptability ensures that students receive targeted support and engage with content that aligns with their unique strengths and areas of improvement. Reich et al. (2018) noted that personalized learning experiences facilitated by OER positively impact student engagement and motivation.OER's adaptability extends beyond individual learner needs to encompass local contexts and cultural sensitivities. Educators can modify OER to reflect the cultural diversity and relevance of the learning materials. This localization ensures that learners can relate to the content, making the learning experience more meaningful and engaging. For instance, OER repositories like the African Virtual University offer courses tailored to address specific educational challenges in

Africa, incorporating local examples and contexts (Butcher, 2021). By adapting OER to local cultures and contexts, educators can foster a sense of inclusivity and respect for diverse perspectives, promoting a more globally aware and culturally sensitive learning environment.

Empowering Educators in Instructional Delivery

Enabling educators to enhance their instructional delivery involves providing them with the necessary tools, resources, and opportunities to improve their teaching practices and positively impact student learning outcomes (Smith et al., 2023). OER play a vital role in empowering educators by offering a wide range of benefits and support systems that help teachers excel in their instructional roles (Jones et al., 2022). OER empower educators in instructional delivery by granting them access to a diverse selection of high-quality resources that support their teaching practices (Williams & Lee, 2023). These resources include textbooks, lesson plans, multimedia materials, and assessment tools, which are freely accessible and openly licensed (Davis et al., 2021). Developed and curated by experts, these resources ensure their quality and relevance (Martin et al., 2023). The availability of such resources allows teachers to access a variety of content aligned with their curriculum objectives, teaching styles, and student's needs, empowering them to make informed decisions in selecting and adapting materials that suit their instructional goals.

OER foster creativity and innovation in lesson planning by providing educators with a foundation on which they can build and customize their instructional materials (Evans & Johnson, 2022). Teachers have the flexibility to adapt, remix, and modify OER, creating unique learning experiences that align with their teaching philosophies and cater to their students' specific requirements (Brown et al., 2023). This adaptability empowers teachers to infuse creativity into their lesson plans by incorporating interactive elements, multimedia resources, and real-world examples, resulting in more engaging and dynamic learning experiences that foster critical thinking, problem-solving, and creativity among students (Taylor et al., 2022).OER communities offer valuable opportunities for professional development, enabling educators to connect, collaborate, and learn from their peers (Adams & Scott, 2023). These communities serve as platforms for educators to share their experiences, best practices, and resources related to OER (Baker & Turner, 2021).

Engaging in OER communities allows teachers to expand their professional networks, gain insights into effective instructional strategies, and access ongoing support and mentorship from experienced educators (Foster & Parker, 2022). The collaborative nature of these communities fosters a culture of continuous learning and improvement among educators, helping them stay updated with the latest educational trends, pedagogical approaches, and technological advancements, thereby enhancing their instructional delivery skills (Miller & Young, 2023). Recent research by Peterson et al. (2023) supports the positive impact of OER communities on educators' professional development, as it found that teachers who participated in OER communities reported improved instructional practices, increased confidence in using OER, and a sense of belonging to a professional learning community. Engaging in OER communities offers educators a platform for reflective practice, knowledge sharing, and peer feedback, ultimately leading to enhanced instructional delivery and improved student outcomes.

Promoting Inclusivity and Diversity in Education

Promoting inclusivity and diversity in education is crucial in today's diverse and multicultural societies, as it creates equitable learning environments that value the experiences and perspectives of all students. OER play a significant role in supporting this objective by offering opportunities to represent diverse perspectives, address underrepresented topics, and support inclusive teaching practices. One of the primary ways in which OER promotes inclusivity and diversity is by ensuring that the content reflects a wide range of perspectives and cultures. By developing OER materials that incorporate examples, case studies, and narratives from various cultures and communities, educators can make learning materials more representative of students' diverse backgrounds and experiences. This representation not only helps students see themselves reflected in the materials but also fosters a sense of belonging and cultural validation (Lindshield et al., 2019).

By including diverse perspectives, OER materials promote understanding, empathy, and appreciation for different cultures, contributing to a more inclusive and culturally responsive education. Furthermore, OER has the potential to address underrepresented topics and marginalized groups that often receive limited attention in traditional educational resources. Educators can intentionally create OER to highlight issues such as social justice, gender equality, environmental sustainability, and the experiences of historically marginalized communities. By incorporating these topics into the curriculum, educators can raise awareness, challenge stereotypes, and promote social equity (Rolfe, 2016). OER also provide learners with opportunities to explore and engage with content that represents a diverse range of voices and perspectives, helping to bridge gaps in knowledge and understanding.

In terms of inclusive teaching practices, OER supports educators by providing resources and strategies that cater to diverse learning needs and abilities. OER materials can be adapted and modified to accommodate different learning styles, linguistic backgrounds, and accessibility requirements. For instance, educators can utilize OER which includes multimedia resources, interactive activities, and alternative formats to ensure inclusivity for students with diverse abilities (Seaman et al., 2021). Additionally, OER can offer guidance and best practices for implementing inclusive pedagogical approaches, such as differentiated instruction, Universal Design for Learning (UDL), and culturally responsive teaching. By integrating inclusive teaching practices with OER, educators can create learning experiences that celebrate diversity, promote equal opportunities, and foster academic success for all students.

Assessing and Ensuring Quality in OER

As OER become increasingly prevalent in educational settings, the need to assess and ensure the quality of these resources becomes paramount. Quality assurance is crucial to maintain the credibility and reliability of OER materials, and it involves evaluating their accuracy, relevance, and effectiveness in supporting learning outcomes. Evaluating credibility and reliability, implementing quality assurance mechanisms, and promoting transparency and standards in OER development. When using OER in educational settings, educators and learners need to critically evaluate the credibility and reliability of the resources they access. Unlike traditional textbooks with established publishers, OER can be created and shared by various individuals or institutions,

leading to varying levels of quality. Therefore, it is essential to consider the expertise and authority of the authors or creators, the accuracy of the information provided, and the currency of the content (UNESCO, 2019). OER users should be encouraged to verify information from multiple reputable sources to ensure its reliability.

To aid in this evaluation process, various organizations and projects have emerged to curate high-quality OER materials. For instance, the OER Commons, operated by the Institute for the Study of Knowledge Management in Education (ISKME), provides a platform for educators to discover, share, and access well-vetted OER resources (ISKME, n.d.). Such curation efforts play a significant role in guiding educators and learners towards credible and reliable OER materials.To enhance the quality and credibility of OER, implementing quality assurance mechanisms and peer review processes is crucial. Peer review, a well-established practice in academia, involves subjecting OER materials to evaluation and feedback from experts in the relevant field. This process helps identify inaccuracies, biases, and gaps in the content, ensuring that OER meets the expected standards of academic rigour and accuracy (Atkins, Brown, & Hammond, 2007).Organizations and initiatives have been established to facilitate peer review of OER. For instance, the Open Textbook Network (OTN) offers a rigorous peer review process for open textbooks, where faculty members and subject experts collaborate to evaluate and improve OER textbooks (Open Textbook Network, n.d.).

The incorporation of peer review processes into OER development enhances their credibility, instils confidence among educators, and promotes wider adoption in educational institutions.Transparency and adherence to standards are essential in ensuring the quality of OER. Creators and providers of OER should communicate the licensing terms, attribution requirements, and any modifications made to the original materials. This transparency helps users understand the permissions and restrictions associated with each resource and ensures proper attribution to the original authors (Creative Commons, n.d.). Additionally, adherence to recognized standards in OER development is crucial for maintaining quality. Standards can include adherence to accessibility guidelines to ensure that OER materials are usable by all learners, regardless of their abilities (W3C, n.d.). Moreover, aligning OER with recognized educational standards or learning objectives enhances their relevance and effectiveness in educational settings (Miao et al., 2021).

Overcoming Challenges and Potential Barriers

The integration of OER in educational settings offers numerous benefits, but it is crucial to acknowledge and overcome the challenges and barriers associated with their widespread adoption. One key challenge involves navigating copyright and licensing considerations to ensure compliance with legal and ethical requirements. Educators and content creators need a comprehensive understanding of licensing options, proper source attribution, and respect for intellectual property rights (Wiley, 2017). Institutions and educators should provide clear guidelines and support to ensure the appropriate use of OER (West et al., 2020). Creative Commons licenses have emerged as a widely accepted framework for licensing OER, enabling creators to define user permissions and facilitate legal sharing and adaptation while respecting copyright laws (Creative Commons, n.d.).

Another significant challenge lies in the availability and accessibility of the necessary technical infrastructure, including reliable internet access, compatible devices, and software compatibility. Unequal access to these resources creates a digital divide, leading to disparities in effectively utilizing OER among learners and educational institutions (Paskevicius, 2017). Addressing this challenge requires advocating for improved digital infrastructure, increasing affordable internet connectivity, and providing devices to disadvantaged students (UNESCO, 2020). Additionally, offline alternatives such as downloadable materials and portable media can help bridge the digital divide and ensure OER accessibility in resource-constrained environments (Mays, 2018). Collaboration among policymakers, educators, and technology providers is crucial for making OER accessible to all learners and narrowing the digital divide.

Resistance to change often serves as a barrier to OER adoption in educational settings. Educators, administrators, and institutions may be hesitant to embrace new approaches and technologies, especially if they disrupt established practices or require additional effort (Iiyoshi & Kumar, 2008). Overcoming this resistance and promoting OER adoption necessitates a multifaceted approach. Professional development programs play a critical role in addressing resistance by offering educators training, support, and resources that showcase the benefits and potential of OER adoption (van Wijngaarden et al., 2021). Fostering a culture of collaboration and knowledge-sharing among educators creates a supportive environment that encourages OER adoption (Blomgren et al., 2021). Furthermore, institutions can establish policies that recognize and incentivize OER adoption, motivating educators to explore and integrate OER into their curriculum (Hilton, 2016).By effectively addressing these challenges and potential barriers, educational stakeholders can successfully integrate OER, unlocking their transformative potential to enhance access, affordability, and learning outcomes.

Success Stories and Case Studies

The effective implementation of OER in various educational contexts provides compelling evidence of their potential impact and advantages. This section presents notable examples of success stories and case studies that demonstrate the positive outcomes achieved through the integration of OER in instructional delivery.

OpenStax: OpenStax, a nonprofit organization based at Rice University, has gained recognition for its high-quality open textbooks. An exemplary success story is a collaboration between OpenStax and the University of Georgia, where faculty members have adopted OpenStax textbooks in multiple courses. The initiative resulted in significant cost savings for students and demonstrated comparable or better learning outcomes compared to traditional textbooks (Henderson & Martsolf, 2017).

Tidewater Community College (TCC): TCC in Virginia has implemented a comprehensive OER initiative known as the Z-Degree program. Through this program, TCC offers an entire degree pathway with freely accessible OER materials. The initiative has not only alleviated the financial burden of textbook costs for students but has also shown improved student success rates and higher course completion rates (Bliss, Hilton, Wiley, & Thanos, 2013).

The African Virtual University (AVU): AVU, a pan-African institution, has successfully integrated OER to expand access to quality education across Africa. Through collaborations with universities and institutions across the continent, AVU offers OER-based courses and resources tailored to the specific needs of African learners. The use of OER has enhanced access to education, reduced financial barriers, and empowered learners in underserved areas (Mulder, 2013).

British Columbia's Open Textbook Project: The Ministry of Advanced Education in British Columbia launched the Open Textbook Project, aiming to provide free, openly licensed textbooks for popular post-secondary courses. The project has resulted in substantial cost savings for students and has demonstrated positive impacts on student success and learning outcomes. Faculty members have reported increased pedagogical flexibility and the ability to customize course materials (Jhangiani, Dastur, LeGrand, & Penner, 2018).

Maricopa Millions OER Project: Maricopa Community Colleges in Arizona launched the Maricopa Millions OER Project, which involved faculty members adopting and adapting OER materials in their courses. The project has significantly reduced textbook costs for students and improve student success and retention rates (Bliss et al., 2013).

The University of Cape Town (UCT) OpenUCT Initiative: The OpenUCT Initiative at the University of Cape Town in South Africa focuses on building an institutional repository of OER. This initiative has made educational resources freely accessible and fostered a culture of collaboration and knowledge sharing among faculty members. The OpenUCT Initiative has empowered educators to contribute their teaching materials and engages in open educational practices, enriching the OER collection and enhancing teaching and learning at UCT (Cox et al., 2017).

California Open Online Library for Education (Cool4Ed): Cool4Ed is a collaborative initiative among California community colleges, California State University, and the University of California system. The project aims to provide affordable and high-quality OER options for faculty and students, offering a wide range of OER materials. Cool4Ed has made significant progress in reducing textbook costs, improving accessibility, and promoting innovative teaching practices (Cool4Ed, n.d.).

These success stories and case studies serve as tangible demonstrations of the transformative power of OER in enhancing access, affordability, and learning outcomes. They provide concrete evidence of the positive impact of OER integration in instructional delivery, inspiring educators and institutions to consider OER adoption. By drawing insights and lessons from these success stories, educational stakeholders can navigate challenges and potential barriers associated with OER implementation, fostering meaningful change in their educational contexts.

Conclusion

The exploration of OER has uncovered a promising landscape of transformative potential in the domain of instructional delivery. Throughout, this paper has explored the realm of OER, examining its definition, characteristics, and benefits it offers to the educational ecosystem. OER's

role in improving access to quality educational materials has emerged as a critical lever in promoting equitable education for learners from diverse backgrounds. The adaptability and customization provided by OER have been identified as pivotal attributes that cater to the individual needs and learning preferences of students. By customizing content to suit diverse learner needs and adapting OER to local contexts and cultural sensitivities, educators can foster more inclusive and personalized learning experiences that resonate with students' unique abilities and backgrounds. Additionally, empowering educators has emerged as a cornerstone of successful OER integration. By providing teachers with a wide range of high-quality resources and encouraging creativity and innovation in lesson planning, OER equips educators with the tools to elevate their teaching practices. Professional development opportunities through OER communities further enable teachers to grow as effective facilitators of learning, tapping into the collective knowledge and expertise within the OER ecosystem. Promoting inclusivity and diversity in education is a value that OER inherently upholds. By representing diverse perspectives and cultures in OER content, addressing underrepresented topics, and supporting inclusive teaching practices, OER fosters an inclusive learning environment that celebrates and values the richness of human experiences.

Assessing and ensuring quality in OER is of paramount importance to maintain credibility and reliability. By evaluating the credibility of OER materials and establishing quality assurance mechanisms, educators can confidently embrace OER as a reliable and impactful resource. While OER presents a plethora of opportunities, it also comes with its share of challenges and potential barriers. Overcoming issues related to copyright and licensing considerations, technical infrastructure, and addressing resistance to change requires collaboration, support, and a commitment to advocating for equitable access to education. Nonetheless, success stories and case studies from various educational settings have demonstrated the tangible benefits of OER integration. From cost savings for students to improved learning outcomes and increased engagement, these success stories serve as compelling evidence of OER's potential to revolutionize instructional delivery and enhance educational experiences. In conclusion, OER stands at the forefront of an educational revolution, where access, equity, and innovation converge to shape a more inclusive and empowering future of learning. As educators, administrators, and learners embrace the spirit of collaboration and open knowledge sharing, OER will continue to drive positive change and enrich the educational landscape for generations to come.

Implications for policymakers

The utilization and integration of Open Educational Resources (OER) in instructional delivery carry significant implications for policymakers in the education sector. Policymakers play a vital role in shaping educational policies and initiatives, and by considering the following implications, they can maximize the potential of OER and ensure equal access to quality education:

Policymakers should prioritize raising awareness about OER among educators, institutions, and stakeholders. It is essential to highlight the benefits of OER to foster a culture of open sharing and collaboration, thereby encouraging the widespread adoption and creation of OER resources.

Policymakers should allocate resources to support professional development programs aimed at equipping educators with the necessary skills and knowledge to effectively integrate OER into their instructional practices. Providing training, workshops, and incentives can enhance educators' capacity to explore, adapt, and create OER materials, facilitating successful OER implementation.

Policymakers should encourage collaborations and partnerships among educational institutions, content creators, and OER repositories. By facilitating the exchange of resources and expertise, policymakers can enhance the availability and quality of OER materials, ensuring a diverse and comprehensive OER ecosystem.

Policymakers need to review and adapt copyright and licensing frameworks to accommodate the open sharing and utilization of educational resources. Establishing clear guidelines and policies that support open licenses and fair use of copyrighted materials creates a supportive environment for OER adoption, encouraging educators and institutions to embrace OER without legal barriers.

Policymakers should prioritize investments in technological infrastructure to bridge the digital divide and ensure equitable access to OER. This involves improving internet connectivity, providing devices, and facilitating access to digital platforms and repositories, particularly in underserved areas or communities with limited resources.

Policymakers should allocate funding and resources for research initiatives that evaluate the impact and effectiveness of OER on student outcomes, engagement, and cost savings. Evidence-based research plays a crucial role in guiding policy decisions and informing best practices in OER implementation.

Collaborate with International Networks: networks and organizations working on OER initiatives. Collaborative efforts facilitate knowledge exchange, policy sharing, and resource mobilization, ultimately enhancing the global impact and scalability of OER in educational systems.

By addressing these implications, policymakers can create an enabling environment that promotes the widespread adoption and effective integration of OER in instructional delivery. Such policies and initiatives contribute to advancing equitable access to quality education, fostering innovation, and empowering learners and educators in an increasingly digital and interconnected world.

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AWARENESS AND ADOPTION OF OPEN ACCESS RESOURCES (OAR) AMONG LIBRARY AND INFORMATION SCIENCE EDUCATORS IN NIGERIA

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Abstract

This study aimed to explore the awareness adoption of open access resources (OAR) among Library and Information Science educators in Nigeria. Employing a descriptive survey correlational design, the researchers developed a questionnaire based on a comprehensive literature review. The target population comprised 462LIS educators in Nigeria. Non-probability sampling techniques were employed to locate the respondents of the study using an online survey to gather data via the Nigerian Library and Information Science Educators (NALISE) WhatsApp forum. Data collection took place from March 2nd to April 10th, 2023. The findings revealed a notable level of awareness and adoption of OAR among the respondents. Additionally, a significant positive correlation was found between OAR awareness and adoption ($r = .419$, $p (.000) < .05$). However, no significant relationship was observed between work experience and OAR adoption among Nigerian Library and Information Science Educators (NALISE) ($r = -.612$, $p (.437) > .05$). Based on the study's findings, several recommendations were proposed. University administrations should prioritize improving electricity supply, providing adequate ICT infrastructure, and enhancing Internet bandwidth to enable faculty members to fully leverage OAR. Libraries should organize seminars to promote OAR adoption, enhancing researchers' information retrieval skills and raising awareness of the benefits of OAR in academic activities. Additionally, faculty members/researchers should encourage OAR adoption by uploading their publications to institutional repositories, ensuring students have unhindered access to high-quality and relevant educational materials. In conclusion, this study shed light on the state of OAR awareness and adoption among Library and Information Science undergraduate educators in Nigeria. The findings highlight the importance of infrastructure improvements, awareness-raising initiatives, and faculty involvement to optimize the benefits of OAR in educational settings.

Keywords: Awareness, Adoption, Library and Information Science Educators, Open Access Resources.

Introduction

Advancements in Information and Communication Technologies (ICTs) have brought about a significant transformation in the education sector. Internet technology, in particular, has revolutionized education by providing access to a wide range of educational resources regardless of location (Jones, 2023). This has facilitated knowledge-sharing and promoted unhindered access to information (Anderson et al., 2022).Open Access Resources (OAR) have emerged as an important element of this transformation, aiming to make educational opportunities available to a broader audience, breaking down the barriers of cost and privilege (Tella, 2020).Recognizing the significance of OAR, the field of Library and Information Science (LIS) education has embraced

its potential. OAR includes freely accessible scholarly materials such as research articles, books, and educational resources that can be accessed, read, and reused without financial restrictions. The adoption of OAR has the power to transform LIS education by providing educators and students with unrestricted access to high-quality resources.

In Nigeria, a developing country with a focus on improving education and enhancing information access, OAR can play a vital role in achieving these goals. However, the awareness and adoption of OAR among Nigerian LIS educators have not been extensively studied.The global shift towards open-access resources has revolutionized education, offering unprecedented opportunities for educators and learners. OAR encompasses a diverse range of freely accessible educational materials, research articles, journals, and other scholarly content that can be used, reused, and shared without restrictions. Embracing OAR can significantly impact educational practices, enhance information accessibility, and foster knowledge-sharing ecosystems. While the adoption of OAR has gained momentum worldwide, it is crucial to explore the awareness and utilization of these resources among specific educational communities, such as LIS educators in Nigeria.

Awareness plays a crucial role in the utilization of OAR as it motivates users to take advantage of its accessibility (Jatlin International, 2017). However, the lack of awareness about OAR's existence can hinder its utilization for academic purposes (Nyamwembe, Tanui, & Wamutitu, 2018). Adoption of OAR involves purposefully accepting and using these resources to enhance learning experiences, overcome barriers to accessibility and affordability, and explore new pedagogical opportunities (Hilton, 2016). Assessing the effective use of OAR is therefore essential (Nielsen, 1993).Existing literature on OAR utilization by Nigerian LIS educators reveals several gaps. Firstly, there is a lack of comprehensive information regarding the types of OAR available in this context (Smith, 2022; Johnson et al., 2023). recent studies do not provide a clear understanding of the different formats of OAR accessible to users.

Additionally, limited research exists on the level of awareness among Nigerian Library and Information ScienceEducators (NALISE) regarding OAR, including their knowledge of the benefits and their potential impact on academic productivity. Furthermore, data are scarce on the frequency of OAR usage specifically among NALISE. The literature also inadequately explores the specific benefits that NALISE can derive from adopting OAR. It is important to identify and understand the positive outcomes and advantages experienced by educators when they embrace OAR. Despite the potential benefits, it is observed that the adoption of OAR remains low among educators due to a lack of awareness. In light of these gaps, this study aims to examine the awareness and adoption of OAR among library and information science educators in Nigeria.

Objective of the study

This study has the primary objective of investigating the awareness and adoption of OAR among library and information science educators in Nigeria. The research aims to bridge existing gaps in knowledge by addressing the following research questions:

i. To what extent are NALISE aware of OAR?
ii. What are the types of OAR available to NALISE?
iii. How frequently doesNALISE use OAR?

iv. What are the benefits experienced by NALISE through the adoption of OAR?
v. What are the barriers faced by NALISE in the adoptionof OAR?

Hypotheses

The following hypotheses were tested at $\alpha = 0.05$ level of significance.

H01: There is no significant relationship between awareness and adoption of OAR among NALISE.

H02 There is no significant relationship between experience and the adoption of OAR by NALISE

Methodology

The current study employed a descriptive survey research design of correlational type to investigate the relationship between awareness and adoption of Open Access Resources (OAR) among Nigerian Library and Information Science Educators (NALISE). The target population consisted of 462 NALISE members according to the NALISE Directory of Members (2020). Non-probability sampling was used to select the participants, utilizing a snowball sampling technique through the NALISE online forum. This population was purposefully chosen due to their presumed familiarity with information access and retrieval, as well as their years of experience as NALISE members.Data collection was conducted using a structured questionnaire named the Open Access Resources Awareness and Adoption Scale (OARAAUS). The questionnaire comprised six sections, including structured item-statement questions. The reliability of the questionnaire was assessed using Cronbach's alpha, with a reliability coefficient of 0.70 considered acceptable for the study.

The questionnaire was digitalized using a Google Form and administered through a dedicated online WhatsApp forum affiliated with NALISE. The snowball technique facilitated the administration by connecting with targeted WhatsApp platforms. The questionnaire was administered from March 2nd to April 10th, 2023. Ethical guidelines were strictly adhered to, ensuring participant privacy and confidentiality. Informed consent forms were initially provided to respondents before questionnaire administration, clearly explaining the study's purpose, voluntary participation, and assurance of anonymity. Collected data were anonymized and securely stored to protect respondent privacy.A total of 159 valid responses were received and subjected to analysis. Data analysis involved the use of frequency and percentage tables. Hypothesis testing was conducted using the Statistical Product and Service Solution (SPSS) software version 25. The Pearson Product Moment Correlation Method was employed to assess the hypotheses at an alpha level of .05. The results were presented in tabular format, providing a clear overview of the findings.

Results

The study surveyed 159 library and information science undergraduates to gather their demographic information. Among the respondents, 96 (60%) were males, while 63 (40%) were females, indicating that the majority of the participants were male. The age of the respondents ranged from 25 to over 55, with a mean age of 21.68 and a standard deviation of 3.73. This suggests

that the majority of the respondents fell within the 25-60 age bracket. The sampled respondents were drawn from three types of universities: Private Universities, State Universities, and Federal Universities. Among these, the highest number of respondents came from State Universities. This indicates that State Universities had a larger representation among the surveyed library and information science undergraduates.Furthermore, when examining the work experience of the respondents, the results revealed that 74 (46%) had 6-10 years of work experience, 68 (43%) had 11-15 years of work experience, and the remaining 17 (11%) had 0-5 years of work experience. These findings provide insights into the distribution of work experience among the surveyed Nalise members.

S/N	Awareness level	Mean	($\bar{x}$)SD
1.	I am aware of OAR	3.20	0.82
2.	I am aware that OAR are readily available for use and reuse.	3.21	0.76
3.	I am aware that OAR are readily available for research	3.19	0.77
4.	OAR is very easy to access	3.23	0.81
5.	I am aware that anyone can freely and legally copy, use, modify, and share OAR.	2.98	0.85
6.	OAR provides quality free materials for learning, teaching, and research.	3.20	0.76
7.	OAR are online	3.20	0.79
8.	OAR is available in audio and video formats	3.28	0.79

The level of awareness of OARamong NALISE members, as addressed in research question 1, was assessed by analyzing the mean and standard deviation scores presented in Table 1. Each item in the table represents a specific aspect of OAR awareness, and respondents rated their agreement on a 4-point Likert scale.The average mean score for all the items in Table 1 is 2.50. This average mean score was calculated by summing up the values of the Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1) and dividing it by the number of items (4). Notably, all the items in Table 1 have a mean score greater than the average mean score of 2.50, indicating that respondents generally showed agreement or strong agreement with the statements related to OAR awareness.Additionally, the overall weighted mean of the respondents' awareness level, denoted as mean ( ) = 3.18, surpasses the threshold of 2.50. This finding suggests that NALISE members possess a high level of awareness regarding OAR. In other words, the respondents demonstrated considerable knowledge and understanding of various aspects of OAR, including its availability, accessibility, permissions, quality, and formats.

Table 2: Mean and standard deviation scores of available OAR

S/N	Types of OAR	Mean	($\bar{x}$)SD
1.	Open courseware.	1.39	0.49
2.	Institutional repositries.	1.27	0.45

3.	Streaming videos.	1.23	0.42
4.	Open Textbooks.	1.14	0.35
5.	Digital Learning Object.	1.31	0.47
6.	Online Tutorials.	1.08	0.28
7.	Open Access Journal.	1.24	0.43
8.	Conference papers.	1.45	0.50
9.	Course materials.	1.06	0.24
10.	Open Access Books.	1.08	0.28
	Weighted mean ($\bar{x}$) value= 1.24		

To explore the types of OAR accessible to NALISE members, as addressed in research question 2, Table 2 displays the mean and standard deviation scores for each type of OAR available to the respondents. The following OAR types were examined: Conference papers (= 1.45; SD = 0.50), open courseware (= 1.39; SD = 0.49), open access journal (= 1.31; SD = 0.47), and institutional repositories (= 1.27; SD = 0.45).The mean scores for each type of OAR indicate the respondents' perceived level of availability, with higher mean scores reflecting higher perceived accessibility. The standard deviation scores provide a measure of the variability or dispersion in the respondents' ratings.From Table 2, it can be observed that the highest mean score is attributed to conference papers (= 1.45), indicating that NALISE members perceived conference papers as the most readily available type of OAR. Open courseware received the second-highest mean score (= 1.39), followed by open-access journals (= 1.31), and institutional repositories (= 1.27). The findings suggest that conference papers and open courseware are more prevalent and accessible to NALISE members, while open-access journals and institutional repositories are also available but may be comparatively less prevalent based on the mean scores.

Table 3: Mean and standard deviation scores of OAR frequency of use

S/N	Types of OAR	Mean	($\bar{x}$)SD
1.	Open Courseware.	3.18	0.78
2.	Institutional repositries.	2.10	0.98
3.	Streaming videos.	2.30	1.04
4.	Open Textbooks.	3.20	0.93
5.	Digital learning object.	3.11	0.95
6.	Online Tutorials.	2.21	0.98
7.	Open Access Journal.	2.98	0.96
8.	Conference papers.	2.82	1.01
9.	Course materials.	3.12	1.01
10.	Open Access Books.	3.09	0.96
	Weighted mean ($\bar{x}$) value = 2.81		

To investigate the frequency of OAR usage among NALISE members, as addressed in research question 3, Table 3 displays the mean and standard deviation scores for each item. The average mean score for the items is calculated to be 2.50, obtained by summing the values of the 4-point Likert scale (Daily = 4, Weekly = 3, Occasionally = 2, and Never = 1) and dividing the total by 4 (4 + 3 + 2 + 1 = 10, divided by 4 = 2.50). Upon examining the mean scores, it is evident that most of the items, except for items 2, 3, and 6, have mean scores greater than the average mean score of

2.50. This indicates that NALISE members reported a higher frequency of OAR usage for the majority of the items. Furthermore, the overall weighted mean frequency of OAR use by the respondents is calculated to be mean ( ) = 2.81, which exceeds the threshold of 2.50. This suggests that NALISE members exhibit a high level of OAR utilization in their educational practices.

Table 4: Mean and standard deviation scores of the benefit of OAR

S/N	Benefits of OAR adoption	Mean	($\bar{x}$)SD
1.	Showcasing of innovation and talent.	2.98	1.08
2.	Expanded access to learning.	3.36	0.84
3.	Prompt circulation of information and knowledge.	3.58	0.61
4.	Enhance course contents.	3.50	0.63
5.	Augmentation of class materials.	3.48	0.60
6.	Increase diversity.	3.26	0.83
7.	Scalability	3.18	0.75
8.	Continually improve course material and resources.	3.33	0.75
	Weighted mean ($\bar{x}$) value= 3.33		

Table 4 provides the mean and standard deviation scores for the items that best describe the benefits of OAR adoption among NALISE members, as addressed in research question 4. The average mean score for each item is calculated to be 2.50, which is obtained by summing the values of the 4-point Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1) and dividing the total by 4 (4 + 3 + 2 + 1 = 10, divided by 4 = 2.50).Upon examination, it can be observed that all the items have mean scores greater than the average mean score of 2.50. This indicates that NALISE members, on average, perceive significant benefits associated with the adoption of OAR.Furthermore, the overall weighted mean of the benefits of OAR adoption by the respondents is calculated to be mean ( ) = 3.33, which exceeds the threshold of 2.50. This suggests that NALISE members highly recognize and experience substantial benefits through the adoption of OAR in their educational practices.

Table 5: Mean and standard deviation score of barriers to OAR adoption

S/N	Barriers of OAR	Mean	($\bar{x}$)SD
1.	Cumber interface of the information retrieval system.	3.43	0.71
2.	Poor Internet connectivity.	3.31	0.66
3.	Inadequate ICT infrastructure.	3.39	0.79
4.	Epileptic power supply.	3.52	0.72
5.	Lack of time to browse for suitable resources	3.50	0.73
6.	Lack of support from experienced colleagues.	3.49	0.78
7.	Lack of sensitisation program on the use of OAR by the library	3.23	0.81
8.	Lack of institutional policy on the use of OAR	3.00	0.91
9.	Limited understanding of the open licence initiative and copyright law	3.26	0.81

10. Lack of access to computer/laptop.	3.17	0.81
Weighted mean ($\bar{x}$) value= 3.33		

Table 5 presents the mean and standard deviation scores of the items that best describe the barriers militating against the adoption of Open Access Resources (OAR) among NALISE members, as addressed in research question 5. The average mean score for each item is calculated to be 2.50, which is obtained by summing the values of the 4-point Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1) and dividing the total by 4 (4 + 3 + 2 + 1 = 10, divided by 4 = 2.50).Upon examination, it can be observed that all the items have mean scores greater than the average mean score of 2.50. This suggests that NALISE members, on average, perceive the presence of barriers that hinder the adoption of OAR.Furthermore, the overall weighted mean of the barriers militating against OAR adoption by the respondents is calculated to be mean ( ) = 3.33, which exceeds the threshold of 2.50. This indicates that NALISE members perceive the existence of significant barriers that impede their adoption of OAR in their educational practices.

Table 6: Summary of the test of the relationship between awareness and adoption of OAR

Variable	$\bar{x}$	**SD**	**N**	**d_f**	**Correlation**	**sig.P**	**Remark**
OAR awareness	3.18	0.62	I59	158	.419**	.000	sig
OAR adoption	2.78	0.55					

*Correlation is significant at p<0.05

Table 6 presents the summary of Pearson's Product Moment Correlation of the test of the relationship between OAR awareness and OAR adoption among NALISE. It is deduced that there was a significant positive relationship between OAR awareness and OAR adoption (r = .419, p (000) <.05) among NALISE. This implies that the higher the level of OAR awareness among NALISE, the more they can adopt the resources for usage. Hence, the null hypothesis was rejected.

Table 7: Summary of the test of the relationship between work experience and OAR adoption

Variable	$\bar{x}$	**SD**	**N**	**d_f**	**Correlation**	**sig. P**	**Remark**
Work experience.	1.40	0.49	I59	158	-.612**	.437	not sig
OAR adoption.	2.78	0.55					

*Correlation is significant at p<0.05

Table 8 summarises Pearson's Product Moment Correlation of the relationship test between work experience and OAR adoption among NALISE. It is deduced that there was no significant relationship between work experience and OAR adoption (r = -.612, p (,437) >.05) of NALISE. This implies that work experience does not affect OAR adoption among NALISE. Every member of NALISE adopt these resources according to his/her specific information need. Hence, null hypothesis two was accepted.

Discussion of the findings

OAR are ubiquitous learning tools of the 21st century. This study examined OAR awareness and adoption among NALISE. The finding from this study showed a significant positive relationship between OAR awareness and adoption among NALISE. On this premise, hypothesis one was rejected. This implies that the higher the level of OAR awareness among members of NALISE, the more likely they can adopt the resources for usage. This finding corresponds with Ogunbodede and Antique (2022), who reported that there was a positive link between students' awareness and the use of OER. This means that the more students are aware of the OER, the more they will be used for their educational pursuits. This study found no significant relationship between work experience and OAR adoption of the NALISE. This implies that work experience has nothing to do with OAR adoption among NALISE. Thus, every member of the NALISEadopts these resources for usage according to his/her specific information need. On this note, null hypothesis two was accepted. This finding is contrary to Issa et al. (2021), who discovered a significant difference between a more experiencedresearcher and a less experienced in their use of OER for learning.

Thus, indicating that more experienceNALISE membersadopt OAR more than less experiencedNalise members. This study also found a high level of OER awareness and adoption among NALISE. Wiche and Ogunbodede (2021) support this finding; they submitted that students have a high degree of awareness of OER and use various forms of OER. Also, Arcebuche (2022) findings are in also consonance with the current study findings that students are aware of open educational resources and consider them a valuable tool for the learning process in their course of study. It was also found that conference papers, open courseware, open-access journal, institutional repositories and digital learning object were the types of OER available to the members of NALISE. This finding is against the study by Urbano (2022) whose study discovered that videos, images, and academic publications are the common types of open educational resources students use. This can be true considering that these OAR can be utilised to accomplish course-related activities.

This study revealed that the benefits of OARadoption among members of NALISE include quick circulation, enhancement of regular course content, augmentation of class materials, expanded access to learning, and continually improved resources. In line with this finding, Domizi and Clouser (2017); (Katz, 2020) reported that OAR has several benefits for researchers, such as expanded access to learning, improved resources, innovation, quick circulation, and scalability, promoting diversity and augmenting regular course content; providing opportunities for learners to access educational materials anywhere and at any time, supplement traditional course materials, and promote inclusivity and improve access and provide new pedagogical opportunities and improve access and provide new pedagogical opportunities. Lastly, this study revealed the barriers to OARadoption among the NALISE including epileptic power supply, lack of time to look for suitable resources, lack of support from experienced colleagues, and inadequate ICT infrastructure.

The finding is against a study by Hettige, Dasanayaka and Ediriweera (2022) who found that lack of time during academic hours and the difficulty to read on digital screens for a longer period were the main constraints for participating students to use OER. Christoforidou and Georgiadou (2022)

affirmed that inadequate knowledge of OAR, finding them is a difficult and time-consuming process, lack of encouragement from the university, and reduced technological skills for adopting OER were some of the barriers identified by their respondents to the use of OAR. The findings from the study are also in consonance with Ogunbodede, Nwachokor, and Aminikpo (2021) discovered that poor electricity supply, poor Internet connectivity, lack of library sensitisation on the use of OAR, and lack of access to computers/laptops were some of the major challenges to the effective use of open educational resources.

Conclusion

No doubt, OAR has come to stay in the educational landscape. OAR facilitate free access to knowledge and enhanced the teaching and learning process. OAR is helping to reorient educational offerings in higher education around the world, especially in underdeveloped nations like Nigeria where access to high-quality educational resources is limited. NALISE in this study demonstrated a high degree of OAR awareness and adoption. The survey also found that the NALISE had a high level of OAR adoption, and benefited from OAR adoption and the major barriers to effective OAR adoption were inadequate information retrieval system, poor Internet connectivity, epileptic power supply and lack of support from experienced colleagues. The hypothesis test revealed that there was a significant positive relationship between OAR awareness and the adoptionofNALISE. This suggested that NALISE's awareness of OAR has a favourable impact on their adoption in the study. In other words, there is a nexus between OAR awareness and adoption. The null hypothesis which states that there is no significant association between OER awareness and use is rejected, while the alternative hypothesis is accepted.

Recommendations

The following are recommendations to address the shortcomings identified in the study:

The university administration should prioritize improving the electricity supply, providing adequate ICT infrastructure, and enhancing Internet bandwidth. These improvements will enable faculty members to fully adopt and utilize open OAR and overcome any technical limitations.

The library should play an active role in promoting the adoption of OAR among the university stakeholders. Organizing programs and workshops that sensitize both academic staff and students about the benefits of OAR in academic activities and improve their information retrieval skills will enhance their engagement with these resources.

Faculty members should be equipped with the necessary technological skills to effectively use OAR. Institutions can offer training programs and workshops to enhance teachers' digital literacy and familiarize them with OAR platforms and tools, enabling them to navigate and utilize OER effectively.

Faculty members should actively encourage the adoption of OAR by uploading their publications to institutional repositories. This will ensure that students have easy and uninterrupted access to high-quality and relevant educational materials for their studies.

Library personnel should inform researchers about the benefits of adopting OAR in the educational process and facilitate communication between faculty and students regarding OAR efforts. This will foster a collaborative environment and encourage researchers to leverage OAR resources for their academic pursuits.

By implementing these recommendations, universities can create an environment that supports the effective use of OAR, ultimately enhancing the educational experiences of faculty members and promoting access to quality educational materials.

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STUDENTS' AWARENESS, PERCEIVED BENEFITS AND PREPAREDNESS TOWARDS USE OF MOODLE PLATFORM FOR LEARNING IN COLLEGES OF EDUCATION IN NIGER STATE, NIGERIA

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Abstract

The Study investigated Students' Awareness, Perceived Benefits and Preparedness towards Use of Moodle platform for learning in Colleges of Education in Niger State, Nigeria. The study adopted descriptive survey research design. Three objectives, three research questions. The population of the study was 6,215 NCE III students from two schools/faculties Colleges of Education in Niger State. Three hundred and sixty-two students constituted the sample size for the study using Krejcie and Morgan sample size. The instrument used for generating data for the study was 30 items researcher-designed questionnaire. The drafted questionnaire was validated by two experts in the field of Educational Technology and psychologist from Federal University of Technology Minna which was pilot-tested and the reliability of the instrument was determined using Cronbach Alpha correlation formula which yielded a reliability coefficient value of 0.87. The instrument was administered on all the respondents and retrieved immediately. Mean and Standard Deviation were used to answer the research questions. A decision rule was set in which a mean score 2.5 and above was considered agreed while a mean score below 2.5 was considered disagreed. The findings of the study revealed that respondents were highly aware and prepared for the use of Moodle platform for learning, respondents also agreed that they will benefit from the use of Moodle platform for learning. Among other recommendations was that the management of Colleges of Education should design policy and reliable Internet connectivity that would guide the implementation of the use Moodle platform.

Keywords: Moodle, Awareness, Perceived Benefits, Preparedness, College of Education.

Introduction

The popularity of the Internet and Internet-based applications has grown fast in recent times. It has affected how we conduct our day-to-day activities. People rely more and more on the Internet to find the information they are looking for or even to learn new subjects. Technology has affected almost all the aspects of our lives and it makes some of our works easier and more efficient. Nowadays it is not possible to think about the teaching and learning process without associating it with the Information and Communication Technologies (ICTs). ICTs are present in all processes that involve the collection of data, processing of information and knowledge creation (Costa, Alvelosa, & Teixeiraa, 2012). In teaching and learning one of the most typical processes is the utilization of technological innovations to make learning more effective and concrete. These technological innovations offer more opportunities for the teaching and learning process. With the use of technology, education took a big leap and is changing its paradigms, from a closed model,

and teacher-centered classroom to a model more open and student-centred, where the teacher moves from one holder of knowledge for a learning mentor, able to manage diverse discourses and practices as well as stimulate the intellectual capacities of students in the treatment of information available.

With the integration of digital technology into their learning, they will achieve a longer knowledge retention rate and more highly motivated to study and succeed (Lungs, 2012). This has been made possible by the dynamic trends in the technological breakthrough in recent times. Nsofor, Bello, Ahmed, Umeh, and Oboh, (2015) opine that emerging technological trends have made students digitally literate and created more learning opportunities for them to explore. The current and frequent emergence of these technologies has changed the face of education especially in the way teaching and learning are experienced, which has put both the teachers and the students in the context of continuous learning. Moreover, in the developed countries, as technology advances, teachers are eager to explore and integrate technologies as they consistently create new technological; oriented ways of pedagogy. The impact of technology can ease people in any aspect of life. One convenience of technology development is also a field in the field of education.

The use of technology in education leads to positive impacts for both teachers and students. A recent trend in higher education is the use of e-learning systems that provide students with online access and learning content. This trend has led to an increasing supply of e-learning technologies in the form of teaching and learning based that enable users to learn regardless of time and place. The definition of e-learning often changes in line with technological advances nowadays. Generally, e-learning is any teaching and learning using electronic networks (LAN, WAN, or the Internet) which are used to communicate the contents, interaction, or facilitation. E-learning can be in forms of Internet, intranet, satellite, audiotape, video, interactive TV is part of the electronic media. According to (Piotrowski, 2010), an e-learning platform represents a system, which provides integrated support for six different activities: creation, organization, delivery, communication, collaboration, and assessment. E-learning is using the Internet to teach and learn, it includes communication, student submission of work, teacher to student and student to student communication, content delivery, and enrichment, using the Internet as a research tool, and using the Internet as a publishing tool. E-Learning is a tool, like writing and speaking, that is used to teach and learn. The Internet provides a huge array of evolving tools that can enhance the teaching process, selecting and using these tools is E-learning (Cysewski & Stephen, 2010).

With the development and expanding availability of the internet, different systems for electronic learning (e-learning) are also being developed, implemented, and used. At first, those systems, also called web-based systems such as Learning Management Systems (LMS) allow instructors and students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online using "an integrated set of web-based tools for learning and course management" (Malikowski, Thompson, & Theis, 2007). A learning management system (LMS) is an information technology (IT) used by instructors to easily build and maintain course websites. Website maintenance includes posting course content, updating events, and managing interactive communication with students via messages, forums, and surveys (OECD, 2015). A learning management system (LMS) is an information technology (IT) used by

instructors to easily build and maintain course websites. Website maintenance includes posting course content, updating events, and managing interactive communication with students via messages, forums, and surveys (Organization for Economic Co-operation and Development, OECD, 2005). Academic institutions have invested heavily in LMS implementation to support online teaching (Hawkins & Rudy, 2009). To justify the widespread investment in LMS technology, it is important to study patterns of actual student LMS use and student satisfaction with LMS technology (Delone & McLean, 2003; Lonn & Teasley, 2009), as well as the correlating factors.

Moodle system is a Learning Management System (LMS) a free Open Source software package designed using sound pedagogical principles, to help educators create effective online learning communities (EduTools, 2006). Moodle as a LMS allows the integration of a wide range of resources, from chats and forums to online booklets, a variety of questions, collections of problems and exercises, lecture notes; including any kind of text-based or HTML formatted documents, multimedia resources such as graphics, video or audio (for instance MP3 files), PowerPoint, or Flash-based applications and Java applets. Moodle focuses on giving educators the best tools to manage and promote learning and allows teachers to organize, manage and deliver course materials. From a didactic point of view, the usage of multimedia tools to create attractive activities makes the learning process friendlier for students. As a consequence, these activities increase the interest of the students in their studies. Teachers can provide students with a large number of resources that they cannot usually show in the classroom due to time constraints. Moodle helps educators to blend traditional classroom pedagogies with various web-based technologies in a single application (Lamb, 2014). Moodle is acknowledged as a self-directed, out of classroom practice which fosters learner autonomy. Lamb (2014) indicated that learners generally welcome internet applications as they can learn at their own pace. Moreover, the Moodle environment aims to enhance students' experience in learning and is designed with a constructivist pedagogical framework. From all the factors mentioned earlier, the major factor that has a role for Moodle to be preferred as a method of learning is that teachers can easily access this software on the program's web page and design a page for their course free of charge, based on the awareness that Moodle platform exists for learning.

Awareness is the ability to directly know and perceive, to feel, or to be cognizant of events. In Moodle, tertiary education should engage learners as active participants in their learning. Achieving this means offering learners opportunities for interaction in ways that can promote change and growth in learner's conception of knowledge. Such pedagogies aim to encourage learners to become autonomous lifelong learners, capable of problem-solving and critical thinking, and to move them from being passive recipients of information and knowledge to being active, enthusiastic learners and knowledge creators. Moreover, tertiary pedagogy is concerned with building meaningful learning relationships between learners and teachers, and learners and their peers. It involves encouraging collaboration in learning as well as cooperation in learning; the appropriation of technology for teaching suggests great opportunities for the promotion of innovative and interactive quality e-learning environments. Consequent upon the above, Moodle software could be perceived to be the immense benefit in learning environment.

Perceived benefit is the extent to which a user believing using a particular technology will be of benefit to him/her. Another definition says perceived benefits refer to the degree to which new technologies provide more benefits than old ones (Raouf, Naser, & Jassim, 2012). These expected benefits include the increased ability of the institutions to accept more students, providing accurate, quick, and more information about the educational process which can lead enhanced decision making, providing better channels of knowledge transfer to the students. The perceived benefit concerning the use of Moodle, it has great potential to create a successful e-learning experience by providing a plethora of excellent tools that can be used to enhance conventional classroom instruction, in hybrid courses, or any distance learning arrangements. Instruction over the Moodle is perceived by many to be a significant breakthrough in teaching and learning. The Moodle allows educators to provide learners with new and innovative virtual environments in an attempt to stimulate and enhance their learning process. Besides, Moodle they are important because they support manipulation of information, facilitate/enhance communications among instructors and learners and provide tools to encourage creativity and initiative. Students who participate in e-learning environments often complain about the lack of feedback that is available in conventional classroom settings (Brandl, 2004).

In Moodle, almost all modules are designed to allow teachers or course participants (students) to provide feedback in qualitative or quantitative form. The current generation of learners has been referred to a 'digital natives' in reflection of their apparent ease and familiarity with digital technology. However, questions remain about how prepared students are for university e-learning environments. Preparedness is the competencies of the students to adopt Moodle platform for learning in higher institutions, Higher education expects students to develop a deep understanding of the course content and to foster a range of cognitive, practical and personal skills. To achieve these aims students must engage in a variety of learning activities and complete a range of assessments that test the achievement of the espoused outcomes.

Statement of the Research Problem

Presently, the enhancement of the dissemination and improvements of the academic resources of the knowledge and researches in the global world is inevitable. This is because there is a big growth of ICT and wider penetration of the internet in the world. Students, lecturers, researchers, and academia need sophisticated and easier means to communicate, create, share and collaborate on their contents, information and studies. They need a source that is rich and reliable. Hence, there is a need to analyse the way social media sites and emergent ICT technologies usages can be used by students and lecturers to enhance academic resourcefulness. Most lecturers still depend solely on the traditional lecture method of teaching; this is because of its simplicity and widespread application in the tertiary institution of learning. The term Moodle is still mirage even among instructional technologist in Nigeria; hence there is a need to gain insight on the concept, practices and the benefits of its usage by students in Nigeria at large. However, Moodle platform does not require much teacher preparation and therefore most lecturers and students are not fully aware of Moodle learning platform and how it can be used as a learning platform among the students and how it can be integrated in the classroom to help ease the burden on them and how they can interact with each other asynchronously regardless of their location. It is obvious that there are very few

studies carried out on Moodle in Nigeria and the world at large. Most of these studies were carried out in data centres and other private organizations. Therefore, there is a need for a study to assess students' awareness, perceived benefits and preparedness to use Moodle platform as a learning management system in Nigeria.

Objectives of the Study

The specific objectives are to;

i. Determine students' level of awareness the use of Moodle platform for learning
ii. Determine students Perceived benefits of the use of Moodle platform for learning.
iii. Determine students Preparedness for the use of Moodle platform for learning.

Research Questions

The following research questions were raised to guide the study:

i. What is the mean difference in the students' levels of awareness of the use of Moodle platform for learning?
ii. What is the mean difference in the students' levels of perceived benefit of the use of Moodle platform for learning?
iii. What is the mean difference in the students' levels of preparedness of the use of Moodle platform for learning?

Methodology

The study adopted a descriptive survey research design. The research work was on students' awareness, perceived benefits and preparedness towards the use of Moodle for learning in Colleges of Education in Niger State, Nigeria. The population of the study comprises all 23,342 students from the two Colleges of Education in Niger State, namely; Federal College of Education Kontagora and Niger State College of Education Minna. The target population for the study was 6,215 NCE III students from the two Colleges of Education in Niger State. The sample for this study comprised of 362 (Three hundred and sixty-two) NCE III students from two schools/faculties i.e School of Science and School of Education in Colleges of Education in Niger State. A structured questionnaire was used for data collection in this study. The questionnaire was designed by the researcher and titled students' questionnaire for student awareness, perceived benefits and preparedness towards the use of Moodle for learning (QSAPPUM). The questionnaire was designed under four (4) different sections and harmonized in one single questionnaire; The questionnaire consists of sections, A, B, C, and D was used as an instrument for data collection. The instrument was administered on all the respondents and retrieved immediately. The descriptive statistics of Mean and Standard Deviation was used to answer the research questions. the questionnaire was administered to the respondent with the period of six (6) weeks

Results

Research Question One: What is the mean difference in the students' levels of awareness of the use of Moodle platform for learning?

The descriptive statistics of Mean and Standard Deviation was used to answer this research question and the summary of the result is presented in table 1

Table 1: Mean and Standard Deviation of Students' Responses on the level of Awareness of the use of Moodle Platform for learning

S/N	Item	N	Mean ($\bar{x}$)	Std. Dev.	Decision
1	Moodle could be used for teaching in tertiary institutions	362	3.43	0.957	Agreed
2	Knowledge of using Moodle would assist my studies	362	3.04	0.806	Agreed
3	Using Moodle would improve my learning achievement	362	3.06	0.810	Agreed
4	Moodle can provide hearing-impaired students with a combination of sensory stimuli	362	2.86	0.846	Agreed
5	Moodle create more interaction between student and lectures	362	2.86	0.862	Agreed
6	Moodle is an effective means of receiving assignment question	362	2.83	0.901	Agreed
7	The use of Moodle could provide me a better learning experience and more opportunity	362	2.79	0.931	Agreed
8	Moodle could be used to serve as meeting places for students	362	2.78	0.948	Agreed
9	Moodle could arouse my interest to receive lectures	362	2.79	0.934	Agreed
10	Moodle will increase the level of my ICT competencies	362	2.56	0.983	Agreed
	Grand Mean		**2.90**		**Agreed**

Decision Mean 2.50

Table 1 shows the Mean and Standard Deviation of students' response on Awareness the use of Moodle platform for learning with total number of 362 responded to 10 items each. The table revealed the computed Mean score of 3.43 with Standard Deviation of 0.957 for item one, Mean score of 3.04 with Standard Deviation of 0.806 for item two, Mean score of 3.06 with Standard Deviation of 0.810 for item three, Mean score of 2.86 with Standard Deviation of 0.846 for item four, Mean score of 2.86 with Standard Deviation of 0.862 for item five, Mean score of 2.83 with Standard Deviation of 0.901 for item six. Mean score of 2.79 with Standard Deviation of 0.931 for

item seven. Mean score of 2.78 with Standard Deviation of 0.948 for item eight. Mean score of 2.79 with Standard Deviation of 0.934 for item nine and Mean score of 2.56 with Standard Deviation of 0.983 for item ten. Respondents agreed to all the 10 items and the grand mean to all the 10 items is 2.90 (with grand standard deviation of 0.899). The grand mean is more than the decision mean of 2.50 hence, this implies that students are aware of the Moodle platform for learning.

Research Question Two: What is the mean difference in the students' levels of perceived benefit of the use of Moodle platform for learning?

The descriptive statistics of Mean and Standard Deviation was used to answer this research question and the summary of the results is presented in table 2

Table 2: Mean and Standard Deviation of Students' Responses on Perceived Benefits of the use of Moodle Platform for learning

S/N	Item	N	Mean ($\bar{x}$)	Std. Dev.	Decision
1	It's free; there are no charges for using Moodle	362	3.62	.736	Agreed
2	Moodle learning can be customized as far as user's requirement	362	3.13	.729	Agreed
3	In Moodle an unlimited number of users can be added on	362	3.04	.814	Agreed
4	Moodle is a great community that can solve your problem	362	2.92	.852	Agreed
5	Moodle provides access to teaching materials and assignments in 24/7 mode,	362	2.97	.891	Agreed
6	In Moodle the quantity and quality of the knowledge obtained does correspond to the spent time	362	2.91	.889	Agreed
7	The quality of the use of the Moodle course match today's level of education.	362	2.90	.923	Agreed
8	Moodle can be used in all subjects	362	2.83	.931	Agreed
9	Moodle useful in my studies	362	2.76	1.010	Agreed
	Grand Mean		**3.01**		**Agreed**

Decision Mean = 2.50

Table 2 shows the Mean and Standard Deviation of students' response on Awareness the use of Moodle platform for learning with total number of 362 responded to 9 items each. The table revealed the computed Mean score of 3.62 with Standard Deviation of 0.736 for item one, Mean score of 3.13 with Standard Deviation of 0.729 for item two, Mean score of 3.04 with Standard Deviation of 0.814 for item three, Mean score of 2.92 with Standard Deviation of 0.852 for item four, Mean score of 2.97 with Standard Deviation of 0.891 for item five, Mean score of 2.91 with

Standard Deviation of 0.889 for item six. Mean score of 2.90 with Standard Deviation of 0.923 for item seven. Mean score of 2.83 with Standard Deviation of 0.931 for item eight and Mean score of 2.76 with Standard Deviation of 1.010 for item nine. Respondents agreed to all the 9 items and the grand mean to all the 9 items is 3.01 (with grand standard deviation of 0.868). The grand mean is more than the decision mean of 2.50 hence, this implies that students agreed with the perceived benefit of the Moodle platform for learning.

Research Question Three: What is the mean difference in the students' levels of preparedness of the use of Moodle platform for learning?

The descriptive statistics of Mean and Standard Deviation was used to answer this research question and the summary of the results is presented in table 3

Table 3: Mean and Standard Deviation of Students' Responses on the Preparedness of the use of Moodle Platform for learning

S/N	Item	N	Mean ($\bar{x}$)	Std. Dev.	Decision
1	I am interested in using Moodle to receive lectures	362	3.39	.890	Agreed
2	I will like to use Moodle when it's available	362	3.02	.803	Agreed
3	I will like to learn about using Moodle	362	3.03	.899	Agreed
4	I am prepared to attend training on the use of Moodle for classroom activities	362	2.93	.930	Agreed
5	I am willing to use Moodle for assignment	362	2.93	.934	Agreed
6	I am ready to interact with my course mate via Moodle	362	2.91	.910	Agreed
7	I am willing to receive my lecture materials through Moodle	362	2.99	.944	Agreed
8	Moodle could be used to serve as meeting places for students	362	2.99	.931	Agreed
9	I am ready to use Moodle because it has immediate feedback	362	2.89	.976	Agreed
10	Moodle is meeting my learning needs	362	2.90	.926	Agreed
11	Using Moodle will enhance my knowledge and my understanding abilities of lectures, tutorials, and presentation	362	2.95	.985	Agreed
	Grand Mean		**2.99**		**Agreed**

Decision Mean = 2.50

Table 3 shows the Mean and Standard Deviation of students' response on Awareness the use of Moodle platform for learning with total number of 362 responded to 11 items each. The table revealed the computed Mean score of 3.39 with Standard Deviation of 0.890 for item one. Mean score of 3.02 with Standard Deviation of 0.803 for item two, Mean score of 3.03 with Standard

Deviation of 0.899 for item three, Mean score of 2.93 with Standard Deviation of 0.930 for item four, Mean score of 2.93 with Standard Deviation of 0.934 for item five, Mean score of 2.91 with Standard Deviation of 0.910 for item six. Mean score of 2.99 with Standard Deviation of 0.944 for item seven. Mean score of 2.99 with Standard Deviation of 0.931 for item eight, Mean score of 2.89 with Standard Deviation of 0.976 for item nine. Mean score of 2.90 with Standard Deviation of 0.926 for item ten. Mean score of 2.95 with Standard Deviation of 0.985 for item eleven. Respondents agreed to all the 11 items and the grand mean to all the 11 items is 2.99 (with grand standard deviation of 0.920). The grand mean is more than the decision mean of 2.50 hence, this implies that students are prepared to use Moodle platform for learning.

Discussion

The study revealed that there is significant difference in students' level of awareness in the use of Moodle platform for learning between Federal College of Education and State College. The findings contradict findings of Olobie, Ezoem And Ekene (2014). The findings of the study have shown that the percentage of students who were aware of the benefits of virtual learning was small. This suggests a general low extent of students' awareness of the benefits of virtual learning.

There is significant difference in students' agreement on Perceived Benefits in the use of Moodle platform for learning between Federal College of Education and State College of Education in Niger State in favour of State College of Education. This also complements the findings of Yeou (2016), Liaw and Huang (2013), Islam (2013), Tagoe (2012), and Motaghian et al. (2013) who found a significant relationship between expected benefits and e-learning adoption. These prior studies emphasized the importance of expected benefits in adoption of e-learning. Tagoe (2012) also posits that there is a significant relationship between expected benefits and the frequency that one uses e-learning systems. Hence, expected benefits' significance as a determinant in this study was in the right direction. Again, it was significant for students and administrators but not instructors.

There is significant difference in students on Preparedness in the use of Moodle platform for learning between Federal College of Education and State College of Education in Niger State in favour of State College of Education. Indicates that when asked whether or not it is time for the university to use LMS for teaching and learning, 124 (96.9%) felt the time had come for UCC to do so, with 3 (2.3%) feeling otherwise. Most Higher Education Institutions (HEIs) use LMS as their enterprise system for teaching and learning. In deed UCC should be counted among those using LMS to engage students.

Conclusion

Based on the findings of this study, the following conclusions were drawn; there There was existing significant difference in mean responses on the level of awareness in the use of Moodle platform for learning between Federal College of Education and State College of Education. It was concluded that, students in Niger State College of Education are more aware of Moodle platform for learning than their counterpart. There was significant difference in the mean responses of students on awareness of using Moodle platform for learning between School of Science and School of Education. It was established that, students from school of science are more aware on

Moodle platform. There was no significant difference between male and female students' level of awareness in the use of Moodle platform for learning in Colleges of Education in Niger State. It was therefore revealed that students of Colleges of Education are aware

There was significant difference in mean responses on the level of perceived benefits of Moodle platform for learning between Federal of college of Education and State Colleges of Education. It was also established, there was significant difference in favor of Niger State College of Education. There was significant difference in the mean responses of students on perceived benefits of using Moodle platform for learning between schools/faculty. It was concluded that, students of School of Science have agreed on perceived benefit of using Moodle platform for learning. There was no significant difference between male and female students' level of perceived benefits in the use of Moodle platform for learning in Colleges of Education in Niger State.

There is significant difference in mean responses on the level of preparedness in the use of Moodle platform for learning between Federal of college of Education and State Colleges of Education. It was drawn that; Niger State College of Education are prepared to use Moodle platform for learning. There is significant difference in the Mean Responses of Students on Preparedness in the use of Moodle platform for learning between schools/faculty. It was revealed that, students from School of Science are prepared to use Moodle platform for learning. There is no significant difference between Male and Female students' level of preparedness in the use of Moodle platform for learning in Colleges of Education in Niger State.

Recommendations

The findings of the study have made it necessary to proffer some recommendations, these are;

i. The management of Colleges of Education should design a policy that would guide the implementation in using Moodle platform.
ii. Colleges of Education should provide a reliable Internet connectivity and computer access to both lecturers and students
iii. classrooms and laboratories should be technologically enhanced in order to support the use of Moodle platform.

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SDG-4: OPEN TECHNOLOGIES FOR LEARNING: EXPLORING RESEARCHERS' PERCEPTION AND INTEREST TOWARDS THE USE OF GOOGLE FORMS FOR DATA COLLECTION IN NORTH-CENTRAL NIGERIA

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Abstract

This study investigates SDG-4: Open Technologies for Learning: Exploring Researchers' Perception and Interest Towards the use of Google Forms for Data Collection in North-Central Nigeria. The study has three objectives, three research questions and three corresponding hypotheses. The study adopted the descriptive survey research design. The population of the study consists of 1,714 lecturers from state colleges of education in North-Central Nigeria, a sample size of 171 was obtained using the purposive sampling technique. The instrument for data collection titled "Researcher's Perception and Interest Questionnaire (RPIQ)" was used to collect data from researchers in academic institutions in North-Central Nigeria. The data was analyzed using mean and standard deviation while the hypotheses were tested using the independent t-test statistics. Findings of the study revealed that researchers have a negative perception towards Google Forms for data collection. Researchers had a positive perception and showed interest in Google Forms for data collection. The hypothesis testing revealed that there is no significant difference between male and female researchers in North-Central Nigeria in their perception and interest towards Google Forms for data collection. Based on the findings, recommendations were made amongst others; Institutions should encourage the use of Google Forms for data collection.

Keywords: Google Forms, Perception, Interest, Gender.

Introduction

The Sustainable Developmental Goal (SDG4) stands for Quality Education which aims to ensure inclusive and equitable quality education for all and promote lifelong learning opportunities. Within SDG 4, the specific target of "Open Technologies for Institutional and Corporate Learning" recognizes the transformative role of technology in education (United Nations, 2015). Technology has revolutionized education, making it more accessible, engaging, and interactive (UNESCO, 2017). In the context of research, technological advancements have significantly impacted the data collection process. Researchers now have access to various tools and methodologies, such as surveys, experiments, case studies, and observations, which contribute to the systematic and scientific inquiry process (Creswell, 2014).

Google Forms is an open technology that provides accessibility and availability to a wide range of users. It is an online survey tool offered by Google, allowing individuals and organizations to easily create customized surveys and collect data without the need for advanced technical skills (Google Forms, n.d.). The user-friendly interface makes it accessible to users with different levels of technological proficiency. Being a web-based tool, Google Forms can be accessed from any internet-connected device, offering flexibility and convenience to users (Google Forms, n.d.). This open access enables researchers, educators, and professionals from various fields to utilize Google

Forms for data collection in their respective domains. Additionally, Google Forms integrates with other Google tools like Google Sheets and Google Drive, facilitating collaboration and efficient data management (Google Forms, n.d.).

The integration with these open technologies enhances the overall usability and functionality of Google Forms, making it a valuable resource for institutional and corporate learning. Google Forms, as an online survey tool, has become widely used for data collection in research studies (Vasantha & Harinarayana, 2016). Its ease of use, customization options, and integration with other Google tools have made it popular among researchers (Jazil et al., 2020; Ahmed & Rehman, 2021). Google Forms has been particularly beneficial for researchers in North-Central Nigeria, where it has been utilized for data collection (Yakkop et al., 2021).

Perception refers to the interpretation and understanding of sensory information from our surroundings. It involves cognitive processes such as attention, sensation, and interpretation. The perception of researchers towards Google Forms is generally positive, considering it a valuable resource for data collection (Yakkop et al., 2021; Alharbi et al., 2021; Rahmania, 2021). Interest refers to a person's curiosity, attention, and attraction towards a particular topic, activity, or idea. It is a psychological state that motivates individuals to explore and engage with a specific area of knowledge or experience. Researchers have shown a high level of interest in using Google Forms due to its user-friendly interface and features like real-time data collection and analysis (Nurmahmudah & Nuryuniarti, 2019; Yakkop et al., 2021).

The integration of open technologies like Google Forms for data collection aligns with the goal of promoting inclusive and equitable quality education through innovative approaches (United Nations, 2019). By utilizing open technologies like Google Forms, researchers can enhance the efficiency and accessibility of data collection, ultimately contributing to the advancement of knowledge and the improvement of educational practices. The use of open technologies, such as Google Forms, for data collection in research studies has gained popularity in the field of education. However, there is a lack of comprehensive understanding regarding researchers' perception and interest towards the use of Google Forms for data collection in North-Central Nigeria (Abubakar & Akor, 2017; Al-Mustapha et al., 2022). Despite the growing interest in open technologies for data collection in educational research, limited literature specifically focuses on researchers' perception and interest towards the use of Google Forms in the context of institutional and corporate learning. Existing studies have primarily explored the general benefits and features of Google Forms in data collection (Nayak et al., 2019), but there is a dearth of research that investigates perception and interests of researchers in North-Central Nigeria towards this tool. Furthermore, while some studies have examined the use of online survey tools in educational research, there is limited research that delves into the perceptions and interests of researchers towards open technologies like Google Forms. Hence, this study aims at Researchers' Perception and Interest Towards the use of Google Forms for Data Collection in North-Central Nigeria

Aim and Objectives

The aim of this study is to explore Researchers' Perception and Interest Towards the use of Google Forms for Data Collection in North-Central Nigeria. Specifically, the study aims to achieve the following objectives. To;

i. Examine the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
ii. Examine the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
iii. Examine the gender difference in the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection.
iv. Examine the gender difference in the interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

Research questions

i. What is the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
ii. What is the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
iii. What is the gender difference based on the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?
iv. What is the gender difference based on the interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Research Hypotheses

H01: there is no significant difference of male and female researchers on their perception towards Google Forms for data collection.

H02: there is no significant difference of male and female researchers on their interest towards Google Forms for data collection.

Literature Review

In a study conducted by Da Silva and Albuquerque (2018), Google Forms was used to collect data on the perceptions of Brazilian university students regarding the use of mobile devices in the classroom. The authors found that Google Forms was an efficient and effective tool for data collection, as it allowed for the collection of large amounts of data in a short period of time. The authors also noted that the use of Google Forms reduced the risk of errors in data entry and simplified data analysis. In another study, Kim et al., (2017) used Google Forms to collect data on the opinions of Korean nurses regarding the use of mobile devices in nursing practice. The authors found that Google Forms was a convenient and efficient tool for data collection, as it allowed participants to complete the survey at their own convenience and eliminated the need for paper-based surveys. Similarly, a study by Alsharari et al., (2021) utilized Google Forms to collect data on the attitudes of Saudi Arabian students towards the use of smartphones in education. The authors found that Google Forms was an effective tool for data collection, as it allowed for the easy distribution and completion of surveys, as well as simplified data analysis. One empirical

study on researchers' attitudes towards Google Forms was conducted by Han and Ellis (2019). The study aimed to investigate the perceptions of researchers in the field of information and library science towards using Google Forms for research data collection. The study found that most participants had a positive attitude towards using Google Forms, citing its ease of use, accessibility, and cost-effectiveness as benefits. However, some participants expressed concerns about data security and privacy.

Methodology

The study adopted a survey research design to collect information from respondents using questionnaires. This design is suitable for describing, analyzing, and interpreting the prevailing circumstances at the time of the study. The population for this research comprises seven state colleges of Education located in North-Central Nigeria, namely Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and the Federal Capital Territory (FCT). These colleges include College of Education Oju in Benue State, Kogi State College of Education Ankpa, Kwara State College of Education, College of Education Akwanga in Nasarawa, Niger State College of Education, College of Education Gindiri in Plateau State, and FCT College of Education in Zuba. The total population across these states consists of 1,714 lecturers, 37 faculties, and 169 departments.

Table 1 Population of the study

S/N	States	State Colleges of Education	Lecturers	Faculties	Departments
1	Benue	College of Education Oju	215	5	22
2	Kogi	Kogi State College of Education Ankpa	280	6	32
3	Kwara	Kwara State College of Education	157	6	19
4	Nasarawa	College of Education Akwanga	310	5	24
5	Niger	Niger State College of Education	271	3	22
6	Plateau	College of Education Gindiri	249	6	24
7	FCT	FCT College of Education, Zuba	232	6	26
Total			**1,714**	**37**	**169**

The study utilized purposive sampling to select samples from four state Colleges of Education in North-Central Nigeria. Purposive sampling is a non-probability sampling method based on the researcher's judgment, allowing for samples to be drawn from the population. The selection of the four colleges was based on accessibility for field study and data collection. This sample represents

57% of the total population of state-owned Colleges of Education in the region. A total of 171 lecturers, representing 10% of the lecturer population, were selected using stratified sampling from the four selected colleges. This sample size was considered appropriate, as it falls within the recommended range of 10-20% for research work. The sample included lecturers from six faculties and 41 departments, representing 10% of the total population of faculties and departments. The sample distribution table is shown below:

S/N	Colleges of Education	Lecturers	Faculties	Departments
1	College of Education Akwanga	41	2	12
2	Niger State College of Education	50	1	6
3	College of Education Gindiri	40	2	12
4	FCT College of Education, Zuba	40	1	11
	Total	171	6	41

Research Instrument

A twenty-item questionnaire titled "Researcher's Perception and Interest Questionnaire (RPIQ)" was developed for the study. The questionnaire utilized a 4-point Likert scale, with response options ranging from Strongly Agree-4 (SA) to Strongly Disagree-I (SD). The questionnaire underwent expert scrutiny and appraisal by professionals from the Department of Curriculum and Instruction, School of Education, FCT College of Education Zuba. The experts evaluated the instrument's appropriateness (face validity), comprehensiveness (content validity), and clarity in terms of relevance and language. To determine the instrument's reliability, a pilot test was conducted involving 30 lecturers from two state universities who were not part of the study's sampled subjects but belonged to the overall population. The scores obtained from the pilot test were analyzed using the Cronbach alpha reliability method, resulting in a reliability coefficient of 0.89. Anikweze (2009) revealed that a reliability index above 0.8970 indicates sufficient reliability for measuring variables in research.

Method of data collection and analysis

One hundred and seventy-one (171) questionnaires were distributed to lecturers in the state colleges of Education in four selected states (Nasarawa, Niger, Plateau, and FCT) in North-Central Nigeria. The researcher enlisted the help of four research assistants who were assigned to administer the questionnaires in their respective states. The instruments were administered and collected within one week, with an effort made to collect responses on the spot to minimize the

risk of loss or missing questionnaires. The research questions were analyzed using mean and standard deviation, comparing the obtained mean averages to the benchmark value of 2.50. Mean values above 2.50 were considered as “agree” while mean values below 2.50 were considered as “disagree”. The hypotheses were tested using t-test statistics in SPSS (Statistical Package for Social Sciences) at a significance level of 0.05.

Data analysis

Research Question 1: What is the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Table 3: Perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

S/N	Items	N	Mean	Std.	Decision
1	I am familiar with Google Forms	171	2.42	0.880	Agree
2	Data collected through Google Forms are reliable and accurate	171	2.47	0.897	Agree
3	I find it easy to create a survey using Google Forms	171	2.45	0.953	Agree
4	Google Forms is user friendly	171	2.52	0.972	Agree
5	I encounter technical issues while using Google Forms	171	2.35	0.972	Agree
	Grand Mean		**2.44**		**Agree**

Decision mean: 2.50

Table 3 shows the perception of researchers in North-Central Nigeria towards the use of Google Forms for data collection. The mean score for item 1 ("I am familiar with Google Forms") is 2.42, which is slightly below the neutral score of 2.50. This suggests that respondents have a slightly negative perception of their familiarity with Google Forms. Item 2 ("Data collected through Google Forms are reliable and accurate") is 2.47, which is also slightly below the neutral score of 2.50. This suggests that respondents have a slightly negative perception of the reliability and accuracy of data collected through Google Forms. The mean score for item 3, 4 and 5 which is below the neutral score of 2.50, suggests that respondents have a negative perception towards Google Forms. The grand mean of 2.44 suggests that respondents generally have a slightly negative perception of Google Forms.

Research Question 2: What is the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection?

Table 4: Interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection.

S/N	Items	N	Mean	Std.	Decision
1	I am interested in learning more about the features of Google Forms for research purposes.	171	2.87	1.027	Agree
2	I find Google Forms to be an exciting tool for data collection in research.	171	2.87	1.051	Agree
3	The use of Google Forms for research purposes sparks my curiosity.	171	2.77	1.031	Agree
4	I am eager to explore the capabilities of Google Forms for my research projects.	171	2.78	0.981	Agree
5	I have a strong desire to incorporate Google Forms into my research methodology.	171	2.73	1.056	Agree
6	I am motivated to use Google Forms for data collection in my research projects.	171	2.75	0.993	Agree
7	The potential benefits of using Google Forms for research strongly interest me.	171	2.99	0.970	Agree
	Grand Mean		**2.81**		**Agree**

Decision mean: 2.50

Based on the table 4, it can be interpreted that the level of interest of researchers in North-Central Nigeria towards the use of Google Forms for data collection is generally positive, as indicated by the grand mean of 2.81 and the decision mean of 2.50. The majority of the participants agreed or strongly agreed with the statements, indicating a high level of interest in learning more about Google Forms, exploring its capabilities, and incorporating it into their research methodology. Overall, the findings suggest that researchers in North-Central Nigeria are receptive to using Google Forms for data collection and are interested in learning more about its potential benefits.

Hypothesis Testing

H01: there is no significant difference of male and female researchers on their perception towards Google Forms for data collection.

Table 5: T-test for the gender difference and the perception towards Google Forms for data collection.

Group	N	df	$\bar{x}$	SD	t-value	p-value	Decision
Male	108		2.38	0.73			
		169			-1.29	0.19	NS

Female	63		2.54	0.87			

Not Significant at 0.05 level

The findings indicate that there is no significant difference between male and female researchers on their perception towards Google Forms for data collection. The mean score for male researchers is 2.38 with a standard deviation of 0.73, while the mean score for female researchers is 2.54 with a standard deviation of 0.87. The t-value of -1.29 with a p-value of 0.19 indicates that the difference in perception between male and female researchers is not statistically significant at the 0.05 level. Therefore, we can accept the null hypothesis (H01) and conclude that there is no significant difference between male and female researchers in North-Central Nigeria in their perception towards Google Forms for data collection.

Table 6 male and female researchers on their interest towards Google Forms for data collection

H03: there is no significant difference of male and female researchers on their interest towards Google Forms for data collection.

Group	**N**	**df**	**$\bar{x}$**	**SD**	**t-value**	**p-value**	**Decision**
Male	108		2.81	1.06			
		169			0.21	0.87	NS
Female	63		2.78	0.79			

Not Significant at 0.05 level

Based on the results presented in Table 6, the null hypothesis (H03) is that there is no significant difference in the interest of male and female researchers towards using Google Forms for data collection. To test this hypothesis, a t-test was conducted on the mean interest scores of male and female researchers. The results show that the mean interest score for male researchers towards using Google Forms is 2.81 with a standard deviation of 1.06, while the mean interest score for female researchers is 2.78 with a standard deviation of 0.79. The calculated t-value is 0.21 with a p-value of 0.87, which indicates that the difference in mean interest scores between male and female researchers is not statistically significant at the 0.05 level. Therefore, we accept the null hypothesis (H03) and conclude that there is no significant difference in the interest of male and female researchers towards using Google Forms for data collection. Both male and female researchers have similar levels of interest in using Google Forms for data collection.

Discussion of Findings

The findings from this study suggest that researchers in North-Central Nigeria generally have a positive perception towards the use of Google Forms for data collection. However, the researchers also had some negative perceptions about Google Forms. Despite these negative perceptions, the researchers in North-Central Nigeria expressed a high level of interest in learning more about the

features of Google Forms for research purposes and were motivated to use Google Forms for data collection in their research projects. This suggests that they are open to incorporating Google Forms and believe that it has the potential to provide benefits for their research. The study investigated two hypotheses related to the perception and interest of male and female researchers towards using Google Forms for data collection. The findings indicated that there was no significant difference between male and female researchers in their perception and interest of Google Forms for data collection.

Conclusion

1.Researchers have a negative perception towards Google Forms for data collection.

2.Researchers show interest towards the use of Google Forms for data collection.

3.There is no significant difference between male and female researchers in North-Central Nigeria in their perception and interest towards Google Forms for data collection.

Recommendations

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

1.Researchers should be encouraged to use Google Forms for data collection, as it has been found to be an effective tool despite their negative perception towards it. Institutions can provide training and support on the use of Google Forms to help researchers become more comfortable and proficient in using it.

2.Institutions should encourage the use of Google Forms for data collection, given the positive perception and interest of researchers towards it. This can be done by providing access to the necessary technology and resources to facilitate its use.

Suggestions for Further Research

1.Replication of the study with a larger and more diverse sample size to increase generalizability of the findings.

2.Investigation of the factors that influence researchers' perceptions, s, and interests towards Google Forms for data collection in North-Central Nigeria.

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OPEN TECHNOLOGIES FOR INCLUSIVE EDUCATIONAL DELIVERY: A MEANS OF ACHIEVING SDG-4

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Abstract

Sustainable Development Goal 4 aims to ensure inclusive and equitable quality education and Education is a fundamental human right and is critical to achieving sustainable development and this so because the United Nations' promote lifelong learning opportunities for all. While, Inclusive education is when all students, regardless of any challenges they may have, are placed in age-appropriate general education classes that are in their own neighborhood schools to receive high-quality instruction, interventions, and supports that enable them to meet success in the core curriculum. Given this fact the current educational trends and practice echoing on the significant of leveraging on technology for effective teaching & learning., As a result of this development, Educators are always striving to personalize learning for students at all level with one form of technology or the other, this is so because technology can help them reach new levels with access to real-time student data, longitudinal information, content, apps, and more. Therefore, Open Technology is a medium that create access that encompasses notions of Open Standards, Open Source, and Open Software for usage at all time. It was based on this premises that, this paper Conceptualized the meaning of Open Technology and Inclusive Education; Examine rationale for the uses of Open Technologies for inclusive education delivery and discussed taxonomies of Open Technologies available for inclusive education such as Open BSD, Open GL, Open LDAP, OpenOffice.org, Open PGP, Open SSH, OpenSSL & OpenVPN; Similarly, the paper unveiled major impediments towards the use of Open Technologies in bringing about inclusive learning and as well discussed measures to improve on the use of open technologies for inclusive education; Lastly, Theoretical Frame work supporting the use of open technologies for inclusive education are discussed. Then, Conclusion & Recommendations were made

Keywords: Open Technology, Technology, Inclusive Education & SDG-4

Introduction

Over the years it has been re-emphasized that education must be the top priority for governments and this is so because the global technological revolution is driving rapid and irreversible changes in every area of our lives: new types of knowledge, new forms of communication, new workplace skills. Therefore, harnessing these changes, making the revolution work for everyone, is the key to economic prosperity and the central challenge for progressive politics. There are brilliant examples of technology used to deliver quality education and this include providing the best resources for teachers to use in classroom teaching and home learning; accurate and timely feedback to students; and engaging, collaborative learning experiences adapted for learners' ability with or without disability, It was based on this background that, the most recent edition of National Policy of Education (NPE-2014-Six-Edition) categorically stated that, in section one of the sub-component eight, clearly stated that, in order to fully realized the goals of education in Nigeria and

gain from the contributions to the national economy, government shall take necessary measure to ensure that; i- Educational activities shall be learner centred for maximum self-development and self-fulfillment and secondly, Teaching shall be practical, activity based, experiential and Information & Technology Supported (IT). Therefore, the above showcase that effective inclusive education delivery out rightly anchored on selecting and integrating appropriate technology to support implementation process (NPE-2014-Six-Edition; Tony, 2021)

Therefore, in a broader perspective, technology can help educators create blended learning environments and leverage on digital technologies and or open technology for formative and summative assessments, bringing new models for learning and teaching to classrooms. This is so because technology in education and the right devices in students' hands helps prepare them with the career and technical skills they need to be successful today and in tomorrow's workforce. The promise of contemporary technology lives in what these tools can do that previous learning and educational technologies could not is for the fact that they are open, connected, individualizable, and flexible. Therefore, Open Technology, is a concept that encompasses notions of Open Standards, Open Source, and Open Software. A standard is a specification for a technology or methodology.

An open standard is such a specification that is publically available, in such a way that anyone who wants, can obtain it and use it to create an implementation of the specified technology or methodology. Software is open source if its source code is available to the general public without restrictions that limit studying it, changing it, or improving upon it. In legal terms, open software is published under an Open Source license. The "open" adjective is also proudly presented in a host of software projects, some of significant prominence in their field: Open BSD, Open GL, Open LDAP, OpenOffice.org, Open PGP, and so on (Dinesh,,;et, al;2021; Wehler, 2018)

However, open Technology thrives and feeds on Open Standards and Open Source, and is better characterized as a process and attitude similar to the scientific process than by technological aspects. Openness has a vital influence on security and reduces costs by leveling the playing field for product selection, and helps battle inflexibility and legacy-problems (Source) It was in line with the foregoing that, open technology was conceptualized as a government policy that allows users access to platforms or systems with very few constraints or restrictions on their use. Open technology standards foster innovation while ensuring that devices and networks can work together seamlessly, this collaborative approach to technology development depends upon what the technology intended to be applied for and used to achieving certain objective (s) Hence, open technology is a term that can refers to a government policy that allows users access to platforms or systems with very few constraints or restrictions on their used and this is possible through open source technology tools.

These open source technologies are seen as the production and development philosophy of allowing end users and developers to not only see the source code of software, but modify it as well for their intended use and accomplishment. The term equally "open source technology tools" implied also a more generally to a community-based approach to creating any intellectual property (such as software) via open collaboration, inclusiveness, transparency, and frequent public updates ((Dinesh,,;et, al;2021; Wehler, 2018). There are two terms that largely explained open technology

tool and these include open sources and open standard the former “open source” refers to something people can modify and share because its design is publicly accessible and it originated in the context of software development to designate a specific approach to creating computer programs.

Today, however, "open source" designates a broader set of values what we call "the open source way” Open source projects, products, or initiatives embrace and celebrate principles of open exchange, collaborative participation, rapid prototyping, transparency, meritocracy, and community-oriented development. That open source software is software with source code that anyone can inspect, modify, and enhance ."Source code" is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software a "program" or "application" works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly. This therefore, implies Open source and open standards are not the same thing. Because in Open source we mean strictly, those software whose source code is freely available to users for reference, debugging, modification, and/or extension. While, Open standards are, typically, specifications and formal descriptions of software or software interfaces. (Dinesh,,;et, al;2021; Wehler, 2018)

More explicitly, standard is a specification for a technology or methodology and open standard is such a specification that is publically available, in such a way that anyone who wants to can obtain it and use it to create an implementation of the specified technology or methodology. A particular product can, by definition, never be a standard; calling a product a standard is a basic category mistake. While not a standard in itself, tt can however of course be an implementation of a standard. For software systems, a particular implementation, often called a reference implementation in this case, can play a role in the definition of a standard. As extensively advocated by Richard Stallman. On the Internet for example, interoperability between the vast hordes of connected systems, consisting of many different makes and models of systems running a Mind bogglingly vast arsenal of different software and software versions, is achieved on the basis of the so-called Internet Standards: standards ratified by the Internet Engineering Task Force (IETF) after a process of extensive peer review An example of an open standard is Postel’s ‘Transmission Control Protocol that defines TCP, which is the very mechanism used by high-level protocols such as SMTP (mail transfer, which is of course yet another open standard and HTTP (data transfer on the world wide web)

Following this development, Open source technology is seen has been beneficial to programmers and non-programmers this is because early inventors built much of the Internet itself on open source technologies like the Linux operating system and the Apache Web server application anyone using the Internet today benefits from open source software. Every time computer users view web pages, check email, chat with friends, stream music online, or play multiplayer video games, their computers, mobile phones, or gaming consoles connect to a global network of computers using open source software to route and transmit their data to the "local" devices they have in front of them. The computers that do all this important work are typically located in faraway places that users don't actually see or can't physically access—which is why some people

call these computers "remote computers." More and more, people rely on remote computers when performing tasks they might otherwise perform on their local devices. For example, they may use online word processing, email management, and image editing software that they don't install and run on their personal computers.

Instead, they simply access these programs on remote computers by using a Web browser or mobile phone application. When they do this, they're engaged in "remote computing. ((Dinesh,,;et, al;2021; Wehler, 2018)

In this perspective, it is worthy to note that, Sustainable Development Goal 4 ultimately aims to ensure inclusive and equitable quality education and it was an established fact that, education is a fundamental human right and is critical to achieving sustainable development and this so because the United Nations' promote lifelong learning opportunities for all. Based on this premises it is important to unveil scholar's opinions as regards inclusive or inclusiveness of educational provision. The term Inclusive Education is when all students, regardless of any challenges they may have, are placed in age-appropriate general education classes that are in their own neighborhood schools to receive high-quality instruction, interventions, and supports that enable them to meet success in the core curriculum.

This therefore means inclusive education pre-supposes an educational setting that cater for and take care of all learners irrespecful of any disability or inability that they might have but they meet equal treatment and opportunity in a learning centre (Classroom). Hence, it can be seen as an education that includes everyone, regardless of their ability, disability, language, or background, in the same classrooms and schools. It aims to provide equal opportunities, celebrate diversity, and foster a sense of belonging among all students. It also means that the education system must adapt to the needs and strengths of each student, rather than expecting them to fit into a standard model. Similarly, it can be perceived as avenue where all students, regardless of any challenges they may have, are placed in age-appropriate general education classes that are in their own neighborhood schools to receive high-quality instruction, interventions, and supports that enable them to meet success in the core curriculum (Bui, Quirk, Almazan, & Valenti, 2010; Alquraini & Gut, 2012).

The school and classroom operate on the premise that students with disabilities are as fundamentally competent as students without disabilities. Therefore, all students can be full participants in their classrooms and in the local school community. Much of the movement is related to legislation that students receive their education in the least restrictive environment (LRE). This means they are with their peers without disabilities to the maximum degree possible, with general education the placement of first choice for all students (Alquraini & Gut, 2012). Successful inclusive education happens primarily through accepting, understanding, and attending to student differences and diversity, which can include physical, cognitive, academic, social, and emotional. This is not to say that students never need to spend time out of regular education classes, because sometimes they do for a very particular purpose for instance, for speech or occupational therapy. But the goal is this should be the exception. The driving principle is to make all students feel welcomed, appropriately challenged, and supported in their learning efforts. (Alquraini & Gut, 2012).

Meaning & Conceptualization of Open Technology and Inclusive Education

Open Technology as a concept thrives and feeds on Open Standards and Open Source as earlier explained though, it is better characterized as a process and attitude similar to the scientific process than by technological aspects. Openness has a vital influence on security and reduces costs by leveling the playing field for product selection, and helps battle inflexibility and legacy-problems (Source) It was in line with the foregoing that, open technology was conceptualized as a government policy that allows users access to platforms or systems with very few constraints or restrictions on their use. Open technology standards foster innovation while ensuring that devices and networks can work together seamlessly, this collaborative approach to technology development depends upon what the technology intended to be applied for and used in achieving certain objective (s) Hence, open technology is a term that can refers to a government policy that allows users access to platforms or systems with very few constraints or restrictions on their used and this is possible through open source technology tools.

These open source technologies are seen as the production and development philosophy of allowing end users and developers to not only see the source code of software, but modify it as well for their intended use and accomplishment. More so, open source technology tools implied more generally to a community-based approach to creating any intellectual property (such as software) via open collaboration, inclusiveness, transparency, and frequent public updates ((Dinesh,,;et, al;2021; Wehler, 2018)

On this same line the concept of inclusion has also been extended to the educational field, where it refers to the idea that all students are ensured with equal opportunities; thus one of the target objectives to be reached by today's school systems has become that of offering the same level of education to all pupils, irrespective of their varying abilities/possibilities. With this understanding, Inclusive education refers to the placement of students with special educational needs in mainstream settings, along with other students without disabilities (Artiles, Dorn, & Christensen, 2006).

Inclusive education determines appropriate educational practices used in general education schools by offering a variety of educational services to help all students with special needs best learn according to their abilities and needs (McLeskey, Hoppey, Williamson, & Rentz, 2004). Salend (2011) defines inclusive education as a philosophy that brings stakeholders together to create a school environment based on acceptance and belonging within the school and the community. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has played an influential role in the consolidation of the idea of inclusive education for children with special educational needs in schools (UNESCO, 1994). Inclusive education has been adopted to ensure the quality of and right to education for all learners and is now a contemporary educational approach recognized globally (Subotić & Anđić, 2014; United Nations Convention on the Rights of Persons with Disabilities, 2016).

Use of Open Technologies as Effective Strategies for Inclusiveness

Scholars' have identified different methods and strategies that ought to be considered in order to bring about inclusiveness in teaching & learning of disable learners and these inclusive teaching

strategies refer to any number of teaching approaches that address the needs of students with a variety of backgrounds, learning modalities, and abilities. These strategies contribute to an overall inclusive learning environment in which all students perceive to be valued and able to succeed. The following identified below are some of the evidence-based strategies aim to provide teachers with an overview of inclusive teaching practices to support the inclusion of students with a diverse range of abilities and strengths. Many of these strategies are relevant for all students, while others could be relevant to some students and they include ensuring the following: (Williams, 2011).

Keep activities and instructions short, clear and engaging

Consider how tasks can be tailored to different student goals, strengths, abilities and learning profiles

Provide a visual schedule

Prepare students for an upcoming transition

Provide a sensitive environment

Provide encouragement and guide learning

Provide a quite area

Express positive regard and support

Facilitate student voice, autonomy and independence

Set clear classroom expectations

Provide lots of opportunities for students to engage in collaborative learning

Teach peers how to interact with each other

Support students to manage and self-regulate their emotions etc

The identified above can help learners focus and learn. Similarly, frequent breaks may also help concrete examples, simplified text, visual supports, breaking tasks into smaller components, using a variety of teaching strategies, and providing alternate ways for students to respond are some of the ways that the listed above can be achieved. Visual cues (such as schedules or cue cards) can let students know what is coming up, and how they should move from one activity to another. Students who find moving from one activity to another challenging will be better prepared if they are aware it is coming up. More so, to provide reminders about upcoming transitions, such as visual supports, countdown timers or regular reminders are indeed very necessary. .Provide an environment that is sensitive to the needs of students who have experienced trauma or adverse childhood experiences and considering providing effective, actionable feedback immediately when students are learning a task or behaviour. The below are some of the example:

Open Technology and strategies for effective teaching & learning for inclusiveness learning community using Google Docs; Piazza & Q and A Community (Inscribe) This can help to foster an inclusive learning community. Without guidance, students will often choose friends or peers

like themselves for creating informal and formal learning communities (Rosser, 1998). There are several tools available to help you create more inclusive learning communities by providing opportunities for students to communicate with you and each other. Just using these tools will not ensure inclusion, however. You will still need to provide structure to learning activities—establishing heterogeneous groups; determining group roles that rotate among members; structuring assignments to require interaction and inclusion of diverse perspectives; actively inviting, validating, and using all students' voices; etc. Moreso, it help students crowd source their notes and have them collectively create study guides. (Williams, 2011

Secondly, it can help build a community where students rely on each other for answers to class-related questions. they are equally online problem-solving platforms that allow students to post questions (including anonymously), answer questions posted by others, see instructor notes about answers, and see which answers have been endorsed by instructors. Students can also post images, videos, and/or equations using the built-in LaTeX editor, and edit computer code collaboratively. It's a great way for students to recognize the value and contributions of classmates with whom they may not have ordinarily(Rosser, 1998). worked.

Creating of Groups for Formal and Informal Learning: This strategy can be use to create regular interaction which can go a long way to helping students reach across cultural differences and learn to value those with different identities and backgrounds. Structuring these interactions to promote inclusion of all students is more vital than ever during remote learning. This could be possible with group projects, letting groups self-form can leave some students on the margins. Consider tools that let you organize heterogeneous groups around strengths and interests. This can be with the use surveys in Canvas or Qualtrics to ask about important characteristics, while more comprehensive teamwork programs like CATME is available for that (Ingram & Parker, 2002; Michaelsen & Sweet, 2008). Moreso, students/learners can be encouraged to use Zoom to create virtual study groups. Consider helping them learn to structure those meetings, maybe by having you or your teaching assistants host a few review sessions yourself first. Hosting the first few meetings may also make the groups more inclusive of all class members than might happen in self-formed study groups. These live study meetings can supplement other approaches like crowd-sourced notes or study guides in Google Docs or class Q&As occurring in Piazza or InScribe. (Muruyama,et.al.,2000)

Specific open technologies tools for inclusive education delivery to achieve SDG-4

It has been revealed that, the global education crisis is real, persistent and need urgent intervention. The inequity in educational outcomes is staggering about 260 million children a third of pupils in primary school today will reach the last grade without learning to read the same number are out of school entirely while, one in five 15-year-olds lack minimum proficiency in reading, maths or science. Hence, there is the need to find cost-effective ways of delivering education of a consistently high standard to hundreds of millions of students – and the scale of the challenge, already exacerbated by Covid-19, this will only grow in the next decade as the world moves towards achieving UN's Sustainable Development Goal 4 to realise inclusive and equitable quality education for all. The solution lies in developing a radically better approach to evaluating and applying new technologies in education (Eleni & Lanitis, 2023)

In line with the foregoing, the end justifications for the use of any technology in teaching and learning process is to ensure democratization of knowledge and as well ensure effectiveness & efficiency in learning process with the technology integration especially, for those educationally challenge learners whom have one form of disability or the other. It was in realization of this fact, that scholars identified the following open technology tools that could be use to bring about inclusiveness in the educational delivery of disable learners: In the view of Eleni & Lanitis (2023) Identified the following as Open Technologies Tools usable for educational purposes:

Artificial Intelligence & open source tool

Learning Analytics & open source tool

Big data & analytics and open source tool

Cloud Computing & Open source tools

Full stock development & Open source tool

Artificial intelligence

Artificial intelligence is one of the most discussed topics in the educational industry. Artificial intelligence in education is a significant technology which helps education in a number of ways. Personalized learning is one of the most important area of education that has used artificial intelligence. In personalized learning, AI helps you to find the best course material for you based on your identity, interests and your way of learning. Artificial intelligence replaced the old-fashioned classroom study with a more personalized and student-centered approach. Artificial intelligence can monitor overall performance by identifying the strength and weakness of a learner. It can rank learners based on their performance and give real-time suggestions to improve the overall performance of their studies. Artificial intelligence is very important so as to keep track, report and monitor the performance of the learners. Chen et al. (2022)

The term "Artificial Intelligence" (AI) was first mentioned by John McCarthyin in 1956 and refers to the ability of computer systems to undertake human tasks (like learning and thinking) that frequently can only be attained through human intelligence Since the 1970s, the specific field of Artificial Intelligence in Education (AIED) has begun to influence the application of technology to instruction and learning, to improve the learning process, and promote student achievements The aim of AIED is to establish AI-powered systems such as virtual pedagogical agents, AI robots and intelligent systems which allow flexible, engaging and personalized learning as well as to automate daily tasks of teaching (e.g. feedback and assessment). AI has been extensively used in education in different forms such as computer programs, humanoid robots, web-based chatbots, and online platforms. Chen et al. (2022) indicate the usefulness of AI in education, which may be used in the form of intelligent tutoring systems for special education, natural language processing, educational robots, performance prediction, discourse analysis, teaching evaluation, learner emotion detection and personalized learning. (AlFarsi et al., 2021).(Sadiku et al., 2021). (Southgate et al., 2019).

Learning Analytics

It was revealed that learning analytics provides great potential to promote inclusiveness in terms of reducing discrimination, increasing retention among disadvantaged students, and validating particular learning designs for marginalized groups. This open technology It's often assumed in education that its benefits are distributed, that everyone has equal chances of succeeding and that the educational ecosystem is, per se, value and power-free. One of the dominant beliefs is that all learners can succeed if they try hard enough, show grit and resilience and take control of their learning and opportunities (Reed & Jeremiah, 2017; Warren & Hale, 2020).

Though student data has always been used in education, the increased volumes, variety, and velocity of data led to a new research focus and practice called learning analytics (Long & Siemens, 2011).

The definition of learning analytics was established in 2011 and is generally accepted to be the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs (Long & Siemens, 2011).

As learning is transitioning towards being digital and datafied, student data from digital learning environments can provide stakeholders (e.g., students, instructors, administrators, student centres, etc.) with actionable information (Khalil et al., 2018). That is, it has the potential to facilitate the design and implementation of more appropriate and effective learning pedagogies, empower active learning, identify factors impacting student success, and support the design of courses to meet students' individual needs (Samuelsen et al., 2019; Nguyen, Tuunanen, Gardner & Sheridan, 2021).

Cloud Computing as open source tool

The cloud has had a huge impact on the way we use the internet and organize our online lives over recent years, and is one of the most fast-developing aspects of digital technology. It affects our home and work life, and is also revolutionizing online learning. The impact on those with special educational needs can be even more significant. Some of the tool that can be use is a virtualized desktop from a basic laptop, PC or tablet, and access all the educational resources they need, from any location. This means that being of limited mobility, or having other disabilities that restrict the ability to attend school or college, are no longer barriers to achieving a full education and excelling academically.

The tool equally can provide greater and more flexible learning opportunities to everyone, regardless of their age, sex, wealth or social demographic. (Bosse,2016). The use of cloud technology has also ensured that this inclusivity also extends to those with special educational needs. It is seen as a platform that offers significant benefits for people of all ages and abilities. It can empower people with visual, learning, age- related, mobility, hearing and speech disabilities to learn more effectively, engage and collaborate with others more easily, and express themselves more clearly. Cloud-based technologies such as natural language processing, AI and machine learning can deliver assistive technologies such as audio captioning and speech and image recognition. And because the cloud is a repository for custom settings, learners can access

information and services formatted to meet their preferences wherever they go, on almost any device. (UNESCO; 2021; ISO, 2012; Mir Ali, 2017; & G3ict)

Big Data Analytics & Open Technology tool

Researchers have proven beyond reasonable doubt that, in this era of technological applications and its use for teaching and learning, especially, in dealing with learners with disabilities which demand all-inclusiveness, Big-data-analytics is one of the open source tool that can be of immense use and this is because, the Teaching-Learning process is changing significantly due to new technological changes. The adoption of Big Data Analytics in the education sector will enables it to strengthen further and reform the system. Therefore, simply put an analytics is defined as a body of knowledge consisting of research techniques in mathematics, statistics, and operations; data collection and storage; techniques of artificial intelligence like deep learning algorithms and machine learning; and big data technologies such as Spark, Hadoop, and Hive. In areas where such data or information is stored, analytics is instrumental.

Analytics deployment is critical to differentiated services and developing new competitive strategies. Analytics is being used as a business strategy by many big organizations such as Apple, Amazon, and Facebook in the present context. Data in significant volume or data over 1 terabyte generated with wide variety and veracity at high velocity is defined as big data. Over the last few years, Big Data has gained much acceptance in various industries (Dagiliene and Kloviene, 2019; Manyika et al., 2011; Corte-Real et al., 2017; Waller and Fawcett, 2013;

Gupta and George, 2016). Optimization of resources, understanding consumer engagement patterns, and improving customer service are important uses of big data. There is an enormous amount of data generated around us from plenty of sources in the present business scenario. Thus, it is necessary to use this vast data present around us.

Techniques that an organization can use to analyze this volume of data are defined as big data analytics (BDA) (Kwon et al., 2014; Gantz and Reinsel, 2012). The emergence of digital devices like mobile phones, laptops, tablets, and social media popularity has led to a rise in big data analytics (BDA) (Gandomi and Haider, 2015). Big Data technologies help organizations in becoming competitive, extending firm performance, and sustaining in the dynamic Kwon et al., 2014). Data discovery and visualization and advanced analytics are two robust data analytics solutions. Data discovery and visualization simplify accessing that data and analyzing the data for rapid decision making and reporting. In contrast, advanced analytics solutions help optimize resources and derive faster customer insights.

Advantages around the use of open technology for learning in an inclusive setting

Researches have shown that creating inclusive classes can help learners improve their performance by enhancing their learning this implies a key starting point for inclusion is making sure everyone feels like they belong to the class community where they have opportunities to be heard and engage with classmates. As an IUB instructor, you have access to technologies to engage every student in your class by giving them a voice and helping create a true learning community. It was on this note that, Muruyama, et. al., 2000, identified the following advantages as thus:

Flexibility: The biggest benefit of open source is that it offers great flexibility to use the platform according to your needs. Interoperability and connectivity with the existing infrastructure or the platform is easier to attain and it also offers the liberty to the users to make changes to its features.

Reliability: Open source is always under continuous review, which leads to more reliability of the platform. Programs like Apache, DNS, HTML and Perl have proven to be robust and reliable even under strict conditions. Since developers devote their time and expertise, it is updated frequently and various features get added to it from time to time.

Quality: A software platform that is developed by countless users usually improves the quality of the product as many new and innovative features get added and the product gets enhanced. In general, the technology gets closer to the users as they can have a free hand in making it also. And this is the prime reason for enterprises to choose the software.

Support options: Open source is usually available for free and it has a huge community group to support the piece of software. The community works together and creates various modules that can be used by paid support options. The price still lies far ….

Challenges and Inhibiting factors associated with open technologies uses fo inclusive learning

Inclusive education has been enacted from a rights-based philosophy, implementation which requires a change in the mindset of school principals and teachers. Although, in overall, teachers are said to support inclusion, the inclusion of different groups of children, especially those with social, emotional or behavioral difficulties, continues to be considered as problematic and which teachers are expected to managed. But scholars such as (Hornby, 2014). Identified the following:

1. Classroom teacher demands,
2. The quality of support for students,
3. The degree of knowledge, understanding, and expertise required by classroom teachers
4. The uncertainty and time-consuming nature of identifying different approaches when providing support,
5. Poor infrastructural ICT facilities needed in schools to translate related curriculum content of learners' with special needs during lesson
6. Gaps in skill and competency of special class teachers in handling technology for teaching & learning
7. There is a shortage of computers, tablets and other devices for conducting electronic lessons and homework. For inclusiveness in learning for an inclusive classroom

Theoretical Frame work supporting the use of open technologies for inclusive education

In view of Ertmer & Newby, (2013), noted that learning theories provide curriculum designers with instructional strategies and techniques verified to facilitate learning in classrooms, which includes the need to implement inclusive education practices for students with special educational needs, especially in general education settings. These instructional strategies and techniques

include modifications of curricula and instructional design, the development of structures, and the use of evidence-based practices. Three major theories are considered to underpin inclusive education theory. Effective inclusive education practices should incorporate ideas from each of these theories so that teachers can successfully make curricular and instructional decisions for each student. These theories are identified as: Behaviourism, Cognitivism, Constructivism. The foremost theory, behaviorisms-based inclusive education practices include the application of behaviourism in inclusive education settings, which clearly appears in the emphasis on student behaviour and performance in manipulating stimulus materials (Ertmer & Newby, 2013).

Examples of behaviourism-based inclusive education practices are included in well-known instructional approaches such as explicit or direct instruction (Al-Shammari, 2019A; Steele, 2005). The method has shown positive research results with students with special needs in general education classrooms (Al-Shammari, Al-Sharoufi, & Yawkey, 2008)

Theoretically, behaviourism is one of the classical theories of learning and also recognized as the oldest. Behaviorism is known as a predominant psychological model as suggested by the metaphor for, 'learning as the acquisition of stimulus-response pairs' (Doolittle, 2014). Behaviourists 'believe the objective of the theory is to impart to the learner the knowledge of reality Behaviourism occurs when consequences are associated with the stimulus or response that is followed by reinforcement to be maintained (Ertmer & Newby, 2013).

To summarize, the key principles of behaviourism that support education are: behaviour is learned, behaviour is governed by the setting in which it occurs, teaching does not occur without learning, learning equates to changing behaviour, behaviour is governed by what follows actions, and there needs to be a focus on the observable. While, Cognitivism-based inclusive education practices are specifically the applications of cognitivism in inclusion settings, which involves the emphasis on mental information processing and interactions to guide student learning. And lastly, Constructivism-based inclusive education practices emphasise making learning more meaningful and using real-life experiences. (Abramson,(2013; Akpan, & Beard 2016;Al-Shammari, 2019A)

Conclusion

In conclusion, it is important to stressed that, Inclusive Education is an on-going, long-lasting process that needs to be pursued with determination, despite the significant challenges it poses; in this direction, all the available/ suitable means should be employed, including technological tools that are widely recognized as having high potential at these ends if SDG-4 is to be fully achieved. Similarly, this so because of the promise of contemporary technology lives in what these tools can do that previous learning and educational technologies could not meaning they are open, connected, individualizable, free accessibility, flexible to be modified to suite a given curricular content of a special needs of the learners and above all free to be use with no cost implications

Recommendation

The following recommendations are made for more effective uses of open technologies tools for inclusiveness in the class of learners with disability as thus:

i. Classroom teacher demands, in relation to curriculum interpretation with special need learners should be viable and achievable
ii. The quality of support for learners with diverse challenges to cater for diverse needs should be available
iii. The degree of knowledge, understanding, and expertise required by classroom teachers should be gauged as been appropriate for learners with disability
iv. The uncertainty and time-consuming nature of identifying different approaches when providing support, should be resolved
v. Needed infrastructural ICT facilities needed in schools to translate related curriculum content of learners' with special needs during lesson should be ensured
vi. Gaps in skill and competency of special class teachers in handling technology for teaching & learning should be taking care of through training and re-training programme

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PRACTICAL TECHNOLOGICAL SKILLS IMPROVEMENT NEEDS OF EDUCATIONAL TECHNOLOGY PRACTITIONERS IN NIGER STATE, NIGERIA

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Abstract

This study assessed practical technological skills improvement needs of educational technology practitioner's in Niger state, Nigeria. The study adopted a descriptive survey research design. The study was guided by three research questions. The population of this study comprised of all Educational technology practitioners in Niger State. A sample of 66 educational technology practitioners were selected using Purposive Sampling Technique. A researcher-designed structured questionnaire was used for data collection and was validated by five experts. The questionnaire was pilot tested and the data obtained were subjected to statistical analysis using Cronbach Alpha Correlation Formula and reliability coefficients of 0.91 and 0.85 were obtained for practical technological skills required and possessed by Educational technology practitioners respectively. Descriptive statistics of Mean, Mean Rank and Standard Deviation were used to answer the research questions. Findings of the study revealed practical technological skills are required and possessed by Educational technology with grand means of 2.98 and 2.87 respectively. Use of Edmodo to share text, video, homework and assignment with students and teaching of students how to make their own web page were practical technological skills not possessed by educational technology practitioners in Niger State and were ranked 14th and 15th with mean of 2.44 and 2.42 respectively. In light of the findings, it was recommended among others that educational technology practitioners should be encouraged to acquire the needed skills and abilities; enabling environment that would enable them utilise these possessed skills should be provided.

Keywords: practical, technological, skills, improvement, needs

Introduction

The integration of technology into education has given rise to educational technology or instructional technology which entails the embedding of hardware and software as tools for teaching and learning process (Owolabi, 2020). Hence, the 21st-century classroom is equipped with technological tools, gadgets and devices to enhance the teaching and learning process. Educational technology which is devoted to design, development, and application of divers media, technologies and tools in teaching and learning intended to promote and enhance teaching and learning. British educational communication and technology (BECTA, 2018). Educational technology as a study and ethical practice, comprise of facilitation of learning and improving performance by creating, using, and managing appropriate technological processes and resources (hardware and software) in a systematic and interactive process of designing instruction to improve educational performance. Similarly, Chisale (2021) defined educational technology as both a process and product, educational technology as a product involves the utilization of particular devices by educational technology practitioners for teaching and learning. As a field, educational

technology emphasizes communication skills, problem solving ability, and approaches to teaching and learning through the judicious use and integration of diver's media into teaching and learning by educational technology practitioners (Arockiasamu, 2018).

Educational technology practitioners are individuals in the field of educational technology confined with the responsibilities to help others acquire knowledge, gain competences or values and technological skills in preparation for graduation and future employment, western governors University (WGU, 2021). These practitioners include educational technology lecturers, instructional designers, technical support staffs, media technologies, and private practitioners among others. Educational technology practitioners possess the capacity and practical technological skills to integrate the right technologies in the right content and right pedagogy to inculcate instructions in the students. An educational technology practitioner is always dynamic and believes in change and have the capacity to prepare future leaders and develop in them the skills that they may need to succeed, teachers certificate Degree (TCD, 2021). Hence, it is essential for them to be technologically savvy, organized, and possess practical technology skills. These practitioners must always be abreast with recent innovations and technologies because of the daily emergence of new technology devices or tools. This could be through workshop organization, seminars, training, in-service, through self-development and working experiences. Educational technology practitioners are individuals who work with school representatives, administrative, and teachers to implement technological solutions in classrooms and other education settings.

Educational technology practitioner advocates for the use of appropriate technology in an academic settings, and help schools use technology to make classroom learning exciting without compromising the integrity of the learning environment. It is the responsibility of Educational technology practitioners to help schools integrate technologies in their classrooms and also educate teachers and non-teaching staffs about programmes that can help make other aspect of student management easier (WGU, 2021). The effective and efficient utilization of technology by educational technology practitioner will enable students to use computer as well as other technologies for learning and problem-solving which is a paramount skill in this 21st-century. In addition the utilization of educational technology devices could save time and improve the effectiveness of students' learning efforts, and student overall learning. It will creates the right learning environments where students are further inspired to attend, and have a better opportunity of communication, collaboration and have greater likelihoods of using higher order thinking and problem-solving skills.

With Educational technology, teachers as educational technology practitioners can upgrade and improve the learner-centeredness of their classroom. It is paramount for educational technology practitioners to integrate technologies in teaching and learning and have strong problem-solving skills, teaching experience, knowledge of classroom management and how technologies are actually used in a classroom setting. Hence, it is necessary for educational technology practitioners to be competent at work and possess the relevant knowledge, and practical skills of integrating all technology tools for effective teaching and learning. This skills involve the ability to write software or website, modules to support classroom activities (Chisale, 2021). Tukur (2018) defined skills as the ability to perform a task with some degree of expertise or proficiency displayed in the

performance of a given task. Skills could also be the manifestation of acquired knowledge by an educational technology lecturer that is translated into practical activity or performance of operational task which can be called technological skills.

Technological skills are important in every field of endeavours, since the performance or execution of any job requires the use of multiple skills. Practical technology skills are specifically important in all technologically related discipline without which work cannot be carried out. Practical technology skills allow educational technology practitioners to use their acquired skills and expertise in performing physical or digital tasks with computer and other technology devices for content delivery to students. Practical technology skills are necessary for an educational technology practitioner to be competent in his job in integrating technology in teaching and learning process, designing, evaluating technology media and operation of media (Chisale, 2021).

Practical technology skills enables educational technology practitioners to operate computer, surf the internet, mounting and operating the projector, using document camera, and to download and upload materials and also to use the power point and edit document from the net. These skills and abilities are required by educational technology lecturers in order to discharge their primary duty more efficiently, since they use technology tools and media for teaching and learning. Educational technology practitioner must possess the requisite qualification of both the manipulative skills and other theoretical knowledge to carry out their duties effectively (Chisale, 2021). Therefore, an educational technology practitioner is expected to possess practical technology skills to be able to operate the computer and other related media for successful lesson delivery (Tukur, 2018).

Technical skills are job-specific or related skills that is required for the performance of a particular job in every field of endeavours, and educational technology as a field of study is not an exceptional since it involves the use of technology tools to deliver and enhance teaching and learning, so its practitioners must possess the needed skills to be able to properly mix the right technology, pedagogy, and content for effective teaching and learning. Realizing the daily advent of new technologies as a result of the advancement by ICT, skills requirement becomes necessary to bridge the gap to attained professionalism and to reach the peak of career in the working place (Chisale, 2021). Practical technological skills required in the field of educational technology include: the application of computer and computer related tools that requires hands on tools such as the use of white board, document camera, virtual meeting and classroom, the use of power point, website search, website design dawn loading of materials from the web, editing and uploading assignment for student among others. However, Tukur (2018) observed that majority of educational technology practitioners have failed in discharging their duties by neglecting the integration of technology media in the teaching and learning, concentrating only on the theoretical aspect due to lack of sufficient knowledge and skills. The non-integration of technologies by educational technology practitioners could be attributed to insufficient possession of required practical technological skills by educational technology practitioners. Which is a determinant factor for improvement needs of educational technology practitioners.

Improvement can be referred to as a change for the better, progress and development. Skills improvement need refer to what is required. Therefore, improvement need can be referring to a gap between the skills possessed and the skills needed to enables the teacher to teach effectively

(Tukur, 2018). Skills improvement need is the knowledge, attitude and skills required of filling the gap created between the knowledge, attitude and skills possessed by Educational technology practitioners. 21st century, employers and recruiters have realized that it is much easier to train smart individuals how to perform the specifics of any role this is as long as they have already acquire a much harder to teach skills set. This skills set comprises critical thinking, soft skills, strong work ethics skills, computer and electronic skills, mathematics skills, programming attention to detail, self-confidence skills, decisions and solve problem skills, plan, organizing and prioritizing work skills, leadership/management skills, analytical and research skills, flexible/adaptability skills, and interpersonal ability and some basic competency in a few areas of expertise. It is against this that this study intends to assess the influence of years of experience and academic qualifications on practical technological skills improvement need of educational technology practitioners in Niger State.

Statement of the Research Problem

In this fourth education revolution, technology is a major feature in educational activities as its usage is essential for the effective instructional delivery. Globally, educational systems are experiencing digital transformation that is accelerated exponentially by the use of technological driven innovations for teaching and learning which has resulted in a paradigm shift in educational activities and system. The integration of technology in education offers tremendous opportunity to improve access to quality education which can improve learning and enhance employability skills, develop and advance 21st-century skills in learners among which are information and digital literacies, leadership skills, critical thinking, analytical skills, problem solving, and collaboration skills.

The importance of integrating technology in Nigerian's institutions cannot be over- emphasized as it will improve the educational standard of the country benefiting both educators and learners. However, technologies are rarely used in Nigerian's institutions. This in adequate utilisation of technologies in Nigerian institutions can lead to ineffective teaching, and ineffective teaching or poor instructional delivery can lead to poor academic achievement. This poor technology skills by the lecturers will result to poor design of software and other educational resources which will continue to deteriorate the educational system. The inability to use media technology to facilitate and improve teaching and learning in Nigeria may lead to the production of graduates that do not possess the 21st century employability skills and cannot compete in the global market. Similarly, Dikko (2017) attributed the non-utilisation of technologies in Nigerian institutions by educational technology practitioners to their in adequate technology skills and confidence in applying them for instructional purposes. Therefore, it is paramount that the technological skills of the educational technology practitioners should be improved. To improve their technological skills, the practical technological skills possessed must be ascertained and then the practical technological skills required investigated so that proper remediation could be achieved. It is against this, background that the study seeks to investigate the practical technological skills improvement need of Educational technology practitioners in Niger State, Nigeria.

Aim and Objectives of the Study

The aim of this study is to determine the practical technological skills improvement need of educational technology practitioners in Niger State, Nigeria. The specific objectives are to:

1. Determine the practical technological skills required by educational technology practitioners in Niger State,
2. Determine the practical technological skills possessed by educational technology practitioners in Niger State;
3. To determine the skills improvement need of educational technology practitioners in Niger State.

Research Questions

The following research questions are raised and answered in the study:

1. What are the practical technological skills required by educational technology practitioners in Niger State?
2. What are the practical technological skills possessed by educational technology practitioners in Niger State?
3. What are the skills improvement need of educational technology practitioners in Niger State?

Research Methodology

The research design adopted for this study is a descriptive survey design. Descriptive survey design is used to describe the distinctiveness or characteristics of individual or groups in a population or a sample of the population, and the relationship that exist between variables (Devin, 2021). Since, this study assessed practical technology skills improvement needs of Educational technology practitioners in Niger State. Descriptive survey design is considered appropriate for the study. The population of this study comprised of all Educational technology practitioners in Niger State. Purposive sampling was be used to select four tertiary institutions in Niger State where educational technology practitioners work as lecturers, programmers, instructional designers, and support staffs. Hence, the sample size was 66 educational technology practitioners in Niger state.

A researcher developed questionnaire was used for data collection. The questionnaire entitled Practical Technological Skills Improvement Need of Educational Technology Practitioner in Niger State (QPTS) consist of two sections. Section A and B, Section A consist of 15 items titled practical technological skills required by Educational technology practitioners was structured on four-point likert scale of Strongly Disagree (SD) = 1, Disagree (D) = 2, Agree (A) = 3, Strongly Agree (SA) = 4 to elicit data on practical technological skills required by educational technology practitioners in Niger State. Section B consist of 15 items titled practical technological skills possessed by educational technology practitioners was structured on four-point likert scale of Strongly Disagree (SD) = 1, Disagree (D) =2, Agree (A) =3, Strongly Agree (SA) = 4 to collect data on practical technological skills possessed by educational technology practitioners in Niger State. A mean

score of 2.50 and above was considered acceptable mean for agreement while a mean score below 2.50 considered not acceptable.

The developed questionnaire was validated by five experts. Two experts from the department of Educational Technology, Federal University of Technology Minna, One educational technology expert from College of Education Minna Niger State, One Psychologist from College of Education Maiduguri and one expert from Industrial Technology Education (ITE) Federal University of Technology Minna Niger State. All corrections and suggestions were effected in the final draft of the instrument. The corrections of the validators include spelling, tense structure, and suitability, use of language and logical arrangement of the items. To determine the reliability of the questionnaire, a pilot-test was conducted on 10 educational technology practitioners who are randomly selected in private and government owned secondary schools in Minna Niger State who were part of the population but are not part of the sample, the data collected were subjected to statistical analysis using Cronbach Alpha to determine the internal consistency of the items. The reliability coefficients of the different constructs of the instrument obtained were 0.91 for section A and B respectively.

Results

Research Question One: What are the practical technological skills required by educational technology practitioners in Niger State?

To answer research question one, Mean, and Mean Rank were used as presented in Table 4.1

Table 4.1: Mean and Mean Rank of the practical technological skills required by educational technology practitioners in Niger State

Table 4.1: Mean and Mean Rank of the practical technological skills required by educational technology practitioners in Niger State

S/N	Items	N	Mean	Rank	Decision
1	Ability to use the internet to look for information and resources in preparation for lesson	66	3.33	1	Agree
2	Ability to teach the students how to operate the projector and digital camera	66	3.12	7	Agree
3	Ability to understand software copyright ethical and related issues	66	2.98	8	Agree
4	Ability to classify the three technological configuration available Additive, Integrated and Independent	66	2.77	10	Agree
5	Ability to use web board and set up discussion group for the students	66	2.76	12	Agree
6	Ability to create web page and use it for instruction	66	2.67	15	Agree

7	Skills to keep track of new instructional media and their use in teaching and learning	66	2.77	10	Agree
8	Skills for computer security knowledge	66	2.86	9	Agree
9	Skills to use authoring tools to design computer aided instruction	66	2.70	14	Agree
10	Skills to make short video using computer, android phone, and Digital camera	66	3.21	4	Agree
11	Skills to burn text, video on computer disk (CDs) using computer	66	3.26	2	Agree
12	Skills to upload text, sound (audio), pictures, video on the internet using computer	66	3.23	3	Agree
13	Skills to use web blogs for the class	66	2.73	13	Agree
14	Skills to develop course ware for the students	66	3.21	4	Agree
15	Ability to install software into the computer	66	3.15	6	Agree
	Grand Mean	**66**	**2.98**		**Agree**

Decision Mean = 2.5

Table 4.1 shows the mean and mean rank of the practical technological skills required by educational technology practitioners in Niger State. The findings indicated that abilities to use the internet to look for information and resources in preparation for lesson was most required for Educational technology practitioners in Niger State with the highest mean of 3.33 and rank first. Skills to burn text, video on computer disk (CDs) using computer, upload text, sound (audio), pictures, video on the internet using computer, develop course ware for the students, make short video using computer, android phone, and digital camera, install software into the computer, teach the students how to operate the projector and digital camera, understand software copyright ethical and related issues of computer security knowledge, classify the three technological configuration available of additive, integrated and independent, use web board and set up discussion group for the students , create web page and use it for instruction are also required by educational technology practitioners in Niger State and were ranked 2nd, 3rd, 4th, 6th, 7th, 8th, 9th, 10th, 12th and 15th respectively.

Furthermore, skills to make short video using computer, android phone, and digital camera, skills for computer security knowledge, keeping track of new instructional media and their use in teaching and learning, use web blogs for the class, use authoring tools to design computer aided instruction are also required by educational technology practitioners in Niger State and were ranked 4th, 9th, 10th, 13th, and 14th respectively. The mean of 2.5 was used as the benchmark. The mean of 2.5 and above was considered ‘Agree’, and the mean of less than 2.5 was considered ‘Disagree’. The table further revealed that the grand mean score response to the 15 items is 2.98, which is above the decision mean; this implies that the various listed practical technological skills are required by educational technology practitioners in Niger State.

Research Question Two: What are the practical technological skills possessed by educational technology practitioners in Niger State?

To answer research question two, Mean and Standard Deviation were used as presented in Table 4.2**Table 4.2**: Mean and Standard Deviation of the practical technological skills possessed by educational technology practitioners in Niger State.

S/N	Items	N	Mean	Std.	Decision
1	I use power point to illustrate concepts in my teaching	66	2.94	0.86	Agree
2	I use Excel to compute my class scores	66	3.12	0.85	Agree
3	I uses Edmodo to share text, video, homework and assignment with my students	66	2.44	0.90	Disagree
4	I use E-mail to communicate with my students	66	3.12	0.95	Agree
5	I teach my students how to use SPSS in their project	66	2.70	0.86	Agree
6	I teach my students how to make their own web page	66	2.42	0.84	Disagree
7	I teach my students how to save downloaded text, sound, pictures and video materials	66	3.02	0.87	Agree
8	I set up video conferencing and use it to teach	66	2.98	0.85	Agree
9	I teach my students how to use Google classroom	66	2.92	0.86	Agree
10	I troubleshot various software problem such as translation, compression of image files, and cross-platform issues	66	2.67	0.71	Agree
11	I collaborate with other lecturers on a project through ICT	66	3.05	0.75	Agree
12	I design online tutorship to follow students learning	66	2.76	0.96	Agree
13	I explore website (portals, web pages, electronic magazine Dictionary, search engine) related to my specialty	66	3.11	0.81	Agree

14	I use flash drive, CD-Room, DVD to store important information pertaining my students	66	3.17	1.03	Agree
15	I use smart board to teach	66	2.64	0.91	Agree
	Total		**2.87**	**0.87**	**Agree**

Decision Mean = 2.5

Table 4.2 shows the mean and standard deviation of the practical technological skills possessed by educational technology practitioners in Niger State. The mean of 2.5 and above was used as the benchmark for 'Agree', and the mean of less than 2.5 is considered 'Disagree'. Consequently, 15 items were listed. The finding indicated that the use of flash drive, CD-Room, DVD to store important information pertaining students was most possessed for Educational technology practitioners in Niger State with the highest mean of 3.17. Use of E-mail to communicate with students, Excel to compute class scores, website (portals, web pages, electronic magazine Dictionary, search engine) related to specialty, collaboration with other lecturers on a project through ICT, teaching students how to save downloaded text, sound, pictures and video materials, set up and use of video conferencing, use of power point to illustrate concepts in teaching, teach students how to use Google classroom, design online tutorship to follow students learning, teach students how to use SPSS, troubleshot various software problem such as translation, compression of image files, and cross-platform issues, use of smart board to teach are the practical technological skills possessed by educational technology practitioners in Niger State with mean score of 3.12, 3.12, 3.11, 3.05, 3.02, 2.98, 2.94, 2.92, 2.76, 2.70, 2.67, and 2.64 respectively. However, use of Edmodo to share text, video, homework and assignment with students and teaching of students how to make their own web page were practical technological skills not possessed by educational technology practitioners in Niger State with mean scores of 2.44 and 2.42 respectively. The table further revealed that the grand mean score response to the 15 items is 2.87, which is above the decision mean; this implies that educational technology practitioners possessed practical technological skills in Niger State.

Research question three: What are the skills improvement need of educational technology practitioners in Niger State?

To answer research question three, Mean, and Mean Rank were used as presented in Table 4.3

Table 4.3: Mean and Mean Rank of the practical technological skills possessed by educational technology practitioners in Niger State

S/N	Items	N	Mean	Rank	Decision
1	I use power point to illustrate concepts in my teaching	66	2.94	8	Agree
2	I use Excel to compute my class scores	66	3.12	2	Agree
3	I uses Edmodo to share text, video, homework and assignment with my students	66	2.44	14	Disagree

4	I use E-mail to communicate with my students	66	3.12	2	Agree
5	I teach my students how to use SPSS in their project	66	2.70	11	Agree
6	I teach my students how to make their own web page	66	2.42	15	Disagree
7	I teach my students how to save downloaded text, sound, pictures and video materials	66	3.02	6	Agree
8	I set up video conferencing and use it to teach	66	2.98	7	Agree
9	I teach my students how to use Google classroom	66	2.92	9	Agree
10	I troubleshot various software problem such as translation, compression of image files, and cross-platform issues	66	2.67	12	Agree
11	I collaborate with other lecturers on a project through ICT	66	3.05	5	Agree
12	I design online tutorship to follow students learning	66	2.76	10	Agree
13	I explore website (portals, web pages, electronic magazine Dictionary, search engine) related to my specialty	66	3.11	4	Agree
14	I use flash drive, CD-Room, DVD to store important information pertaining my students	66	3.17	1	Agree
15	I use smart board to teach	66	2.64	13	Agree
	Total		**2.87**		**Agree**

Decision Mean = 2.5

Table 4.3 shows the mean and mean rank of the practical technological skills possessed by educational technology practitioners in Niger State. The findings indicated that the use of flash drive, CD-Room, DVD to store important information pertaining students was most possessed for Educational technology practitioners in Niger State with the highest mean of 3.17 and rank first. Use of E-mail to communicate with students, Excel to compute class scores, website (portals, web pages, electronic magazine Dictionary, search engine) related to specialty, collaboration with other lecturers on a project through ICT, teaching students how to save downloaded text, sound, pictures and video materials, set up and use of video conferencing, use of power point to illustrate concepts in teaching, teach students how to use Google classroom, design online tutorship to follow students learning, teach students how to use SPSS, troubleshot various software problem such as translation, compression of image files, and cross-platform issues, use of smart board to teach are the practical technological skills possessed by educational technology practitioners in Niger State and were ranked 2nd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, and 13th respectively. However, use of Edmodo to share text, video, homework and assignment with students and teaching of

students how to make their own web page were practical technological skills not possessed by educational technology practitioners in Niger State and were ranked 14th and 15th respectively. The mean of 2.5 and above was used as the benchmark for 'Agree', and the mean of less than 2.5 is considered 'Disagree'. Hence, skills improvement needs of educational technology practitioners in Niger State are skills on the use of Edmodo to share text, video, homework and assignment with students and teach students how to make th**eir own web page.**

Discussion of Findings

Finding from this study revealed that practical technological skills are required by educational technology practitioners in Niger State, this finding agrees with the finding of Aliyu et al. (2016) whose study showed that 53 ICT competencies were needed by the automobile technology teachers towards the development of ICT for effective teaching-learning purposes in the technical colleges. Similarly, Livinus et al. (2017) findings found out that six skills were required to improve the work skill requirement of students offering Building Construction in technical colleges in Benue state. In addition, Ehimen and Ezeora (2018) finding also showed that technical college graduates needed skills to identify symbols, to use measuring instrument, read blueprint. Surajudeen and Ismail (2018) study also found out that lecturers of technical education and computer education needed capacity building in the operating computer, uploading of text on the internet and videoconferencing for e-teaching in universities. In the same vein, Tella, et al. (2018) study showed that the basic ICT required for recruitment of librarian into the academic and research libraries at the digital age are the specific ICT skills useful and relevant to each unit of the library and the general skills such as word processing, spreadsheets/excel, power point presentations, knowledge of databases, files folders, email/internet, hardware/software, web design and management, mobile technology and social media skills.

Furthermore, Michika and Manabete (2019) findings also revealed that lecturers teaching in polytechnics required ICT peripheral equipment competencies such as use of the digital camera, use of the web camera for internet communication, use of the scanner to copy messages, setting up and using Liquid Crystal Displays (LCDs) and use of a multimedia projector. Idris et al. (202) finding also revealed that technical skills are required for self-reliance in automobile mechanics occupation, automobile diagnostic tools and equipment, technical skills in the servicing, maintenance and repairs of the systems and sub systems of the motor vehicles. Similarly, Wombo (2020) study revealed that ability to operate computer, browse the internet, send and receive text/pictures/sound, participate in video conferencing, burn text/ video on computer discs and upload text/sound/pictures/ video are the technical competencies required for the modern instructional delivery approaches. Offia et al. (2020) finding also revealed that electrical electronics engineering student requires electrical design, and drafting skills, electrical machine operating skills, general safety skills among other technical skills for employment in oil and gas industry.

Discovery from the study revealed that educational technology practitioners possessed practical technological skills in Niger State, this finding agrees with that of Ridwan et al. (2019) whose study revealed that the level of ICT competencies of lecturers in universities in Benue State is high. Similarly, Basil et al. (2020) findings revealed that undergraduate students possessed the

relevant ICT skills that will enhance their learning. Oluseyi, et al. (2020) study also revealed that out of four competencies assessed, two were moderately possessed (planning of instruction and classroom instruction skills) one was fairly possessed (practical demonstration skills) while the remaining one was not possessed (ICT skills). Obiageli et al. (2021) findings also revealed that English language teachers in secondary schools in Awka South possess the basic computer operational skills. However, this finding disagrees with that of Ogwa (2016) whose study revealed that teachers are lagging in their pedagogical skills in planning curriculum, instructional objectives and evaluation in electrical installation trade teaching.

Dzikite et al. (2017) also found out that lecturers lacked adequate technological-pedagogical-content knowledge essential for teaching in the digital society. Similarly, Ademola et al. (2018) study also revealed that most of the lecturers in colleges of education in Nigeria are not proficient in the use of power-point, excel and spreadsheet, cannot apply computers to solve real life academic problems. Jimoh et al. (2018) also revealed that lack of skills and knowledge to operate e-teaching facilities, consistent power failure, poor internet access and connectivity and inadequate knowledge to prepare e-teaching lesson were among the prominent barriers to effective utilization of e-teaching approach. Muhammed et al. (2019) findings revealed that the teachers are lagging in construction of wooden articles. In the same vein, Jimoh, et al. (2020) found out that some work-based skills in manufacturing, marketing, management, quality and safety were not possessed by technical college students.

Findings emanating from this study also revealed that skills improvement needs of educational technology practitioners in Niger State are skills on the use of Edmodo to share text, video, homework and assignment with students and teach students how to make their own web page. This finding agrees with that of Tsojon et al. (2016) who found that all the 64 skill improvement needs identified in the utilization of weather instruments were needed by Lecturers of Agricultural Education in Colleges of Education. Las et al. (2017) study also showed that most of the teachers have a basic knowledge on ICT but needs improvement. Gangbe, et al. (2019) findings also agrees with the finding of this study as it revealed that, ATE lecturers in the institutions need skills improvement training in terms of repairing and maintaining, starting and ignition system, automatic wheel balancing and alignment as well as engine diagnostic and turn up areas in ATE. Patrick (2019) finding also revealed that automobile technicians need improvement in 27 skills for servicing modern automobile engine and its support system. In addition, Asogwa and Okanya (2019) study found out that teachers of carpentry and joinery need improvement in stress grading and Computer Aided Drafting. Patiko et al. (2020) study also found that teachers of introductory technology needed improvement.

Recommendations

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

i. since, practical technological skills are required by educational technology practitioners, therefore, they should be encouraged to acquire the needed skills and abilities;

ii. educational technology practitioners possessed practical technological skills, enabling environment that would enable them utilise these possessed skills should be provided;

iii. educational technology practitioners do not possess practical technological skills on the use of Edmodo to share text, video, homework and assignment with students and teach students how to make their own web page, therefore, conferences, seminars and workshops should be organised for them on how to use Edmodo to share text, video, homework and assignment with students and teach students how to make their own web page;

iv. adequate training programmes should be organised for educational technology practitioners to equip them with the needed technology skills to use technologies in all areas of educations;

v. Curriculum planners and developers should plan and develop Educational technology curriculum to integrate practical technological skills required by educationaltechnology practitioners.

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ASSESSMENT OF UTILIZATION OF WHATSAPP FOR COLLABORATIVE LEARNING AMONG MATHEMATICS UNDERGRADUATES IN ILORIN METROPOLIS

BY

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Abstract

The study of mathematics has developed to become more engaging and interactive as a result of improvements in educational technology and the incorporation of digital learning platforms and applications as a complement to conventional classroom training. This study assessed the utilization of WhatsApp platform for collaborative learning among mathematics' undergraduates in tertiary institutions. The study adopted a quantitative research approach. A total of 207 undergraduates studying mathematics in three Universities in Kwara state were randomly selected. Data was collated using a researcher-deigned questionnaire from the respondents and were analyzed using descriptive statistics of mean count, frequency and percentage. Findings from the study indicated that undergraduate Mathematics students Utilize WhatsApp for collaborative learning; undergraduate Mathematics students Perceived WhatsApp as a useful tool for collaborative learning, and; undergraduate mathematics students face challenges while using WhatsApp for collaborative learning in Ilorin. Hence, the study recommended that for effective and efficient teaching and learning of Mathematics, teachers and curriculum developers should include the use of interactive technology such as WhatsApp into the teaching and learning process.

Keywords: Learning Mathematics; WhatsApp Platforms; Collaborative Learning;

Introduction

Mathematics, apart from being an intellectually stimulating discipline, it could also be seen as the cornerstone of all fields of studies. A crucial part of education is learning mathematics, which helps students develop their reflective thinking skills, critical thinking, problem-solving, and numeracy skills (Keziah & Ronel, 2022). It is critical for students to understand the fundamentals of mathematics since it is so important in many disciplines, including science, technology and education. Nowadays, critical thinking in answering Mathematics is a required skill for an individual to have better performance in Mathematics as well as choosing the appropriate strategy and analyzing the mathematics' problem thoroughly (Incebacak & Ersoy, 2016).

The study of mathematics has developed to become more engaging and interactive as a result of improvements in educational technology and the incorporation of cutting-edge teaching approaches. Digital learning platforms and applications are one well-known strategy that has gained traction as a complement to conventional classroom training. Students may study mathematics at their own speed using interactive courses, digital manipulatives, and real-time

feedback provided by digital learning platforms like Khan Academy, Wolfram Alpha, and Desmos etc. As shown in research by Su et al. (2021), these platforms offer tailored learning experiences, adjusting information to each student's strengths and shortcomings. According to the study's conclusions, mathematics performance among students using individualized digital learning platforms was much higher than that of students in conventional classrooms.

Moreover, gamification has been integrated into mathematics learning to increase students' motivation and engagement. Gamified mathematics apps, like Prodigy and Math Bingo, incorporate game elements, rewards, and challenges, making the learning process more enjoyable and rewarding for students. A study by Lee et al. (2022) found that the gamified approach enhanced students' problem-solving skills and perseverance in tackling complex mathematical challenges.

Collaborative learning has also been recognized as a beneficial strategy in mathematics education. Group activities, peer discussions, and collaborative problem-solving tasks allow students to share insights, exchange ideas, and deepen their understanding through interaction. A research study by Ofori-Kusi & Tachie (2022) reported that exploring social media like WhatsApp platform for teaching and learning of mathematics improve students understanding of mathematical concept and recommended that WhatsApp learning group can be a viable alternative to the teaching and learning at the university when face-to-face learning is not possible. Therefore, active learning strategies like the use of digital platform encourage students to engage in hands-on activities, problem-solving exercises, and group discussions to deepen their understanding of mathematical concepts.

Research by Hiebert et al. (2021) highlights the effectiveness of active learning strategies such as problem-based learning, flipped classrooms, and inquiry-based instruction in improving students' mathematical proficiency. These strategies encourage students to actively construct knowledge, make connections, and apply mathematical principles in real-world contexts. The integration of technology in mathematics education has revolutionized the learning experience. Interactive software, online platforms, and educational apps provide students with opportunities for dynamic exploration and visualization of mathematical concepts. A study by Wu and Chen (2022) found that technology-enhanced learning environments, such as virtual manipulatives and simulation tools, promote conceptual understanding and problem-solving skills among mathematics students in tertiary institutions.

WhatsApp, a mobile instant messaging application, has experienced rapid growth and widespread adoption worldwide, with over 2 billion active users as of 2021 (WhatsApp, 2021). Its popularity stems from its availability across various mobile platforms and the ability to exchange messages, multimedia files, and conduct voice and video calls. In tertiary education, students and educators have integrated WhatsApp into their learning processes due to its convenience, real-time communication, and familiarity (Iqbal et al., 2022; Owusu-Fordjour et al., 2021). Within the context of this study, digital platforms like Whassap provided the learners and the lecturers with a diverse array of technology-based tools for communicating new knowledge and skills to enhance the learning process. According to Peachey (2017), digital platforms and web-based resources were used with mobile gadgets which supported by pedagogy using text, audio and video.

Patil, Deepthi and Tadasad cited in Mefolere, (2016) state that WhatsApp is an instant messaging free application that is beneficial. The Application is downloadable, and the installation is fast and easy (Ling, 2016). To use WhatsApp, one needs to have an internet connection. Also, the receiver of the message at the other end must have the application installed on the phone. Conversion on WhatsApp can be on a one-to-one basis or in a group (Ling, 2016). The latter allows up to 250 persons at a time. According to Bounik and Deshen (2014), the group chat is a unique feature of WhatsApp, and it permits communication within defined boundaries. The initiator of the group becomes the administrator, he or she is privileged to add or remove members. He/she also performs the function of changing the profile picture of the group. Members of the group have equal rights. Participants receive any message that is sent to the group, and they can respond equally.

WhatsApp is a multimedia communication platform that allows users to send contents like pictures, audio, videos, make voice calls, send document etc. The unique feature of the mobile application has made one of the best in the world. Another unique feature of WhatsApp is its group chat feature. The group chat feature allows you to communicate with up to 256 people at once (whatsapp.com, 2017).

Due to the group-based feature of WhatsApp, it is necessary to examine the application's effort in fostering collaborative learning. Dillenbourg (1999) explained collaborative learning as when two or more people come to learn something together. Collaborative learning concerns learners in active group participation throughout the entire learning process (Monteiro and Morrison, n.d). According to Kim, Lee and Kim (2014), collaborative learning can be achieved via different tools, such as discussion boards, blogs, and instant messenger. Social media's potential strength to facilitate collaborative learning appears evident, and it is supported by scholarly literature (Junco et al, 2011; Brown, 2012; Novak et al, 2012).

According to Cornell University cited in Johansson (2016) "when students learn together with others, for instance in discussion settings that provide group solving tasks or content, they are part of a collaborative learning environment". Collaborative learning could motivate participants, and also arouse their interest (Njoku and Prince, 2015; Yin, 2016; Monteiro and Morrison). Also, Eccles and Tenenbaum (2004) as cited in Kim, Lee and Kim (2014), opine that collaborative learning needs team-related skills and task-related skills to enable team members to work together smoothly and efficaciously. According to Yin (2016), students use WhatsApp to create class publications by publishing their work in the group. WhatsApp enhances online collaboration and communication and promotes students' performance (Barhoumi, 2015).

WhatsApp enables synchronous and asynchronous communication, fostering continuous interaction among students and instructors. Through instant messaging, students can seek clarification, share ideas, and engage in group discussions. The platform encourages peer-to-peer learning, as students can exchange knowledge, provide feedback, and support each other's learning processes (Iqbal et al., 2022; Owusu-Fordjour et al., 2021).

WhatsApp's interactive features promote active participation and engagement in mathematics discussions and problem-solving activities, leading to deeper conceptual understanding.(Johnson & Ramirez, 2021) WhatsApp's mobile nature allows students to access mathematical resources and collaborate anytime, anywhere, making it convenient for students to engage in mathematics

learning beyond formal classroom hours.(Garcia et al., 2023) WhatsApp's group chat functionality facilitates peer-to-peer collaboration, allowing students to learn from each other, share strategies, and provide mutual support in solving mathematical problems.(Chen et al., 2022) WhatsApp enables personalized feedback and guidance from instructors, facilitating individualized support and addressing specific learning needs in mathematics.(Baker et al., 2023)

WhatsApp's mobile nature offers students the flexibility to engage in collaborative learning anytime and anywhere. Mathematics students can access the platform using their smartphones, eliminating the need for physical presence. This accessibility facilitates active participation, particularly for distance learners or those facing time constraints (Bada & Adeyemi, 2022; Haruna et al., 2021). WhatsApp's informal and user-friendly interface fosters a sense of community among learners. It creates a comfortable environment where students can freely express their opinions, seek assistance, and form study groups. Such community-building promotes a positive learning atmosphere and helps in reducing the barriers between students and instructors (Albelbisi et al., 2022; Hämäläinen & Vähäsantanen, 2022).

In the study of Naidoo (2020) who investigated on how postgraduate mathematics education students' experiences of using digital platforms for learning within the COVID-19 pandemic era suggested that before using digital platforms for mathematics learning, it is important for students to be encouraged to practise and engage collaboratively within digital platforms. The study adds to the developing knowledge in the field concerning using digital platforms for learning mathematics within the COVID-19 pandemic era.

Statement of the Problem

The use of WhatsApp as a platform for collaborative learning in tertiary institutions is growing in popularity, but there are still a number of issues that need to be resolved if it is to be as successful as possible in helping students learn mathematics. Concerns have been raised concerning the confidentiality of educational talks and student data as a result of WhatsApp's privacy and security standards coming under investigation in recent years (Bada & Adeyemi, 2022; Iqbal et al., 2022). End-to-end encryption on the network offers a certain amount of protection, but organizations must make sure that private information transmitted on WhatsApp is sufficiently safeguarded and that students' privacy rights are upheld.

Students' focus and productivity may be negatively impacted by WhatsApp's constant accessibility and the potential for high volumes of messages due to information overload and distractions (Albelbisi et al., 2022; Hämäläinen & Vähäsantanen, 2022). The overwhelming volume of messages and notifications may make it difficult for students to prioritize and participate meaningfully in discussions. Managing the flow of information and fostering meaningful relationships are tactics that educators must address.

WhatsApp is extensively utilized, however when using it for collaborative learning, it is important to take fairness and inclusion into account. Since some students might not have access to cellphones or dependable internet connections, they might not be able to fully engage in the collaborative learning process. For inclusive educational methods to be successful, fair access must

be provided, as well as alternate participation options. However, educators require direction on successful pedagogical tactics and methodologies in order to fully realize WhatsApp's potential for collaborative learning (Bada & Adeyemi, 2022; Iqbal et al., 2022). To match WhatsApp's use with particular learning objectives and results, careful preparation and assistance are needed for its integration into the curriculum. To effectively use WhatsApp as a medium for collaborative learning, educators may need professional development opportunities and materials.

While WhatsApp has a number of collaborative capabilities for mathematics learning, more thorough study is needed to determine how it affects student learning outcomes in tertiary education (Hämäläinen & Vähäsantanen, 2022; Iqbal et al., 2022). Studies looking at how well WhatsApp promotes critical thinking, knowledge production, and general student involvement might offer insightful information to educators. To better comprehend WhatsApp's function as a platform for collaborative mathematics learning in tertiary institutions, however, it is important to address these issues and obstacles. This will help educators harness WhatsApp's potential and design inclusive and engaging learning environments.

Purpose of the Study

The purpose of this study was to:

i. Examine the use of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis.
ii. Investigate the perceived usefulness of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis
iii. Find out the challenges of using WhatsApp for collaborative learning among undergraduate Mathematics students

Research Questions

1. How does the mathematics undergraduates use WhatsApp for collaborative learning in Ilorin Metropolis?
2. What is the perceived usefulness of WhatsApp for collaborative learning among mathematics undergraduates in Ilorin Metropolis?
3. What are the challenges of using WhatsApp for collaborative learning among mathematics undergraduates in Ilorin Metropolis?

Methodology

This study employed a descriptive research method of survey type. The target population for the study were undergraduate mathematics students in Ilorin Metropolis. A researcher-designed questionnaire was used to gather response from 207 undergraduates randomly selected from three universities in Ilorin Metropolis. The research instrument had four sections. Section A had demographic information of the respondents while section B, C and D elicited responses on the

use, the perceived usefulness and the challenges of using WhatsApp by mathematics undergraduates respectively. The response mode for the instrument were strongly agree, agree, strongly disagree and disagree.

Responses gathered from the instrument were analyzed using descriptive statistics of mean count, frequency and percentage.

Results

Research Question One : What is the Use of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis

Table 1: Use of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis

S/N		SA	A	D	SD
1.	WhatsApp has been an effective platform for collaborative learning in Mathematics classes	120(60%)	45(22.5%)	20(10%)	15(7.5%)
2.	I find it easy to communicate with my peers about Mathematics topics through WhatsApp	106(53%)	54(27%)	30(15%)	10(5%)
3.	WhatsApp discussions with my peers have helped me understand complex mathematical concepts better.	126(63%)	58(29%)	10(5%)	6(6%)
4.	Collaborating on group projects through WhatsApp has enhanced my problem-solving skills in Mathematics.	90(45%)	97(48.5%)	11(5.5%)	2(1%)
5.	WhatsApp has provided a convenient way for me to seek help and clarifications from my peers when facing difficulties with Mathematics assignments.	80(40%)	40(20%)	68(34%)	12(6%)

6.	Using WhatsApp for collaborative learning has increased my motivation to engage with Mathematics course materials.	82(41%)	62(31%)	51(25.5%)	5(2.5%)
7.	I feel more confident in sharing my ideas and opinions about Mathematics topics in WhatsApp group discussions	97(48.5%)	60(30%)	30(15%)	13(6.5%)
8.	WhatsApp has facilitated effective information-sharing and resource exchange among Mathematics students.	147(73%)	33(16%)	15(7.5%)	5(2.5%)
9.	I am satisfied with the level of engagement and participation within the WhatsApp groups focused on Mathematics.	102(51%)	53(26.5%)	30(15%)	15(7.5%)
10.	WhatsApp has improved my overall learning experience in Mathematics courses.	128(64%)	50(25%)	12(6%)	10(5%)

In table above, it was revealed that the largest number of the respondents 165(82.5%) agreed on the statement: WhatsApp has been an effective platform for collaborative learning in Mathematics classes, while 35(17.5%) respondents, disagreed with the statement. 160 (80%) respondents agreed on the statement: I find it easy to communicate with my peers about Mathematics topics through WhatsApp, while 40(20%) of respondents disagreed on the statements, furthermore, 184 (92%) of the respondents agreed on the statement: WhatsApp discussions with my peers have helped me understand complex mathematical concepts better, while 16 (8%) respondents disagreed on the statement. 187(93.5%) respondents agreed on the statement: Collaborating on group projects through WhatsApp has enhanced my problem-solving skills in Mathematics, while 13 (6.5%) disagreed with the statement. 120(60%) respondents agreed on the statement: WhatsApp has provided a convenient way for me to seek help and clarifications from my peers when facing difficulties with Mathematics assignments, while 80(40%) disagreed on the statement. 144(72%) respondents agreed on the statement: Using WhatsApp for collaborative learning has increased my motivation to engage with Mathematics course materials, while 56(28%) disagreed on the statement. 157(78.5%) respondents agreed on the statement: I feel more confident in sharing my ideas and opinions about Mathematics topics in WhatsApp group discussions, while 43(21.5%) disagreed on the statement. 180(90%) respondents agreed on the statement: WhatsApp has facilitated effective information-sharing and resource exchange among Mathematics students,

while 20(10%) disagreed on the statement. 155(77.5%) respondents agreed on the statement: I am satisfied with the level of engagement and participation within the WhatsApp groups focused on Mathematics, while 45(22.5%) disagreed on the statement. 178(89%) respondents agreed on the statement: WhatsApp has improved my overall learning experience in Mathematics courses, while 22(11%) disagreed on the statement. This implies that the majority of the respondents among the undergraduate Mathematics students in Ilorin Metropolis on the Utilize WhatsApp for collaborative learning.

Research questions Two:

What is the perceived usefulness of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis

Table 2: Perceived usefulness of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis

S/N		SA	A	D	SD
1.	WhatsApp has been a valuable tool for enhancing my collaborative learning experience in Mathematics.	130(65%)	45(22.5%)	15(7.5%)	10(5%)
2.	I believe that using WhatsApp for collaborative learning has been beneficial to my understanding of Mathematics concepts.	100(50%)	60(20%)	30(15%)	10(5%)
3.	WhatsApp has proven to be a useful platform for exchanging study materials and resources related to Mathematics.	90(38%)	60(30%)	35(17.5%)	15(7.5%)
4.	Collaborating with peers on WhatsApp has improved the efficiency and effectiveness of my Mathematics learning process.	86(43%)	70(35%)	35(17.5%)	9(4.5%)
5.	I find WhatsApp to be a practical and convenient medium for engaging in group discussions and sharing ideas related to Mathematics.	104(52%)	65(32.5%)	25(12.5%)	6(3%)
6.	The use of WhatsApp has positively influenced my motivation to actively participate in collaborative learning activities in Mathematics.	95(47.5%)	85(42.5%)	15(7.5%)	5(2.5%)

			92(46%)		
7.	WhatsApp has allowed me to receive timely feedback and support from peers, contributing to a better learning outcome in Mathematics.	80(40%)		18(9%)	10(5%)
			88(44%)		
				32(16%)	
8.	I believe that WhatsApp has played a significant role in enhancing my problem-solving abilities in Mathematics.	64(32%)			16(8%)
			70(35%)		
	The collaborative learning features of			23(12.5%)	
9.	WhatsApp have helped me tackle challenging Mathematics assignments with greater ease.	97(48.5%)			10(5%)
			58(29%)	12(6%)	
	I perceive WhatsApp as a valuable				
10.	tool for fostering a sense of community and mutual support among Mathematics students.	120(60%)			10(5%)

Table 2, Revealed that a large number of the respondents 175 (87.5%) agreed on the statement: WhatsApp has been a valuable tool for enhancing my collaborative learning experience in Mathematics, while 25(12.5%) disagreed with the statement. 160 (80%) agreed on the statement: I believe that using WhatsApp for collaborative learning has been beneficial to my understanding of Mathematics concepts, while 40(20%) disagreed on the statement. 150 (75%) agreed on the statement: WhatsApp has proven to be a useful platform for exchanging study materials and resources related to Mathematics, while 50(25%) disagreed on the statement. 156(78%) of respondents agreed on the statement: Collaborating with peers on WhatsApp has improved the efficiency and effectiveness of my Mathematics learning process. while 44(22%) disagreed with the statement. 169(84.5%) of respondents agreed on the statement: I find WhatsApp to be a practical and convenient medium for engaging in group discussions and sharing ideas related to Mathematics, while 31(15.5%) disagreed with the statement. 180(90%) of respondents agreed on the statement: The use of WhatsApp has positively influenced my motivation to actively participate in collaborative learning activities in Mathematics, while 20(10%) disagreed with the statement. 172(86%) respondents agreed on the statement: WhatsApp has allowed me to receive timely feedback and support from peers, contributing to a better learning outcome in Mathematics, while 28(14%) disagreed with the statement. 152 (76%) agreed on the statement: I believe that WhatsApp has played a significant role in enhancing my problem-solving abilities in Mathematics, while 48(24%) disagreed with the statement. 167 (83.5%) agreed on the statement: The collaborative learning features of WhatsApp have helped me tackle challenging Mathematics assignments with greater ease, while 33(16.5%) disagreed on the statement. 178 (89%) agreed on the statement: I perceive WhatsApp as a valuable tool for fostering a sense of community and

mutual support among Mathematics students, while 22(11%) disagreed on the statement. This implies that the majority of the respondents among the undergraduate Mathematics students in Ilorin Metropolis agreed on the Perceived usefulness of WhatsApp for collaborative learning.

Research questions Three: What are the challenges of using WhatsApp for collaborative learning among mathematics undergraduates in Ilorin Metropolis?

Table 3: The challenges of using WhatsApp for collaborative learning among mathematics undergraduates in Ilorin Metropolis.

S/N		SA	A	D	SD
1.	Coordinating group discussions on WhatsApp is sometimes challenging due to conflicting schedules among Mathematics students.	70(35%)	100(50%)	25(12.5%)	5(2.5%)
2.	The lack of a formal structure on WhatsApp for collaborative learning can lead to disorganized discussions.	76(38%)	88(44%)	26(13%)	10(5%)
3.	I find it challenging to keep up with the volume of messages and notifications in the Mathematics WhatsApp group.	110(55%)	58(29%)	27(13.5%)	5(2.5%)
4.	Some Mathematics students may not actively participate in collaborative discussions on WhatsApp, affecting the overall engagement.	54(27%)	30(15%)	26(13%)	90(1%)
5.	Technical issues, such as slow internet connections or device compatibility problems, can hinder smooth collaboration on WhatsApp	76(38%)	60(30%)	44(22%)	20(10%)
6.	Miscommunication and misunderstandings may occur more frequently on WhatsApp compared to face-to-face interactions.	80(40%)	46(23%)	50(25%)	24(12%)
7.	WhatsApp conversations may deviate from Mathematics-related topics, making it difficult to stay focused on academic discussions	96(48%)	34(17%)	50(25%)	20(10%) 10(5%)

8.	The informal nature of WhatsApp may lead to the sharing of inaccurate or unreliable information related to Mathematics.	120(60%)	30(15%)	40(20%)	8(4%)
9.	Privacy concerns regarding sharing personal contact information with peers on WhatsApp can be a challenge for some students.	110(70%)	60(26%)	22(11%)	10(5%)
10.	WhatsApp's limited formatting and editing features can make it challenging to present complex Mathematical equations and diagrams.	70(35%)	90(45%)	30(15%)	

Table 3, Revealed that a large number of the respondents 170 (85%) agreed on the statement: Coordinating group discussions on WhatsApp is sometimes challenging due to conflicting schedules among Mathematics students, while 30(15%) disagreed with the statement. 164 (82%) agreed on the statement: The lack of a formal structure on WhatsApp for collaborative learning can lead to disorganized discussions, while 36(18%) disagreed on the statement. 168 (84%) agreed on the statement: I find it challenging to keep up with the volume of messages and notifications in the Mathematics WhatsApp group, while 32(16%) disagreed on the statement. 84(42%) of respondents agreed on the statement: Some Mathematics students may not actively participate in collaborative discussions on WhatsApp, affecting the overall engagement, while 116(58%) disagreed with the statement. 176(88%) of respondents agreed on the statement: Technical issues, such as slow internet connections or device compatibility problems, can hinder smooth collaboration on WhatsApp, while 24(12%) disagreed with the statement. 126(63%) of respondents agreed on the statement: Miscommunication and misunderstandings may occur more frequently on WhatsApp compared to face-to-face interactions, while 74(37%) disagreed with the statement. 130(65%) respondents agreed on the statement: WhatsApp conversations may deviate from Mathematics-related topics, making it difficult to stay focused on academic discussions, while 70 (35%) disagreed with the statement. 150 (75%) agreed on the statement: The informal nature of WhatsApp may lead to the sharing of inaccurate or unreliable information related to Mathematics, while 50(25%) disagreed with the statement. 170 (85%) agreed on the statement: Privacy concerns regarding sharing personal contact information with peers on WhatsApp can be a challenge for some students, while 30(15%) disagreed on the statement. 160(80%) of respondents agreed on the statement: WhatsApp's limited formatting and editing features can make it challenging to present complex Mathematical equations and diagrams, while 40(20%) disagreed with the statement. This implies that majority of the respondents among mathematic undergraduate students face one or two challenges whiles using WhatsApp for collaborative learning.

Discussion

Research question 1, sought to investigate the Use of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis. The study revealed that large number of the respondents among mathematics undergraduates agreed on the Use of WhatsApp for collaborative learning. Research question 2, further sought to examine the Perceived usefulness of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis. The study revealed that majority of the respondents agreed on Perceived usefulness of WhatsApp for collaborative learning among undergraduate Mathematics students in Ilorin Metropolis. Finally, Research question 3, sought to find out the challenges of using WhatsApp for collaborative learning among mathematics undergraduates in Ilorin Metropolis. The study revealed that majority of the respondents among undergraduate mathematics students faces one or two challenges of using WhatsApp for collaborative learning in Ilorin metropolis.

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DETERMINANT FACTORS AND FACILITATING CONDITIONS ON UTILIZATION OF TECHNOLOGIES FOR TEACHING BIOLOGY IN SECONDARY SCHOOLS IN ILORIN METROPOLIS.

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Abstract

Technology is of paramount importance in our world today and the driving force of education in developed countries. The main purpose of this study is to investigate the determinant factors and facilitating conditions on utilization of technologies for teaching biology in secondary schools in Ilorin metropolis. The study was guided by the technology acceptance model theory. This study employed a descriptive survey design. The population of the study were all biology teachers in public secondary schools in Ilorin metropolis. The sample size was determined from the estimate of the target population which is 368. The sample size for this study was 250 respondents from 100 public secondary schools. A well-structured questionnaire was the instrument. The data collected was analysed using descriptive and inferential statistics. Findings shows inadequate technologies available for teaching biology in public secondary schools in Ilorin metropolis, need for ICT training to equip teachers with required skills to utilize technologies for teaching biology, poor teachers attitude towards utilization of technologies and lack of administrative support on utilization of technologies for teaching biology. Findings revealed that for technologies to be effectively adopted in public secondary schools in Ilorin metropolis, emphasis should be on developing competence of teachers via in- service ICT training. Teacher's perception in using technologies were found to be positive, hampered by unavailability of adequate equipment and lack of administrative support for utilization of technologies. The study recommends teachers' ICT development with corresponding supply of equipment and school administrator should support utilization of technologies for teaching biology.

Keywords: Technology, Determining Factors, Facilitating Conditions, Utilization.

Introduction

Technology is of paramount importance in our life today. It is commonly accepted by practitioners and scholars (Chen et al., 2020) that the developments in technology has impacted on every sector of the economy. It is the driving force of advancement in education and other fields in developed countries and has positively impacted the developing countries (isioto et.al 2017). This impact, amongst others, poses a global challenge of new skillset demands for the workforce in every sector (Cobo, 2013; Mutongoza et al, 2021). The education sector is no exception to these demands and thus requires innovative digital pedagogies (Tai et.al. 2015). The positive impact of science and technology can be seen in the development witnessed in education, communication, transportation, agriculture and health all over the world (Isioto et. al, 2017).

Information and Communication Technologies have greatly impacted the teaching and learning process (Alison et.al, 2012). In their study, Bere and Rambe (2016) contend that the use of technology in classroom increases students' motivation and consequently students' performance is improved. In addition, incorporating technology in teaching and learning boosts students' confidence and enables them to develop positive attitudes towards learning (Williams & Williams, 2011; Fu 2013; Dlamini &Mbata, 2018). Tandiono (2021) emphasizes that students live in a technological world and if their learning environment mirrors their lived experiences, they will be encouraged to take an active role in their learning and thus excel in their studies. Technology gives students intellectual ability to deal with unfamiliar problems and to grasp intuitively what they know regarding a new phenomenon not previously encountered (Laurillard, 2013; Dlamini & Mbatha, 2018; Ahmed and Kazmi, 2020; Skhephe & Mantlana, 2021). ICT meets educational needs, supports the learning process and promises to bring solutions to challenges that the education system is facing (Earle, 2002; Rajasingham, 2011; Das, 2019; Morris & Rohs, 2021).

Despite many efforts towards the use of technology in the teaching and learning of biology, such as the national policy on ICT in education (2019), many teachers are unaware of how to apply it correctly; there has been little or no paradigm shift. Teacher's role, as the main driver of education change is now increasingly competitive with the provision of various communication tools, internet with social media, and television. The internet and television are alternative learning sources. The Internet in ICT is a vast resource for learning; open educational resources can be harnessed (UNESCO, 2014).

As noted by Laurillard (2013), teachers are struggling to use technology in their classrooms because they themselves are incompetent and have had inadequate training on the use of technology in teaching .Thus, teachers education training (skills) and attitude are among factors that determine teachers' use of technology (Shodipe and Ohanu, 2021).There are several frameworks that outline the essential components of effective technology integration. For example, the Technology Acceptance Model (TAM) proposed by Davis et al. (1989) argues that an individual's behavioral intention to use a system is regulated by perceived usefulness and perceived ease of use. According to TAM, teachers 'beliefs and attitudes, such as the technology self-efficacy can predict their actual technology adoption. Thus, TAM could also be regarded as

perceived usefulness by teachers in terms of access and utilization of e-resources as it enhances their productivity (Adeleke and Nwalo, 2017). Teachers' positive attitude and competency or self-efficacy in using technology has been found to relate to a more frequent use of technology in the classroom (Erdogan 2011, Ezeh & Etodike, 2017).

Teachers with prior computer experience are more likely to learn new skills and adopt innovative technology (Groff and Mouza 2008; Gupta and Bhaska 2022). On the contrary, teachers lacking confidence in their computer skills are less likely to use technology in their teaching practices (Wozney et al. 2006; Berger 2020). In addition to perceived competence in technology skills, teachers positive attitude towards technology may also affect their technology integration practices (Hew and Brush 2007;Ogbeide c 2019).Teachers lack of adequate skills and competencies in designing and implementing constructive use of technology in the teaching and learning process (Chen 2008) are among other factors that determine technology integration. Vannatta and Nancy (2004), Shodipe and Ohanu (2021) suggested that the amount of technology trainings teachers received also determine teachers' technology use. Other factors

Stallard (2006); Ikwuka, et al. (2017) suggested that the main problem of teachers in implementing ICT appropriately and effectively is attitude towards the use of ICT, provision of infrastructure in schools are badly affected by public sector corruption in Nigeria (Ezeh & Etodike, 2017), their level of enthusiasm to the use of ICT tools Albirini (2006); Teo (2006) ; Alzaidiyeen, et.al, (2010); Yusuf and Balogun, 2011); Yesilyurt et al. 2016) and teachers' attitude towards the use of ICT is determined by thecombination of different factors according to Mustafina (2016)

Administrative supports, which is mainly to provide teachers with time and enabling environment to practice the integration of technology in teaching and availability of technology infrastructures which are facilitating conditions for utilization of technology. According to the national policy on ICT in education (2019), the government shall provide adequate information technology for effective implementation. Levin and Wadmany (2008) suggested that opportunities to practice, reflect, and interact with other teachers are crucial in the process of facilitating classroom technology adoption. Onyema (2019); Ogbeide C (2019), opined that availability of technology, among other conditions are challenges for using online platforms in Nigeria. Technologies help to bridge shortcomings of traditional classroom teaching (Sun et.al 2022).The support from school environment is a key force in promoting teachers' intention to use technology (Inan and Lowther 2010; Drossel et al. 2017; Eickelmann et al.2017). As Porter and Graham. (2016) suggest, strong infrastructure, technological support, and pedagogical support should be provided for teachers to facilitate ease of use.

Biology is one of the science subjects taught in secondary schools in Nigeria. This school subject is the scientific study of living things and vital process (Martin & Robert, 2015).Humans need the understanding of biology to maintain healthy living, so as to be able to pursuit their goals of life (Thompson and Soyibo 2012). Biology is further detailed to compose of numerous sub-discipline like zoology, botany, genetics, medicine, agriculture, anatomy and histology, to mention a few. Hornby and Webmeier (2007) described Biology as the scientific study of life and structure of plants and animal. Similarly, Gorgeous (2013) describes Biology as a natural science that deals with study of life and living organisms, including their structures, growth, function, distribution,

evolution and taxonomy and understanding of and responding to some of the most pressing issues of the day, from the many challenges arising from the population growth, human impact on ecosystems and services to climate change (Kim & Diong, 2012). According to Nwakonobor (2008) and Ahmed & Abimbola (2011;Sarojini (2019). The objectives of new Secondary School (SS) Biology curriculum as provided in the National Policy on Education (2013) include: Adequate laboratory and field skills in Biology: Acquisition of necessary Biology skills (for example observation, classification, Identification and others): Meaningful and relevant knowledge in Biology: Ability to apply scientific knowledge to everyday life, matters of personal and community health and agriculture and Reasonable and functional scientific attitude.

The utilization of technology in teaching biology has yielded positive results. Factors such as the teachers' usage of inappropriate teaching methods (Ahmed and Abimbola, 2011; Auwalu et al., 2014; Jimoh, 2015) and the abstract nature of biological concepts such as cell division (Sungur et al., 2001; Cimer, 2011; Ansuman, 2012) which are often hindrances to learning Biology, have prompted science educators and researchers to find alternative ways to make biology teaching and learning more efficient in senior secondary schools. Ahmed and Odewumi (2020) recommend use of visual learning devices because it has positive impact on students' academic performance Teachers can master Technological Pedagogical and Content Knowledge (TPACK) through the application of technology-based guided inquiry to enhance technology literacy, learning quality and also as a medium for problem-solving Irdalisa et al,(2020).The use of blended collaborative problem based learning (Sugiharto et. al, 2019;Arani 2021). The effects of web quest on secondary school biology students' achievement in cell division in Ilorin by saheed et. al, (2019). The use of e-learning platforms that offer interactive virtual laboratories, multimedia resources, and online discussions that can facilitate problem solving, inquiry and collaboration among students (Lazonder and Hermsen, 2016; Harasim, 2017) to mention a few. However, teacher's ability to integrate technologies in classroom is crucial to education innovation (Koh et al, 2017). Thus, it became imperative to examine the determinant factors and facilitating conditions on utilization of technologies for teaching biology in secondary schools in Ilorin metropolis.

Purpose of the Study

The main purpose of this study was to investigate the determinant factors and facilitating conditions on utilization of technologies for teaching biology in secondary schools in Ilorin metropolis.

The specific objectives of the study was to find out:

1. The available technologies for teaching biology in secondary schools in Ilorin metropolis,
2. To examine teachers skills on utilization of technologies for teaching biology in secondary schools in Ilorin metropolis.
3. To establish teachers attitude towards use of technologies for teaching biology in secondary schools.
4. To investigate administrative support on utilization of technologies for teaching biology in secondary schools in Ilorin metropolis

Research Questions.

1. Do teachers utilize technologies for teaching biology in secondary schools in Ilorin metropolis?
2. Are teachers equipped with the required training and ICT skills to utilize technologies for teaching biology in secondary schools in Ilorin metropolis?
3. Do the administration support the utilization of technologies for teaching biology in secondary schools in Ilorin metropolis?
4. Do teachers have adequate technologies available for teaching biology in public secondary schools in Ilorin metropolis?

Research Hypothesis

Ho1: There is no significant difference between biology teacher's ICT skills and their level of utilization of Technologies for teaching biology in Ilorin metropolis secondary schools.

Ho2: There is no significant difference between administration support and their level of utilization of Technologies for teaching biology in Ilorin metropolis secondary schools.

Methodology

This study is a descriptive research design of the survey type. This study is aimed at investigating the determinant factors and facilitating conditions on utilization of technologies for teaching Biology in secondary schools in Ilorin metropolis. The population for this study were all Biology teachers in public secondary schools in Kwara state while the target population were the Biology teachers in public secondary school in Ilorin metropolis. Three local government areas were randomly selected among the six local government areas making up Ilorin metropolis.

Samples were drawn from the three local government areas i.e. Ilorin west, Ilorin east and Ilorin south of Ilorin metropolis. The sample size were determined from the estimate of the target population which is 368 (according to Kwara state Teaching Service Commission, 2023). Using Cohen et.al. 2007 table of random sampling, at 99 percent confidence level, the sample size for this study were 250 respondents from 100 secondary schools in Ilorin metropolis.

Research Instrument

The research instrument was a researcher- designed questionnaire. The questionnaire was a 4 points Likert-scale titled determinant factors, facilitating conditions, utilization and technologies-questionnaire (DFFCUTQ). The questionnaire has two sections, A and B. Section A deals with respondent demography; it contain information of respondents such as gender, educational qualification, and work experience while Section B deals with items determinant factors, facilitating conditions and utilization of technologies for teaching Biology.

Validity

To ensure face and content validity of the instrument (DFFCUTQ), the questionnaire was given to experts in educational technology and experts in measurement and evaluation to check the suitability and viability of the instrument. The researcher personally visited the secondary schools where the study was carried out to seek permission from the authorities of the schools. The questionnaire was administered to biology teachers and retrieved immediately for data analysis.

The data obtained would be analyzed using descriptive statistics and inferential statistics. Percentage would be used to analyze demographic information provided by respondents. Mean and standard deviation would be used to analyze data and provide answer to research questions. Independent t-test would further be used as an inferential statistics to test the null hypothesis.

Data Analysis

The data obtained was analyzed and interpreted using descriptive statistics and inferential statistics. Percentages was used to analyze the personal information provided by the respondents. Mean was used to answer research questions one, two, three and four while t-test was used to test the null hypotheses that were formulated from research questions at 0.05 level of significance. The hypothesis of no significant difference was accepted when the t-calculated (t-cal) value was less than the t-critical (t-tab) value of 1.96 at 0.05 level of significance while hypothesis of no significant difference was rejected when the t-calculated (t-cal) value was greater than the t-critical (t-tab) value of 1.96 at 0.05 level of significance.

Results and Interpretations

Research Question One: Do teachers utilize technologies for teaching biology in secondary schools in Ilorin metropolis?

Table 1: Descriptive Statistics on Biology Teachers' Utilization of Technologies for Teaching Biology

Biology Teachers' Utilization of Technologies	Never	%	Rarely	%	Frequently	%
How often do you use computer	175	70.00	61	24.40	14	5.60
How often do you use internet	175	70.00	14	5.60	61	24.40
How often do you use printer	175	70.0	14	5.6	61	24.4
How frequent do you use computer in the classroom for content delivery	236	94.4	0.00	0.00	14	5.6
How frequent do you use internet in the classroom for content delivery	174	69.6	0.00	0.00	76	30.4
How frequent do you use projector	235	94.00	15.00	6.00	0.00	0.00

in the classroom for content delivery				
	Weighted Average	**78.00**	**6.93**	**15.07**

Table 1 revealed that respondents generally do not Utilize various technologies such as computers, internet, printer for teaching biology in secondary schools in Ilorin metropolis (Weighted mean = 78.00), they also do not use these technologies for content delivery (projectors) (81.6). These responses emphatically agreed that teachers do not utilize technologies for teaching biology in secondary schools in Ilorin metropolis.

Research Question Two: Are teachers equipped with the required training and ICT skills to utilize technologies for teaching biology in secondary schools in Ilorin metropolis?

Table 2: Descriptive Statistics on Biology Teachers' Skills on Technologies for Teaching Biology

Biology Teachers' Skills of Technologies	Good	%	Fair	%	Poor	%
How would you rate your ability to use word processor MSWord	151	60.4	99	39.6	0.00	0.00
How would you rate your ability to use spreadsheet e.g. MS excel	151	60.4	99	39.6	0.00	0.00
How would you rate your ability to use databases e.g. MS access	150	60.0	100	40.0	0.00	0.00
How would you rate your ability to use presentation tools e.g. PowerPoint	136	54.4	114	45.6	0.00	0.00
How would you rate your ability to use graphic designs tools e.g. Adobe	51	20.4	199	79.6	0.00	0.00
How would you rate your ability to use internet search tools e.g. Google	235	94.0	15	6.0	0.00	0.00
Weighted Average	**58.27**		**41.73**		**0.00**	

Table 2 revealed that respondents (Biology teachers in public schools) predominantly possess skills and ability to utilize various technologies such as computers, internet, printer for teaching biology in secondary schools in Ilorin metropolis (Weighted mean = 58.27) while a sizable number do not have the ability or skill needed to utilize these technologies for preparation and content delivery of biology lessons to students in secondary school in Ilorin metropolis (41.73). These responses agreed that more than half of the population of teachers do not have the skill and ability to use technologies for teaching biology in secondary schools in Ilorin metropolis.

Research Question Three: Do the administration support the utilization of technologies for teaching biology in secondary schools in Ilorin metropolis?

Table 3: Descriptive Statistics on Administrative Support on Utilization of Technologies for teaching biology

Administrative Support on Utilization of Technologies for teaching biology	Never	%	Rarely	%	Frequently	%
How would you rate your school administration efforts in purchasing and repairing of technology facilities?	236	94.4	14	5.6	0.00	0.00
How would you rate your school administration efforts in motivating teachers towards integrating technology in teaching and learning?	236	94.4	14	5.6	0.00	0.00
How would you rate your school administration effort's sponsoring teachers for technology integration in-service courses?	**236**	**94.4**	**14**	**5.6**	**0.00**	**0.00**
Weighted Average	**94.4**		**5.60**		**0.00**	

Table 3 presents responses on administrative support which is an essential component in the utilization of technologies for teaching biology. It revealed that school administrators do not support the use of technologies for teaching biology in public schools in Ilorin metropolis. They rarely purchase these technologies (5.6), motivate teachers on utilization (5.6) nor sponsor biology teachers in skill acquisition which will provide avenue for utilization of technologies for teaching biology in secondary schools in Ilorin metropolis (Weighted mean = 5.6). These responses agreed that very little number of school administrators support the use of technologies for teaching biology in secondary schools in Ilorin metropolis.

Table 4: Descriptive Statistics on Availability Technologies for teaching biology

Availability Technologies for teaching biology	**Available**	**%**	**Not Available**	**%**
Do you have computer/laptops in your school?	38	15.2	212	84.8
Do you have internet access in your school?	89	35.6	161	64.4
Do you have Printers in your school?	89	35.6	161	64.4
Do you have Biology software in your school?	89	35.6	161	64.4

Do you have projectors in your school?	89	35.6	161	64.4
Weighted Average		**31.52**		**68.48**

Ho1: There is no significant difference between biology teacher's ICT skills and their level of utilization of Technologies for teaching biology in Ilorin metropolis secondary schools.

Table 5: Relationship between ICT skills and utilization of Technologies for teaching biology

	ICT skills	N	Mean	Std. Deviation	df	t	Sig
Utilization	Skilled	119	5.8319	.37551	248	-15.876	.000
	+Not Skilled	131	11.0076	3.53770			

Table 5 indicate that the t(248) = -15.876 is less than P-value (P>0.05). This implies that significant difference exists between level of utilization of technologies for teaching biology among ICT skilled biology teacher to Unskilled biology teacher in Ilorin metropolis secondary schools. Hence, this research Hypothesis raised in the study, which states that there is no significant difference between biology teacher's ICT skills and their level of utilization of Technologies for teaching biology in secondary school in Ilorin metropolis is rejected.

Ho2: There is no significant difference between administration support and their level of utilization of Technologies for teaching biology in Ilorin metropolis secondary schools.

Table 6: Relationship between administrative support and Utilization of Technologies for teaching biology

	Administration	N	Mean	Std. Deviation	df	t	Sig
Utilization	Supported	101	6.0336	.63049	248	24.135	.000
	Not Supported	149	12.2475	3.05092			

Table 6 indicate that the t(248) = 24.135 is less than P-value (P>0.05). This implies that significant difference exists between administrative support and Utilization of Technologies for teaching biology in secondary schools in Ilorin metropolis. Hence, this research Hypothesis raised in this study, which stated that there is no significant difference between administrative support and the level of utilization of Technologies for teaching biology in secondary schools Ilorin metropolis is rejected.

Recommendations.

The study recommends teachers' ICT development with corresponding supply of equipment and school administrator should support utilization of technologies for teaching biology.

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A CORRELATIONAL ANALYSIS OF OUT-OF- FIELD SECONDARY SCHOOLS' SCIENCE AND TECHNOLOGY EDUCATION TEACHERS ANXIETY ON CONTENT MASTERY AND PEDAGOGICAL CONTENT KNOWLEDGE IN KANO STATE

By:

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Abstract

This study examined the relationship between the out-of-field secondary school science and technology education (STE) teachers' anxiety on Content Mastery (CM) and Pedagogical Content Knowledge (PCK) in Kano State. Correlational survey design was used to sample the subjects of the study. The population of the study was 666 out-of-field Science and technology education teachers' in 543 public and private senior Secondary School drawn from the Seven (7) educational zones of Kano State, Nigeria. Multiple sampling techniques were used in selecting the samples used in the research study. Two (2) objectives form the focus of the study with resultant two research questions and two Null hypotheses. Out-of-field Anxiety Questionnaire (OFF AQ) developed by the researcher and validated by experts (educational psychologist and science educationist) were used for the purpose of data collection. OFF AQ was found to have a reliability coefficient of 0-84 using Cronbach alpha coefficient. The data collected were sorted and analyzed for Means (x), Standard Deviations (SD), Analysis of Variance (ANOVA), Pearson Product Moment Correlation (PPMC) Coefficient and Linear Regression for the research questions and null hypotheses rose in the study. In addition, Scatter Plots were used to further the homogeneity or otherwise to elaborate on the extent of relationship between the major variables in the study. Finding reveals that, there is positive relationship between Content Mastery (CM) and Pedagogical Content Knowledge (PCK) and also between PCK and years of teaching experience and gender.

Keywords: Out-of-field (OFF), Science and Technology Education Teachers (STET), Content Mastery (CM), Pedagogical Content Knowledge (PCK).

Introduction

It is known fact that education is an instrument per excellence for change and development. To this end, educational processes bring about knowledge creation, attitudinal change, social dispositions and skills development. The Global Education 2030 Framework for All (EFA) which is championed by the Sustainable Development Goals (SDG) believes that, education is a human right for all throughout life and that access must be matched by quality (UNESCO, 2019). Undoubtedly therefore, the teacher is in the heart of every educational system as he/she helps in dispensing knowledge, clearing misconceptions and difficulties and evaluating learning outcomes. Thus, the field of science and technology education is oriented towards the teaching and learning of science and technology to even non-science oriented pupils, students and adults within and

outside the formal school setting. They are trained to instruct in subject-specific areas, design curricula, have analytical skills in assessing students learning progression and have interpersonal relationship with students, parents, school administrator and stakeholders. In addition, he/she possesses oral and written communication skills to translate the science curricula into teachable unit plans for the attainment of overall educational goals and objectives. The nature of how science education curricula is outlined and taught in schools does not differ markedly in the methodology and assessment to other subjects in our schools. The science education curricula are broken into chemistry (science of physical elements), science and technology education (natural sciences) and physics (mechanics and laws of nature) for students to have understanding of the nature of science. A robust understanding of the nature of science and its methodologies (processes) requires capable and informed professional teachers. For the student to have awareness and scientific inquiry attitude and skills he needs to be taught by professional teachers not by individuals who see teaching as a past-time activity or a stepping -stone to greener occupations. The dearth in quality and supply of teachers is an issue that has continued to affect the smooth delivery of the content science curricula in schools. For instance, in the United States of America (USA), it has become the practice of many states to declare teaching vacancies every year by subject areas, grade level and geographical location. The scenario is almost the same in United Kingdom) UK) where it is reported that, the nation faces an uphill battle to fill all classrooms with qualified teachers (Eurydice, 2022). In Africa, Nilsson (2023) gave a description of what obtains in various countries as reported by World Education Forum in Dakar (2020) and noted that many African countries are faced with massive shortage of qualified teachers which hinders their efforts to achieving the goals of universal basic education. He stated that to achieve EFA by 2015, African countries would need between 18% (Angola) and 84% (Malawi) increase in their current teacher supply, noting that majority of the teachers in most countries are unqualified according to the national requirements. This similar scenario if not worse may be what is obtainable in Nigerian schools. This inadequacy in teacher demand and supply cuts across all subjects and particularly the biology, chemistry, physics and other STE discipline are not spared from the rot of been taught by STT who are not in the 'core' area of STT. In most schools, you have teachers in other core areas of science and technology at secondary level of education. This are described as Out-of-field (OFF) teachers in general sense. It also describes the employment of teachers who are not professionally trained to teach in subjects' areas that have little knowledge of. Out-of-field teaching has become a syndrome bedeviling teaching profession. It is worth noting here that, Transforming Education in Kano State (TENS, 2017) programme championed by Kano State Universal Education Board (SUBEB) reported that, there are no enough science teachers in our classrooms for efficient and effective subject delivery of instructions (SUBEB, 2018). This trend where unprofessional teachers have found their ways into classroom is not exclusive problem of Kano State. Similarly, In Ekiti State, Adeyemi (2021) reported serious unfilled vacancies in Science and technology education as he stated that, out of the 2178 Science and technology education teachers needed in urban schools in 2021, only 762 teachers were in post leaving a deficit of 1416 Science and technology education teachers. The result of this shortage of qualified ST teachers in Secondary Schools may have resulted to the employment of individuals who are not trained teachers to teach outside their specialty areas, which is known as out-of-field teaching (Hobbs, 2022; Nixon, Luft & Ross, 2017). Anxiety is an unpleasant emotional state or condition that includes feelings of uneasiness, worry

and expressed by the teacher. Educational psychologists and educators thought that, it has the tendency to derail the realization of expected learning outcome. Anxiety According to American Psychiatric Association (2023) anxiety is a psychological and physiological state which is characterized by physical, emotional, cognitive and behavioural components. Jenaabadi, et al., (2016) attest that anxiety is a group of physical, behavioural and mental changes occurring in response to threat which results in ineffectiveness, wearing out, lack of energy and power, and an exhaustion of the inner resources of an individual due to unsatisfied needs. Contextually, the behaviour of the OOF Science and Technology Teacher includes; teacher readiness, feeling of inadequacy of or insufficient knowledge of subject-specific area, insufficient knowledge of teaching strategy, loss of confidence, jittery in the classroom etc. Anxiety construct is characterized by fear, panic, mental disorientation and apprehension, increased respiration, rapid pulse, sweaty palms, stress, burnout and high blood pressure (Cimen & Yilmaz, 2015; Jenaabadi, et al., 2016). A survey of teaching force of many nations has shown that, a very high percentage of teachers are assigned to teach out of their field of specializations (Cinkir & Kurum, 2015; Sambe, 2015; Subair & Talabi, 2015). Out-of-field teachings are global trend which has been phenomena in Nigeria. The trend has been in the rise occasioned by government's ineptitude or willingness to arrest the situation. Employment into teaching has been largely reduced to settlement of individuals that are used for political thuggery. Weldon (2016) stated that OOF teachers in secondary schools are teachers teaching subject for which they have not studied above first year at university and for which they have not studied their teaching methodologies. They are faced with the problem of knowledge gap in the mastery of the content and in methodologies of teaching. To certain extend in Kano State; no school is spared of this menace from public to private schools and from urban to rural schools. It is noteworthy, these groups of teachers may be ill-prepared to teach effectively, which may eventually manifest in the form of poor performances of students at external examinations. Poor teaching may lead to a decrease in the standard of education and other unpleasant and scary situations. There is a correlation between teacher anxiety and Content Mastery (CM) and even in their methodologies of teaching in the classroom. CM can be viewed as the profound understanding of subject-specific curricular which is regarded as teachers' content specific knowledge. It is a prerequisite for teaching any subject and essential requirement for teacher certification. Fernandez (2018) postulated that there is a relationship between content knowledge and good teaching. Teachers with in-depth mastery of their subjects can draw links between different areas of knowledge in the same subject and others. This implies that, CM is the conceptual understanding of the subjects that teachers' do teach in order to help students have a change of concept from the unscientific that they hold to an acceptable scientific concept. Teachers' lack of content limits their ability to anticipate the directions in which students' learning might proceed. They may not be able to prepare effectively for lessons, as lesson that is not well prepared contains incomplete subject matter, incorrect facts, lacks the necessary details and suitable illustrations. The presentation in the classroom may become disorderly, haphazard and uncoordinated (Ambe & Agbor, 2018). Researched literature has shown that, there are a number of teacher factors that influences teacher anxiety in the classroom which could relate CM, PCK, teacher years of teaching, teacher qualification and even gender. Inexperienced teachers who are more likely to be OOF are less effective and more anxious than the professional teacher. Others reported that experienced teachers do not feel anxious. However, some studies affirmed that

experienced teachers are anxious as a result of work overload. According to Rice (2020) the magnitude of the effect of teacher experience varies depending on the teacher's level of education and the subject area. Kaya (2019) and Van Driel and Berry (2022) found that content knowledge had influence on pedagogical content knowledge and anxiety level. They further stated that "teachers without strong Content Mastery, strong Pedagogical Content Knowledge finds it impossible to achieve". Olugbemi (2021) carried out a study on assessment of PCK of in-field and out-of-field Chemistry teachers in Abuja Nigeria. The design of the study was a descriptive survey. The result revealed significant and positive relationship between teacher pedagogical content knowledge and student teacher learning in rural and urban areas. The in-field Chemistry teachers had more experience in teaching Chemistry compared to the out-of-field Chemistry teachers. This indicates that the in-field teacher had a higher level of presenting a good role model to the students, compared to the out-of-field teachers. He further opined that experience gained over time, enhances the knowledge, skills, and productivity of workers. Ilugbusi, Falola, & Daramola (2007) reported that inexperienced teachers are easily upset and destabilized by unfamiliar situations which will lead to apprehension. This may imply that inexperienced teachers could get confused, mixed up the content of the topics taught to the students and hence the students will receive wrong information which may lead to poor achievement among the students. Ameen, Guffey and Jackson (2002) and Aynur and Aydin (2014) in their separate studies concluded that, the younger and less experienced teacher feels greater anxiety and stress than their older and more experienced teachers. This shows further that, newly recruited teachers even if professional trained are likely to be anxious in their early days of teaching. Similarly, Clayford (2020) revealed that teachers who have been in the teaching profession for many years are less prone to high levels of anxiety. Hadley and Dorward (2011) revealed that teachers with less experience were more anxious than the more experienced teachers about teaching elementary mathematics while male teachers had lower anxiety than the female teacher about mathematics. On the contrarily, Desouky and Allam (2017) emphasized that teachers with higher teaching experience and higher qualifications exhibited higher level of anxiety, stress and depression which resulted from the challenges faced on the job. A gender issue is topical and generates more concerns and interest amongst stakeholders. The teaching profession is crowded today by more female's teachers in urban centres than their male counterparts. Reports of the performances of each segment have also generated a lot of debate. This study is also interested in evaluating the influence of gender and other demographic factors in the school in relation to Out-of-field Science and technology Teachers on Content Mastery and Pedagogical Content Knowledge in Kano State.

Objectives of the Study:

The main objectives of the study are to determine whether there is a relationship between Out-of-field (OOF) Science and Technology Teachers' anxiety on Content Mastery and Pedagogical Content Knowledge and other related variables.

Research Questions Two research questions guided the study:

What is the relationship between out-of-field Science and technology Teachers' anxiety on Content Mastery (CM) and Pedagogical Content Knowledge (PCK)?

What is the correlation between out-of-field Science and technology Teachers' anxiety on Content Mastery, school type, school location, gender, years of teaching experience, and educational qualification on Pedagogical Content Knowledge?

Formulated Null Hypotheses two null hypotheses were raised and tested at 0.05 significance levels:

HO1: There is no significant relationship between out-of-field Science and technology Teachers' anxiety on Content Mastery (CM) and Pedagogical Content Knowledge (PCK)

HO2: There is no significant relationship between out-of-field Science and technology Teachers' anxiety on Content Mastery, school type, school location, gender, years of teaching experience, and educational qualification on Pedagogical Content Knowledge.

Research Methodology

The study adopted the Correlational research design which seeks to understand the kind of relationship naturally occurring between anxiety on content mastery and PCK It seeks to figure out if two or more variables are related and if so why. The population of the study was 666 out-of-field Science and technology Teachers' in 543 public and private senior Secondary Schools were drawn from educational zones in Kano Central district, Kano State, Nigeria. Multi-stage sampling technique was adopted in this research; stratified sampling technique was used in selecting 226 senior secondary schools from Kano Central educational zones thereafter simple random sampling technique was used in picking 501 (private = 246 & public =255) out-of-field Science and technology education teachers' selected from 7 educational zones in Kano State. Three research questions and corresponding 3 null hypotheses were raised to guide the study. Out-of-field Anxiety Questionnaire (OFF AQ) was used as the instrument for collecting data amongst Secondary Science and technology Teachers' on Content Mastery and Pedagogical Content Knowledge. The instrument was a 5Point Likert scale graded into; Very High Anxious (VHA), High Anxious (HA), Moderately Anxious (MA), Low Anxious (LA) and Very Low Anxious (VLA) items. The questionnaire was validated by experts in psychology and science education and a reliability coefficient of 0.84 was obtained using Cronbach Alpha formulae. The data collected were subjected to analysis of Means (X) and Standard Deviations (SD) for the research questions 6 while inferential statistics were used for analyzing the null hypotheses formulated at alpha 0.05 levels of significance.

Data Analysis The data collected were subjected to analysis and presented as follows:

Research Questions

What is the relationship between out-of-field Science and technology education teachers' anxiety on Content Mastery and Pedagogical Content Knowledge (PCK)?

Table 1: Analysis based mean difference of out-of-field science and technology education teachers' Content Mastery and Pedagogical Content Knowledge

Variable	N	Mean X	Standard Deviation SD	Mean Diff X
PCK	501	48.64	12.770	

				1.51
CM	501	50.49	13.14	

The result shows that, CM produces a Mean of 50.49 and Standard Deviation 13.14 while PCK had a Mean score of 48.64 and a deviation of 12.77, respectively. This further indicates a Mean difference of 01.51 which suggest that, there is no significant sufficient variation between the two variables. The data was further subjected to regression analysis to determine whether there is a relationship or convergence on the two variables to warrant a conclusion of the existence of a relationship. Hence, the description below using a scatter plot.

Fig 1: Scattered Plot showing the linear Relationship between CM and PCK of Out-Of-Field Science and technology education Teachers Figure 1 shows the scattered plot which indicates whether there a relationship between Content Mastery and Pedagogical Content Knowledge of out-of-field Science and technology education teachers' anxiety. The figure shows a homogeneity or convergence of views which indicates a positive relationship between the two variables.

2. What is the correlation between out-of-field Science and technology education teachers' anxiety on Content Mastery, school type, school location, gender, years of teaching experience, educational qualification on Pedagogical Content Knowledge?

Table 2: Analysis of Out-of-field Biology Teachers' anxiety on Content Mastery and Moderating Variables and Pedagogical Content Knowledge

Moderating Variables	**N**	**Mean X**	**Standard Deviation SD**
Pedagogical Content Knowledge	501	48.64	12.77
School Type	501	1.48	0.52
School Location	501	1.52	0.52
Gender	501	1.33	0.47
Qualification	501	4.31	2.32
Years of Experience	501	1.87	0.78
Certificate	501	1.47	0.50
Content Mastery	501	50.49	12.75

Table 2 shows that Mean and Standard Deviation of Out-of-field Science and technology education Teachers' anxiety on Content Mastery and demographic school factors. The analysis shows a Mean Score of 48.64 and deviation of 12.77 for PCK while School Type, School Location, Gender, Teachers Qualification, Years of Teaching Experience and Certificate have of Means (X) of 1.48, 1.52, 1.33, 4.31, 1.87, 1.47, 50.49 and SD; 0.52, 0.52, 0.47, 0.32, 0.78, 0.50 and 12.75, respectively. These show that there is a correlation from the distributed Mean Scores on each of the moderating variables.

Analysis of Null Hypotheses The following null hypotheses were formulated and tested at alpha 0.05 levels of significance:

Hypothesis HO1: There is no significant relationship between out-of-field (OFF) Biology Teachers' anxiety on Content Mastery and Pedagogical Content Knowledge (PCK).

Table 3: Linear Regression Analysis Model on Content Mastery on Pedagogical Content Knowledge.

Model R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.766a	.587	.586	8.219

The result shows r (1,499) = 0.766, r2 = 0.587. This indicates that 58.7% of the total variance in Out-of-field Biology Teachers' anxiety on Pedagogical Content Knowledge (PCK) which is accounted for by Content Mastery. To determine whether the model was a good predictor, ANOVA result is presented Table 4

Table 4: Regression ANOVA of the Content Mastery and Pedagogical Content Knowledge

Model		Sum of Squares	df	Mean Square	Fcal	Sig.
1	Regression	47920.993	1	47920.993	709	.000
	Residual	33704.891	499	67.545		
	Total	**81625.884**	**500**			

Table 4 displays the ANOVA analysis on whether the linear model was a good predictor of correlation between CM and PCK. The Table shows that, there is a significant relationship between the predictor (Content Mastery) and the criterion variables (Pedagogical Content Knowledge). The results showed an $F(1,499) = 709.469$, $p(0.00) < 0.05$ which indicates that the model is a good predictor hence, there was a relationship between the variables.

Table 5: Linear Regression Coefficient between Content Mastery and Pedagogical Content Knowledge

Model	Unstandardized Coefficients		Standardized Coefficients	t_{cal}	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	11.040	1.458		7.569	.000
1 Content mastery	.745	.028	.766	26.636	.000

Table 5further shows the regression coefficient between Content Mastery and Pedagogical Content Knowledge. The result shows that Out-of-field Science and technology education Teachers' anxiety on content mastery is a significant predictor of their anxiety in pedagogical content knowledge (B = .75, tcal = 26.63, p (0.00) < 0.05). The regression coefficient indicates that for any increase in one unit of Out-of-field

Science and technology education Teachers' anxiety in Content Mastery there will be a corresponding increase in anxieties in Pedagogical Content Knowledge (11.04).

HO2: There is no significant relationship between out-of-field Science and technology education teachers' anxiety on Content Mastery, school type, school location, gender, years of teaching experience, educational qualification on Pedagogical Content Knowledge. The null hypothesis was analyzed using multiple regression test and the summary of the results is presented in Table 6

Table 6: Multiple Regression Modelof Content Mastery and Demographic factors on Pedagogical Content Knowledge

Model R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.767a	.589	.583	8.252

a. Predictors: (Constant), Content mastery

b. Certificate, School Location, School Type, Gender, Year of experience, Qualification.

Table 6 shows the regression coefficient for the independent variables; Content Mastery and PCK on moderating variables; school factors (school location, school type), and demographic factors gender, years of experience and qualification. The result shows r(1,499) = 0.767, 0.589.which indicates that 58.9% of the total variation in out-of-field Science and technology education teachers' anxiety on Pedagogical Content Knowledge (PCK) is accounted by one or two or more dependent variables. To determine whether the model was a good predictor, ANOVA result was presented in Table 7

Table 7: Regression ANOVA of Content Mastery, School Factors and Demographic Factors on Pedagogical Content Knowledge

ANOVA

Model		Sum of Squares	df	Mean Square	Fcal	Sig.
1	Regression	48058.413	7	6865.488	100.83	.000
	Residual	33567.471	493	68.088		
	Total	**81625.884**	**500**			

a. Dependent Variable: Pedagogical Content Knowledge

b. Predictors: (Constant), Content Mastery, Certify, School Location, School Type, Gender, Year of Experience and Teacher Qualification.

Table 7 displays the ANOVA result. The result shows that there is a significant correlation between the predictors content mastery, school factors, demographic factors and the criterion variables

(pedagogical content knowledge) *Fcal* (1,499) = 100.83, p(0.00) < 0.05. This clearly indicates that the model is a good predictor.

Table 8: Multiple Regression of Content Mastery, School Factors and Demographic Factors on Pedagogical Content Knowledge

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t cal	Sig.
		B	Std Error	Beta		
1	(Constant)	13.570	3.335		4.069	.000
	Sch. Type	.218	.736	.009	0.296	.768
	Sch. Location	.157	.727	.006	0.216	.829
	Gender	.014	.812	.001	0.017	.987
	Qualification -.	. 0862	.187	-.016	-.462	.644
	Years of Exp.	-.637	.516	-.039	-1.233	.218
	Certificates	-.782	.901	-.031	-.868	.386
	Content Mastery	.737	.030	.758	24.944	.000

a. Dependent Variable: Pedagogical Content Knowledge

Table 8 shows the results of analysis of PCK on school type, school location, gender, qualification, year of experience, certificates and content mastery. The result indicates that school type is a nonsignificant positive predictor of out-of-field Science and technology education Teachers' anxiety on Pedagogical Content Knowledge (PCK) (B = .218, t = 0.296, p (0.76) >0 .05). Similarly, school location, gender, qualification, year of experience, certificates are not significant predictors of out-of-field Science and technology education teachers' anxiety on Pedagogical Content Knowledge (PCK). However, content mastery is a significant predictor of out-of-field Science and technology education teachers' anxiety on Pedagogical Content Knowledge (PCK) (B = .737, t = 24.99, *p* (0.00) <0 .05) while holding constant teacher characteristics; gender, qualification, year of experience, certificates and content mastery and school characteristics; school type and location. This indicate that an increase in one unit of Out-of-field Science and technology education Teachers' anxiety in content mastery will increase of .737 units of their anxiety in Pedagogical Content Knowledge (PCK).

Discussion of Findings The descriptive analysis of the quantitative collected with the anxiety questionnaire showed that there was actually a correlation between content mastery and pedagogical content knowledge amongst OFF Science and technology education teachers. The X scores of science and technology education teachers on the variables been measured indicates a very insignificant difference of 01.51 which implies that there is a positive relationship. The descriptive analysis using the scatter plot further showed the convergence of the two variables which again confirms that there is a relationship between CM and PCK amongst OFF science and

technology education teachers with anxiety.In order to find out how significant is the correlation between CM and PCK, inferential statistics using linear regression was used to analyze the hypothesis raised. The result shows r (1,499) = 0.766, r2 = 0.587. This indicates that 58.7% of the total variance in Out-of-field Science and technology education Teachers' anxiety on Pedagogical Content Knowledge (PCK) which is accounted for by Content Mastery. Patra and Guha *(*2017) compared the PCK and self-efficacy of geography teachers in India They submitted that, PCK and self-efficacy of geography teachers was positive and significantly related. In the same vein, this study supports the findings of Haciomeroglu (2014) which examined the structure of elementary pre-service teachers' mathematics anxiety and mathematics teaching anxiety in Turkey and found a significant relationship between predictors (i.e., test, course, and computation) and PCK, thus implying that anxiety influences mathematics teaching. This only confirms that 'anxiety construct' affects whichever variables it is compared with in any learning setting. This finding can be attributed to out-of-field science and technology education teachers' inability to transfer the subject content effectively to the students' and engage the students' effectively in the learning process; inability to prepare or set laboratory properly before demonstration this will inhibit effective teaching and practical demonstrations; being unable to 12
effectively prepare, plan and write lesson efficiently. In the contrary, the study of Mutodi and Ngirande (2014) that explored students' teachers Mathematics anxiety levels at a selected tertiary institution in South Africa, found that there is no significant correlation between home language and math anxiety level. The result of analysis on the relationship between CM and PCK on other teacher factors (such as years of service, gender, qualification, school type and location). The Means obtained indicated that there is a relationship between the factors and OFF Science and technology education teachers anxiety. Further analysis of the hypotheses raised in the study indicated a regression coefficient for the independent variables; Content Mastery and PCK on moderating variables; school factors (school location, school type), and demographic factors gender, years of experience and qualification to be r (1,499) = 0.767, 0.589 which shows 58.9% variation in out-of-field Science and technology education teachers' anxiety on Pedagogical Content Knowledge (PCK) is accounted by one or two or more dependent variables. Hadley and Dorward (2011) and Aynur and Aydin (2014) studies revealed that, teachers generally with less years of teaching experience were more anxious than the experienced teachers. This may be because as new entrants in to teaching have not gathered experience to enable them have the confidence during teaching. On the contrary, the study of Desouky and Allam (2017) reported that teachers with higher teaching experience and higher qualifications exhibited higher level of anxiety, stress and depression than those with lesser teaching experience. Nisbet (2015) investigated the teaching experiences of six elementary pre-service teachers (EPTs), three with high mathematics anxiety and three with low mathematics anxiety, during their student teaching semester. The collected data were transcribed and findings revealed both similarities and differences across EPTs. The result of the study revealed that EPTs with high mathematics anxiety were weaker with respect to content knowledge and pedagogical content knowledge. In a related study, Uusimak and Nason (2004) investigated the causes underlying a sample of eighteen thirdyear Australian pre-service primary teachers' negative beliefs and anxiety about mathematics. The design of the study was qualitative in nature. Data collection was through semi-structured

interview. Result indicates that, the participants felt most anxious about mathematics when they had to communicate their mathematical knowledge in some way (48%). Similarly, Houlihan(2009) examined the personality effects on teaching anxiety and teaching strategies in University Professors in Canada. The design of the study was descriptive survey. Data were collected through an online medium using survey monkey. The collected data was analyzed using multiple regressions. Result revealed a positive and significant correlation between anxiety and teaching strategies such as student-to-student discussions. Gender related was considered in this study which also showed that there is actually a significant relationship on CM and PCK. Gender factor analysis showed B = 0.001, tcal = 0.017, P (0.987) > 0.05. This meant that there was a significant relationship between gender and OFF Science and technology education teachers on CM and PCK. Aftab (2016) stated that males display more occupational stress/ anxiety towards teaching than the females. Similarly, Desouky and Allam (2017) reported gender difference in anxiety and depression in their study, as female teachers showed a higher rate of very severe anxiety and stress compared to their males counterpart.

Conclusion and Recommendations. The result of the study revealed that there was a significant relationship between the Content Mastery and the Pedagogical Content Knowledge. Therefore, Out-of-field (OFF) Biology teachers in Kano State have shown that, there is a very strong connection between anxiety on CM and PCK. Thus, we could assert that, OFF Biology Teachers have indicated that, there anxiety affects their CM and PCK which inevitably also translate to poor content delivery in the classroom.

13 Furthermore, anxiety on CM and PCK had significant influence on gender, teacher qualification and other related teacher factors examined in the study It is thus recommended that; government should enact a policy that will stop the further employment of teachers not professionally trained to teach. In addition, teachers should be assigned to teach in subjects' areas they have mastery on and be given trained on methodologies of teaching which are continually evolving.

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COLLEGES OF EDUCATION ENGLISH LECTURERS' READINESS FOR ONLINE TEACHING IN THE NEW NORMAL

By
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Abstract

The COVID-19 pandemic has caused global disruption, affecting every aspect of human life in many ways. A telling example of the disruption caused by COVID-19 is the temporary closure of educational institutions worldwide. To ensure the continuity of education for students, face-to-face classes have been moved online, ushering a new version of online learning in which lectures, lessons, and all learning activities are conducted remotely. This study adopted a descriptive study of the survey type. The study was designed to assess the Colleges of Education English lecturers' readiness for online teaching in the new normal in Oyo State, Nigeria. Multi-stage sampling technique was used for this study. In stage one, censure sampling technique was used to select all the three Colleges of Education in Oyo State that are government owned while in stage two purposive sampling technique was used to select all Education English lecturers in all government owned Colleges of Education in Oyo State, Nigeria. The research instrument that was used was subjected to reliability test using Cronbach's alpha and the reliability coefficient index of 0.84 was obtained. The data collected for this study were analyzed using descriptive statistics (Frequency Count, Percentage and Mean) to provide answers to research questions. The findings from data gathered in this study indicated that the readiness to online teaching by COE English lecturers was poor. The findings of this study also established that online facilities posed a challenge to COE English lecturers' readiness of online teaching in the new normal. Based on the findings of this study, the researchers recommended among others that governments must ensure the availability of reliable and adequate online tools, technology-enabled learning for lecturers to bridge the disparities originated in the education system before and after COVID-19 catastrophe which is also inevitably necessitated for uninterrupted learning which is known as new normal. Government should organize periodical capacity building workshops for the college of education lecturers with adequate online teaching tools in case of any inevitability.

Key words: New normal, Covid-19, Pandemic, Online teaching and College lecturer

Introduction

The COVID-19 pandemic has caused global disruption, affecting every aspect of human life in many ways. A telling example of the disruption caused by COVID-19 is the temporary closure of educational institutions worldwide. To ensure the continuity of education for students, face-to-face classes have been moved online, ushering a new version of online learning in which lectures, lessons, and all learning activities are conducted remotely. In developed societies, online learning is not new. It is part of the curriculum and students are generally familiar with different aspects of online learning through the use of Moodle, Blackboard, and other learning management systems. However, in developing societies such as Cambodia, online learning is not common, and there are many issues when it comes to implementing this learning mode. Prior to the COVID-19 pandemic, the concept of blended learning- a combination of face-to-face learning and online learning – was introduced at some Cambodian universities such as the Institute of Technology of Cambodia, but it was not really a common learning method.

The advent and impact of COVID-19 have changed everything. As schools and universities were ordered to close to contain the spread of the coronavirus, traditional physical classes were transitioned to an online mode of learning. The transition was abrupt, posing a lot of challenges for students, teachers, school administrations, and even parents. The challenges may vary across countries, systems, institutions, and groups of students. However, in the context of Nigeria characterized by limited resources, including technological and human resources, the challenges presented by the adoption of online learning have been considerable, particularly in the remote part of the country. Online learning (often used interchangeably with e-learning) is a form of distance education that involves using technology as the mediator of the learning process, and that teaching is entirely delivered through the internet (Kolawole & Kolawole 2021). Depending on individual educational institutions/instructors, students might have to attend regularly scheduled online lectures/presentations and/or discussions.

Moreover, students usually access learning materials online, such as recorded lectures/presentations, reading lists, activities, assignments, and so on through the provided platform. With online learning, students submit their works and receive feedback online. Students can also connect and interact with their peers online, and sometimes they can be together in an online class with an instructor while working through their digital lessons, materials, or assessments (Stauffer, 2020). Indeed, COVID-19 has brought dangerous times for public education, with risks of fragmentation and unravelling as we stand to lose both teachers and students who may not return to schools once they reopen. A certain privatization occurs when learning moves from schools into the home. We should be concerned that we can already hear claims that the current emergency and ad-hoc measures should be transformed into lasting reforms. Nonetheless, we also need to recognize that many parents and communities have awakened to an appreciation of teachers' work and their professionalism. More and more people are becoming aware of the multiple roles that schools play in providing for the well-being of children and youth, and in ensuring health and nutrition, alongside academic learning. This increased awareness and appreciation can serve as the basis for a new revival of public education.

The pandemic has forced a massive shift away from learning and teaching in traditional settings with physical interactions. This is a major problem for children living in poverty worldwide, who often rely on the physical setting of their schools to provide educational materials, guidance, and, sometimes, the only decent meal of the day. A big concern amid COVID-19 pandemic and the ensuing lockdown is education, which is at standstill affecting learning of millions of students worldwide. In the absence of any medical treatment and vaccine, social distancing emerged as a potent mitigating factor. The public places across nations have been shut to prevent the spread of this deadly disease and amid all institutionalized education becomes the biggest casualty. Schools and higher education institutions across the globe have been shut, impacting the learning of over 90% of world's student population. As per UNESCO estimates, COVID-19 related closure impacted the study of 1540 million students across 191 nations. In India, COVID-19 related educational institutions closure affected the learning of over 320 million students (UNESCO, 2020).

Statement of the Problem

The challenges of on line teaching experienced during Covid-19 pandemic in Nigeria are unlike those experienced elsewhere. Despite the current popularity of online instruction, does it have any limitations in Nigeria, particularly, in the Colleges of Education? Studies have found out that learners are moderately lacking in computer proficiency and, since online learning is centred on computer technologies usage, it is a barrier to those learners without good computer skills. The challenges in teaching and learning with technology such as lack of user's sufficient level of knowledge and skills for the use of multimedia, internet and web technology, non-availability of online environments and non-adoption and innovation of online method into teaching and learning process by faculties. Existing literature showed that socio-demographic factors such as gender and age could influence users' participation in technology-mediated learning (Kedia and Bhagat, 1988; Surry, Ensminger and Haab, 2005). Thus, it is generally accepted that gender is an issue in technology acceptance; that males are more enthusiastic and more positive than females; that men and women experience learning technologies differently (Burge, 1998) and that women often tend to lag behind in Internet adoption (Greenspan, 2004). However, developing countries in general, and Nigeria in particular, may not be exceptions; hence, assessing the influence of gender on the level of ICT skills could not be overlooked. Specifically, this research will survey lecturers from three Colleges of Education in Oyo State in Nigeria, assessing the level of Internet access, degree of deployment of instructional design principles, level of ICT skills, and influence of gender on ICT skills required for online teaching in Nigeria.

Research Questions

The following research questions were raised and answered in the study.

1. What is the readiness level of Colleges of Education English lecturers for online teaching in the new normal?
2. What is the availability level of online tools among Colleges of Education English lecturers for online teaching in the new normal?

Methodology

This study adopted a descriptive study of the survey type. The study was designed to assess the Colleges of Education English lecturers' readiness for online teaching in the new normal in Oyo

State, Nigeria. Multi-stage sampling technique was used for this study. In stage one, censure sampling technique was used to select all three Colleges of Education in Oyo State that are government owned while in stage two purposive sampling technique was used to select all Education English lecturers in all government owned Colleges of Education in Oyo State, Nigeria.

The instrument used was researchers' designed questionnaire as a tool to gather data for the study. This research design was therefore, considered appropriate because the study involved studying and describing the existing conditions in the areas of implementation of ICT for learning support using the NCCE's policy and guidelines as a yardstick. The instrument is titled "Questionnaire on Colleges of Education English Lecturers Readiness for Online Teaching in the new normal Questionnaire (QOCEELROTINN).

In order to test the reliability of the instrument, the prepared questionnaire was administered on Osun State College of Education lecturers, Ilesha, Osun state which is not part of the selected Colleges of Education (outside the coverage of the study). This approach was necessary to ensure that the items are clear enough and easily understood and to know whether there is a need to include or exclude more items. Reliability is necessary to ascertain whether the instruments are capable of reproducing consistent or similar results after a number of repeated administrations. At the end of administration, the data collected were analyzed with Cronbach's alpha and the reliability coefficient index of 0.84 was obtained. This implied that the instrument is reliable and capable of collecting expected data for this study. The researcher administered the instrument Questionnaire on "Questionnaire on Colleges of Education English Lecturers Readiness for Online Teaching in the new normal (QCEELROTINN) on the lecturers working in the selected Colleges of Education in Oyo State, Nigeria.

The data collected for this study were analyzed using descriptive statistics (Frequency Count, Percentage and Mean) to provide answers to research questions.

Research Question 1: What is the readiness level of Colleges of Education English lecturers on online teaching in the new normal?

Table 1: Readiness level of Colleges of Education English Lecturers on Online Teaching in the new normal

S/N	Statements	SA (%)	A (%)	D (%)	SD (%)
1	I have sound knowledge of ICT to operate on any online platform	5(3.40)	17(11.50)	47(31.80)	79(53.40)
2	With my good knowledge of internet, using online learning platform would not be a problem	4(2.70)	16(10.80)	55(37.30)	73(49.30)
3	With my good knowledge in general web browsing/surfing, using online learning platform would not be a problem	4(2.70)	20(13.50)	44(29.70)	80(54.10)

4	I have a sound electronics device (computer/smartphone) required to register for an online learning class	5(3.40)	10(6.80)	59(39.90)	74(50.00)
5	I have access to good internet broadband to get me connected to an online learning class	8(5.40)	29(19.60)	36(24.30)	75(50.70)
6	I have regular power supply to support my online learning class	12(8.10)	21(14.20)	50(33.80)	65(43.90)
7	I would not face any form of distraction in using online learning during this covid-19 period	3(2.00)	33(22.30)	39(26.40)	73(49.30)

Table 1 displays the readiness level of Colleges of Education English lecturers on online teaching in the new normal. It was revealed that majority of the respondents revealed poor level of readiness on online teaching during and post Covid-19 pandemic. Sound knowledge of Information and Communication Technology (ICT) is a prerequisite to involvement in any form of online teaching. It was found that an overwhelming majority of the respondent 79(53.4%) intensely agreed to not having sound knowledge of ICT, followed by 47(31.8%) who agreed to the same view, 17(11.5%) and 5(3.4%) disagreed and strongly disagreed respectively. Majority of the respondents indicated not having sound knowledge of ICT. These persons will indeed find it difficult to participate in any form of online teaching.

Also, on the knowledge of internet, it is also very important as online learning are sent by facilitators and received by the students through the use of internet. As regards the knowledge on the internet, 73(49.3%) of the respondent agreed while 55(37%) strongly agreed that with their poor knowledge of internet, online learning would be a problem. 16(10.8%) and 5(3.4) who disagreed and strongly disagreed respectively. On the other hand is the opinion that their sound knowledge of internet alone is not enough for effectively participating in online learning platform.

More so, on the importance of general web browsing and surfing, a large number of the respondents believed it is a problem for them as far as online learning is concerned. 80(54.1%) of the respondent disagree, 44(29.7%) of the respondent of the respondent strongly disagree, while 20(13.5%) agree. This was also followed by 4(2.7%) respondents who strongly disagreed with the idea. In addition, sound electronic device is the gateway to any form of online learning. This is because online learning requires the use of an ICT device be it computer or simple handheld smart phone that fully equipped with necessary software.

Surprisingly, most of lecturers 74(50.0%) respondents disagreed to having sound electronic device, this was followed by 59(39.9%) respondents who strongly disagreed to having electronic device. This is not surprising as the use of smartphone and computer have become common trend among so many especially those that can afford it. A few number of respondents, 10(6.8%) and 5(3.4%) however agreed and strongly agreed about having sound smartphone for online learning respectively.

On the access to good internet, it was found that online learning requires good access to internet for student to be able to benefit fully. All leaning materials are sent and received through the internet; hence, internet becomes a prerequisite for online learning.75 (50.7%) of the respondents disagreed to having access to good internet broad band but this was closely followed by 36(24.3%) of respondents who disagreed to having access to internet broadband. This can be attributed to a common fact that access to personal internet in Nigeria requires money and not all lecturers can actually afford to buy the amount of data needed to operate an online learning platform. On the two extreme are respondents who strongly agreed and strongly disagreed i.e. 29(39.9%) and 8(5.4%) with the view respectively.

Also, regular power supply is a determinant factor for effective ICT. Indeed, ICT requires power to be able to perform their functions optimally. Regular power supply is a mirage in some part of Nigeria and alternatives of power supply (generator, inverter, solar etc.) has become a thing of luxury to those who can afford them. With the present power crisis facing Nigeria, majority of the respondents 65(43.9%) overwhelmingly agree with the availability of regular power supply needed for online learning, this was followed by 50 (33.8%) respondents who disagree to having regular power supply, this sets of lecturers could include those leaving in urban areas and some of whom can afford to provide alternative means of power. 21(14.2%) respondents strongly disagreed while 12(8.1%) respondents strongly agreed.

However, it was also observed that one of the major problems lecturers do face in the use of online related services is distraction that may come either from environmental factor or internet related distraction like those from social media such as Facebook and Whatsapp. Whether the respondents will not be facing any form of distraction in their use of online teaching platform 73(49.3%) of the respondents disagreed while 39(26.4%) agreed. This means that there are tendencies of facing distraction in the process of using online learning platforms. 33(22.3%) and 3(2.0%) of the respondent strongly disagreed and strongly agreed respectively.

It was correspondingly found out that 34(50.4%) of lecturers had access to their own personal computer and the internet while 71(44.5%) respondents did not. Also, 39 (37.7%) of the lecturers had uninterrupted power supply in their homes, whereas 549(51.8%) respondents did not. Again, 51 (48.2%) of the lecturers had access to use facilities at home, while 42(41.7%) of lecturers claimed that they did not. Although 40(38.5%) of the lecturers had uninterrupted power supply at their residence, 58 (55.5%) respondents did not. In summary, majority of the lecturers reported that they do not have the facilities needed for online lecturing.

Similarly, it was revealed that 44(55.7%) of lecturers had access to their own personal computer and internet, while 19(11.3%) respondents claimed they did not. Likewise 55(32.7%) of the lecturers claimed they had uninterrupted power supply in their institution computer center whereas 71(64.3%) responded they did not. 40(23.8%) respondents had uninterrupted power supply at their residents, whereas 73 (66.7%) respondents did not. Moreover, 89.3% of lecturers do not have electronics class roll while 78.9% do not have digital library.

Research Question 2: What is the availability level of online tools among Colleges of Education English lecturers for online teaching in the new normal?

Table 2: Availability of Online Teaching Tools Used in the new normal

S/N	ICT Facilities	Mean(X)
1	Desktop	1.11
2	Laptop	1.18
3	Projector	1.26
4	Projector screen	0.91
5	Video camera	0.94
6	Compact disk	0.92
7	Examination Scoring Machine (EMS)	0.40
8	Radio Cassette	0.26
9	Printer	0.014
10	Scanner	0.016
11	Photo copier	0.52
12	Generator	1.39
13	Server	0.38
14	Satellite dish	0.93
15	Interactive white boards/smart board	0.76
16	Software	0.66
	Grand mean	0**.77**

The results in Table 2 revealed that in almost all the items raised under the availability of online tools for online teaching in the new normal, over 90 percent confirmed that the facilities were either not adequate or not available except for the common facilities like GSM, personal computer and laptop computer that had mean scores of 1.39, 1.26 and 1.18 respectively. While facilities like good internet access, Electronic bulletin board, very small aperture satellite dish and Examination Scoring Machine had the lowest mean scores of .014, 016 and .26 respectively.

Conclusion

Amidst Covid-19 pandemic, internet has become mitigating tool to rescue education from severe effects of worldwide lockdown and closure. By closing the gates of many educational institutions around the globe, coronavirus pandemic has provided an opportunity to practise digital form of teaching and learning. This much needed but suddenly imposed online teaching started unplanned in hurry to safeguard academic life of millions of students affected by this worldwide pandemic.

The research explored COE lecturers' readiness in online teaching in Nigeria. The results obtained from data gathered and analyzed in this study indicated that the readiness to online teaching by COE lecturers was poor. The findings of this study also established that online facilities posed a challenge to COE English lecturers' readiness of online teaching in the new normal.

Recommendations

Based on the findings from this study, the following recommendations were made as follows:

Colleges of education, must as a matter of necessity, improvise means through which knowledge delivery and general learning activities can be achieved seamlessly and at the lowest cost to the lecturers and students even while at home.

The Colleges of Education management should inculcate online teaching practices as this will further accelerate the pursuit of aspects of technology based teaching that would be found most useful.

The governments must ensure the availability of reliable and adequate online tools, high quality digital academic experience, and promote technology-enabled learning for lecturers to bridge the disparities originated in the education system before and after COVID-19 catastrophe which is also inevitably necessitated for uninterrupted learning which is known as new normal.

Government should equip the college of education lecturers with adequate online teaching tools and retrained on the use of these tools for any inevitability.

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EXTENT OF UTILIZATION OF DIGITALIZED RESOURCES IN TECHNOLOGY EDUCATION PROGRAM IN SOUTH-WEST NIGERIAN UNIVERSITIES FOR SUSTAINABILITY IN DISRUPTIVE TIMES.

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Abstract

The need to produce competent graduates for effective performance in the global workplace for sustainability in disruptive times necessitated this study, to determine the extent of utilization of digitalized resources in technology education programme in South-West Nigerian Universities. Two research questions and two hypotheses guided the study. The study adopted a descriptive survey design. The population of the study was 50 Technology education lecturers from the universities offering technology education programme in South-West, Nigeria. This population formed the sample. The instrument for data collection was a 17-item validated questionnaire developed by the researcher. The reliability of the instrument was established using Cronbach Alpha with reliability coefficient of 0.86 and 0.79 for clusters A and B respectively Data collected were analysed using mean and standard deviation to answer the research questions while t-test statistic was used to test the null hypotheses at 0.05 level of significance. The results revealed that digitalized resources for instructional delivery and evaluation process in technology education programme in South-West Nigerian universities during modern era and disruptive times were utilized at a very low extent. Also, ownership of institutions did not significantly affect the opinion of technology educators regarding the extent they utilize digitalized resources for instructional delivery and evaluation process in technology education programme in South-West Nigerian Universities. It was recommended among others that university administrators in collaboration with the government should provide adequate digitalized facilities for lecturers in order to facilitate their teaching and evaluation process.

Keywords: Digitalization, Technology Education, Disruptive Times, Digitalized Resources, Sustainability.

Introduction

Digitalization is radically interfering and changing the fundamental assumptions of the way of life and organization of work in a postmodern society which is becoming more globalized and more digitalized than ever before. Therefore it is becoming increasingly important for organizations to quickly, efficiently and appropriately plan the digital transformation to achieve flexibility and to maintain market competitiveness. In the provision, utilization and maintenance of digitalization, it is expected that teacher and leaners enjoy more comfort, convenience, portability, durability, security and accountability.

Today's digital era revolves around the use of new technologies that create value for institutions and offer a host of benefits (Summarberg & Makinen, 2011) (Parida et-al., 2019 Scott et-al., 2019). Digitalization is in connection with computerization and the possibility of computer aided exploration (Sanders 1974). Wachal (1971) sees digitalization as one of the key, if not crucial features of the modern world. He is supported by Van Dijk (2006) stating that we are on the way to having a single communication infrastructure that will encompass all the activities of the society.

Digitalization provides unprecedented access to knowledge, reduced cost and greater interdisciplinarity, which is also a necessary as trends indicate that younger generations will on average perform far more different occupations than generations in the 23rd century (Mittal et-al., 2018). Digitalization has a massive impact on the economic field which plays a vital role in the development and advancement of institutions and society (Denecken 2016) Evangelista et-al 2014; Katz et-al., 2014). Digitalization harnessed the resources such as electronics communications computers, internet, e-mail, software, satellite, mobile communication gadget and other allied electronic devices for dissemination of knowledge and information Klerk et-al., 2019) posited that digitalization comprises computer and ICT, materials and utilizations, which aid information collection and dissemination. These definitions imply that digitalization does not only solve the use of electronic devices for teaching, but also the presence of the instructors in the learning.

The introduction of digitalization resources to the education system was aimed at improving education delivery and preparing students for the information age. According to the Greenwood (1997) and Schwab (2017). Digitalization resources provide productive teaching and learning which increases peoples creative and intellectual resources. The resources enable teachers and students to develop capability for high quality learning and innovative abilities. Electronic learning resources encourage users to peruse through information by using internet technology. Following the use of internet and the increased connectivity this brought more coordination and integration between teaching and learning activities could take place (Porter & Heppelmann, 2014) while this process of automation and increasing connectivity is still ongoing, the next wave of digital technology has introduced itself and is often referred to as the fourth industrial revolution (Schwab, 2017).

Consequently technology education needs to prepare an individual for career in technology and has to be properly positioned in the global village through utilization of digitalization resources. This could help to produce competent graduates that would compete favourably and globally in the world of work. This technology education is the application of scientific knowledge for practical purposes, especially in industry machinery and equipment development. There are five

main types or branches of technology education programme of instruction thus, automobile technology, building technology, electrical technology.

Technology education is designed to equip recipients with appropriate knowledge, saleable and manipulative skill as well as desirable work attitude for gainful employment (Lasisi, (2022). Technology education according to Mbali (2016) is designed to prepare individuals to acquire skills for occupation, trade or job. Nwankwo, Obeta and Nwangbo (2013) opined that technology education has been a major part of national development in many developed nations because of its positive effect on national industrial productivity and economic growth. It is connected with the practical use of machinery and scientific principles in performing specific engineering and technological jobs.

Technology education is offered in public tertiary institutions with options in automobile mechanical technology, building/woodwork technology and electrical/electronic technology programme. Each of these areas provides specialized skill area for students to acquire for economic development. Technology education programmes is imperative due to its place in the technological, economic and sustainable industrial skill development.

Sustainability refers to the ability to maintain or support a process continuously overtime, in business and policy context sustainability seeks to prevent the depletion of natural or physical resources so that they will remain available for the long term. Sustainable national development is a state of having well balanced, steady and effective use of human, material and capital resources for total economic independence of a nation without compromising the future (Umezulike & Okoye, 2013).

Shaibu, Okpe and Mbaegbu (2019). See sustainable national development as progress, advancement or qualitative changes that are evident in a nation over a period of time, electronic technology, mechanical technology and woodwork technology. These are careers programmes of instruction through refresher and upgrading education leading to employability or self-employ. However, the need to utilize digitalization resources in technology education programmes has been advocated by Rose and Chilvers (2018). They said that in the era of technology education development digitalization are expected to be fully and properly utilized. This digitalization resources, such as software packages enable the educators to carry out huge analyses that maybe tedious manually; moreso, digitalization resources could help in the area of technology education research and evaluation of the programme. Consequently, utilization of digitalization in technology education programme becomes imperative as the traditional teaching and learning method, instructional delivery and evaluation process slowly moving to electronic process and activities (Klerk & Rose, 2020), irrespective of institution type (federal and state universities). Thus the extent they utilize digitalization resources in the area of instructional delivery and evaluation process are of concern.

Statement of the Problem

The need to utilize digitalization resources in technology education programme had advocated by the researcher digitalization in southwest universities remains a mirage due to its slow pace of utilization. The low utilization of digitalization resources among technology educators was as a result of non-availability of digitalization resources as their students prove naive of digitalization practice in their training. This unsatisfactory manner of practice in the delivery of technology

education programme could stressed to the non-utilization of digitalization resource for instructional delivery and evaluation process. Research shows scanty report with non-utilization of digitalization resources in teaching and learning of technology education programme which may lead to production of incompetent graduates in the current era. This the problem of the study is that the students do not perform in the world of work and the extent digitalization resources are utilized in the area of instructional delivery and evaluation process is somehow low.

Purpose of the Study

The main purpose of the study was to ascertain the extent of utilization of digitalization resources in technology education programme in south-west, Nigerian universities, specifically, the study determined the extent of utilization of digitalization resources:

1. For instructional delivery in technology education programme in south-west Nigerian universities.
2. In evaluation process in technology education programme in south-west Nigerian universities.

Research Questions

The following research questions guided the study;

1. To what extent are digitalization resources utilized for instructional delivery in technology education programme in Southwest Nigerian Universities?
2. What is the extent of utilization of digitalization resources in evaluation process in technology education programme in southwest Nigerian Universities?

Hypotheses

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

1. There is no significant difference between the mean ratings of respondents from state and federal universities on the extent of utilization of digital learning resources for instructional delivery in technology education programme.
2. There is no significant difference between the main rating of respondents from state and federal universities on the extent of utilization of digitalization resources for evaluation process in technology education programme.

Method

This study adapted a descriptive survey design the population of the study comprised 50 technology education lecturers in the eight universities offering technology, education programme in southwest Nigeria. This population formed the sample since the number is manageable. The instrument for data collection was a 17-item questionnaire tittled; “Utilization of Digitalization learning resources in Technology Education Programme Questionnaire (UDRTEPQ)” developed by the researcher. The questionnaire was subjected to validation by three experts from Ekiti State University. The reliability of the instrument was established using Cronbach Alpha with reliability coefficients of 0.86 and 0.91 for cluster A and B respectively. Data collected were analyzed using mean and standard deviation to answer the research questions while t-test statistic was used to test the null hypotheses at 0.05 level of significance.

Results

Respondents' mean ratings on the extent of utilization of digitalization resources for instructional delivery in technology education programme.

S/N	Digitalization Resources for Instructional	X	SD	Remarks
1.	Use power-point in classroom instruction	2.75	0.44	Lowly utilized
2.	Use e-mail as point of contact with students	1.75	0.43	Very lowly utilized
3.	Create and use on-line syllabus with hyperlink	2.75	0.44	Lowly utilized
4.	Use the computer Auto-card in teaching technical drawing	2.75	0.44	Lowly utilized
5.	Use web 2.0 to record lesson live and upload them on website page	2.75	0.44	Lowly utilized
6.	Use CD-ROM to present subject content	2.87	0.42	Lowly utilized
7.	Use computer to score and access students via online software	2.75	0.44	Lowly utilized
8.	Use social networking tools to discuss ideas with students	2.87	0.42	Lowly utilized
9.	Use interactive white boards/smart board	1.75	0.43	Very lowly utilized
10.	Use online real-time teacher instruction and feedback via chart rooms	2.00	0.00	Very lowly utilized
	Cluster Mean	2.05		

Data in Table 1 show that all the items listed had mean ratings ranging between 1.75 and 2.75 with a cluster mean of 2.05. This means that digitalization resources were very lowly utilized for instructional delivery in technology education programme of universities in southwest Nigeria. The standard deviations for all the items were within the same range showing homogeneity in respondents mean ratings.

Table 2:

Respondents' means ratings on the extent of utilization of Digitalization resources in evaluation process in technology Education Programme.

S/N	Items	X	SD	Remarks
1.	Use digitalization resources for continual programme improvement	2.00	0.00	Very Lowly utilized
2.	Use application software to determines how much and how well students are learning	2.10	0.30	Very lowly utilized

3.	Use computer to formally evaluate students learning	2.00	0.45	Very utilized	Lowly
4.	Use computer excel to evaluate student achievement and assign grade	1.90	0.30	Very utilized	Lowly
5.	Use digitalization resources for face-to-face feedback during class	1.80	0.36	Very utilized	Lowly
6.	Use ICT to facilitate students learning process	3.00	0.35	Lowly utilized	
7.	Use application software to improve continues assessment	2.40	0.40	Lowly utilized	
	Cluster Mean	2.30		Very utilized	Lowly

Data in table 2 show that all the items listed had mean ratings ranging between 1.80 and 2.40 with a cluster mean of 2.30. This means that digitalization resources were very lowly utilized for evaluation in Technology Education Programme of Universities in Southwest Nigeria.

Table 3

Summary of t-test analysis on extent of utilization of digitalization resources for instructional delivery in technology education programme in state and federal universities.

Universities	**N**	**X**	**SD**	**df**	**tcal**	**terit**	**X**	**Decision**
Federal	23	2.34	0.56	48	0.27	2.02	0.05	NS
State	27	2.38	0.57					

Table 4 shows that the calculated t-value of 0.27 is less than the critical t-value of 2.02. This means that respondents from state and federal universities do not differ significantly in their mean ratings on the extent of utilization of digitalization resources for instructional delivery in technology education programme. Therefore, the null hypothesis of no significant differences before the two groups was not rejected.

Table 4

Summary of t-test analysis on extent of utilization of digitalization resources for evaluation in technology education programme in state and federal universities.

Universities	**N**	**X**	**SD**	**df**	**tcal**	**terit**	**X**	**Decision**
Federal	23	2.93	0.12	48	2.01	2.02	0.05	NS
State	27	2.96	0.13					

Table 4 shows that the calculated t-value of 2.01 is less than the critical t-value of 2.02. This means that technology educators in state and federal universities do not differ significantly in their means ratings on the extent of utilization of digitalization resources for evaluation in technology education programme. Therefore, the null hypothesis of no significant difference between the two groups was not rejected.

Discussion

Findings of the study shows that digitalization resources were very lowly utilized for instructional delivery in technology education programme of universities in southwest Nigeria. The finding is in line with Ukor, Ajwuazie and Ayenhenre (2014) and Inije, Utoware and Kren-Ikidi (2013) who reported that digitalization technologies are not utilized for instructions. However, finding contrasted those of Cleverly and Stepherd in Allen (2003) who agreed that information and communication technologies are being used in the developed and developing world for instructional functions and that computers and network perform a lot of function in teaching. It was also found that respondents did not differ significantly in their mean ratings on the extent of utilization of digitalization for instructional delivery in technology education programme in state and federal universities. This means that institution type did not affect the extent of utilization of digitalization resources for instructional delivery in technology education programme. This finding is in agreement with Nwosa (2013) who noted that institution type has no effect on the extent to which technology educators utilize internet facilities for teaching technology education courses in various institutions.

Furthermore, the findings showed that digitalization resources were very lowly utilized for evaluation in technology education programme of universities in south west Nigeria. This finding is in line with Beyer (2007) who observed that digitalization resources are not adequately utilized by evaluators at all levels of education. Respondents did not differ significantly in their mean ratings on the extent of utilization of digitalization resources for evaluation process in technology education programme in state and federal universities. This means that institution type did not affect the extent of utilization of digitalization resources for evaluation process in technology education programme. Technology educators in the state and federal equally do not utilized digitalization resources for evaluation process in the programme.

Conclusion

Based on the findings of this study it was concluded that digitalization resources for instructional delivery and evaluation process in technology education programme in Southwest Nigerian Universities were very lowly utilized. It was also discovered that ownership of institutions did not significantly affects the opinion of technology educators regarding their rating of utilization of digitalization resources such as instruction delivery and evaluation process in technology education programme in south-west, Nigerian Universities.

Recommendations

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

1. University administrators in collaboration with the government should provide adequate digitalization facility for lecturers in order to facilitate their teaching evaluation.
2. That digitalization resources should be fully integrated into the programme of teaching and learning in Technology Education Programme by the curriculum planners and its utilization made compulsory for lecturers irrespective of the courses assigned to them.
3. The associations of Technology Education of Nigeria, should regularly organize seminars and workshops on the utilization of digitalization resources in instructional delivery and evaluation process in technology education programme.

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ONLINE PLATFORMS FOR FACILITATING ADULT LITERACY LEARNERS' LANGUAGE AND COMMUNICATION SKILLS IN ILORIN, NIGERIA

BY

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Abstract

The teaching and learning of language and communication skills have generated controversies among adult educators and researchers. How language is taught to adult literacy learners has been a major issue. This study therefore, examines online platforms for facilitating adult literacy learners' language and communication skills in Ilorin, Nigeria with emphasis on learners' attitude towards using online platforms. This study adopted a mixed method of both quantitative and qualitative analysis otherwise known as triangulation. The population of the study comprised all the facilitators and adult literacy learners in Ilorin, Kwara State. Purposive sampling technique was used to select two facilitators of g language and communication skills in each of the sampled centres making a total of sixteen (16) facilitators. A researchers' designed instrument was used to gather data for this study. Data gathered were analysed using both descriptive and qualitative analysis techniques. The findings of the study revealed that most frequent used platform by facilitators for adult literacy learners learning language and communication skills is the WhatsApp platform, while there was negative attitude of adult literacy learners towards using online platforms in learning communication skills. This study concludes that the most commonly online platform used by facilitators for adult literacy learners learning language and communication skills was the WhatsApp platform, while other online platforms were rarely used. Based on the findings and conclusion, it was recommended among others that adult learners' facilitators should expose their adult learners into online learning platforms in order to improve their performance especially in language and communication skills.

Key Words: Online Platforms, Literacy, Communication Skills, Adult Learners

Introduction

Communication is a prevalent activity that floods virtually all aspects of human life. It is the only social activity that determines human existence, and it is also a phenomenon that evaluates the life of human beings and beyond. In this contemporary world, technology has greatly influenced human communication. Communication has been crucial among human beings since the time immemorial, but its significance is more prominent in today's world. Geographical boundaries

have been flattered, where information generation and dissemination unite people together across the world (Adedimeji, 2017). The reality of today is that human communication has been greatly influenced by the information and communication technology (ICT).

Communication, generally speaking, is perceived as the process of sending and receiving of meaningful or understandable information from the sender to the receiver through an appropriate channel with adequate feedback. Adedimeji (2017) defines communication as the process of mutual sharing of information, ideas, thoughts and emotions between a source and a receiver for mutual understanding, reduction of uncertainty for appropriate actions. The purpose of communication depends on the context in which the communication is taking place. For instance, the purpose of communication in a financial institution will vary significantly from what is obtainable in the academic settings. Whatever, the differences in the purpose, there are still some meeting points of which educate, inform, command, among others are the reasons for communication (Durosinmi, 2017).

There is no doubt about the fact that language is a major means of communication. The affinity between man and language is so intrinsic that the formal cannot exist without the latter. Besides, the world has shrunk to a global village and the amount of information available to man can be engendered with the use of information and communication technology (ICT). For effective communication to take place, there must be communicative competence between two or more individuals involved in order to ensure that messages are delivered and appropriately received. Language and communication skills are basically four types, and they are all inter- related: listening, speaking, reading and writing. Listening and reading skills are information retrieval, that is, information gathering and critical evaluation; while speaking and writing are productive skills which one expresses oneself and produces information for various functions (Adedimeji, Alabi & Abdullahi-Idiagbon, 2013).

However, in order to provide an insight into how effective communication can take place, the four language and communication skills are to be examined. Listening means hearing with comprehension. Thus, there is a difference between listening and hearing. Hence, listening is a conscious process that consists of receiving, focusing, deciphering and storing information (Abubakar, 2018). Reading is the ability to of an individual to encode and decode meaning from the text (Akinyemi, 1991). Reading is a conscious effort of extracting information from the written words (text). The level of consciousness may vary based on the level and purpose of reading. However, without any concentration, the reader might have just be staring at books. Listening and speaking are primary, oracy and natural sources of language and communication skills, although they are different in terms of operation.

Speaking is directly connected with listening, while listening is only complete when the listener understands what is being heard, a good speaker has to be able to communicate his thoughts successfully to the listener. Speaking is a verbal mode of expression, it involves, the use of sounds that must be heard and understood. It involves the use of the organs of speech with the articulation of speech sounds. These sounds must be meaningful and intelligible. In order to communicate successfully, a speaker must cultivate the skill of effective speaking as poor speech would distract the listener's attention from what is being so to how it is said. A good speaker is not expected to pretend to speak in a false accent or copy another speaker in a target language, rather, a good speaker should speak in a natural way (Adedimeji, 2017).

Writing is the most technical of the communication skills and it is the most difficult to teach and learn. Sincerely, all other communication skills must be adequately learnt be learning writing skill. The quality of one's ability to reason, organise and process information determines how good the writing would be. A good writing should be clear, has proper grammatical structure, punctuation and spelling which must pass through all the writing. A good writer should know his or her readers so as to ensure a functional communicative interaction by using a suitable style and language. Ideally, people write to inform, recommend, motivate, prompt or play a part in a debate, persuade, impress, record, instruct, reinforce or build on existing situations and beliefs (Adedimeji, 2013).
The purpose of communication is to get messages across to other clearly and unambiguously. Doing this involves both the sender of the message and the receiver. It is important to note that the process can be fraught with errors and the message may be misinterpreted by the recipients. Adedimeji (2017) identifies a model of communication with interrelatedness of the four language skills using reasoning as the mastery skill for effective utilisation. The model examines that:

a. Encoding = Speaking + Writing Skills

b. Decoding = Listening + Reading Skills

c. (a) + (b) above = Reasoning.

Therefore, it goes without saying that no one can be reasonable without the mastery of listening, speaking, reading and writing. This is more vivid as presented in Figure 1.

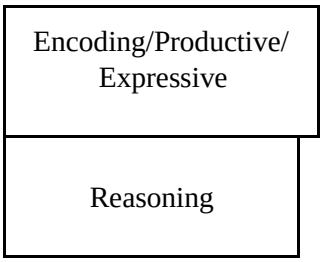

Figure 1: The Interconnection of Communication Skill Source: (Adedimeji, 2017).
Technologies have dramatically changed the way people gather information and communicate with others worldwide. It has removed the distance obstacles and has made it possible for higher education to effectively teach anyone. Technology integration is being increasingly used in instruction to improve teaching and learning (Gilakjani, 2017). This rapid development of technology integration has presented a better pattern to find the new teaching models. According

to Dockstader (2008), there are some important reasons for integrating technology into the classes. These include:

1. Through integrating technology, more depth into the content-area syllabus would be possible.
2. In the information age, there is an urgent need to learn technology.
3. Learners are motivated through technology that ultimately enhances academic engagement time.
4. Working in more depth with the content, learners can move beyond knowledge and comprehension to application and analysis of information.
5. Learners learn where to find information in an information rich world.
6. Learners develop computer literacy through using different computer skills as part of the learning process.

Billings and Mathison (2011) emphasis that there are two reasons that educational technologies assist in raising learners' achievement. The first reason is that they perform a very good job of engaging the learners in the material. The second one is that they get learners excited to take part in the educational tasks. One of the basic advantages of integrating technology into the classes is that when they are applied, they can make learning more fun for the learners. If the learners have a lot of enjoyable materials, they will be engaged in the lesson that will help them better understand the learning materials. Furthermore, when the lessons are fun for the learners, they will be more excited to take part. In order for teachers to integrate technology effectively, they should know how to appropriately use them and how to teach their learners to use them accurately.

Adult literacy learners are particularly older learners who have peculiar characteristics in their domains. Based on the characteristics of adult literacy learners, facilitators should be careful in selecting appropriate instructional resources for teaching communication skills. Adult education is an all-round education that embraces all categories of learning. Significantly, it is an education of out-of-school programme. Adult education according to Nzeneri (2010) embraces all experiences through which an individual acquires knowledge of or skill, develops intellectual capacity and strengthens his or her will. It also includes information acquired through all senses.

Adult learning and education (ALE) is an umbrella term encompassing a wide range of contexts in which learning by adults may take place around the globe. Diverse classifications of learning exist, using multiple lenses related to the organisation, governance or funding sources, how intentional the learning is, or what the purposes or motivations underlying the learning are functional goals such as career promotion or work, leisure or well-being needs or improving active citizenship and participation in community action (Lee & Desjardins, 2019). To Najeemdeen and Ishola (2022), adult education is any activity with an educational purpose that is carried out by people who engaged in ordinary business life with purposeful effort directed towards self and community development.

The study on strategies used for teaching adult literacy learners reading comprehension in Ilorin, Nigeria, the findings revealed that combinations of various strategies were the most preferred strategy used by facilitators in teaching adult and literacy learners reading comprehension (Najmudeen & Ishola, 2022). There are various online platforms for teaching language and communication skills. Such platforms include, telegram, WhatsApp, google classroom, podcasts,

among others. The affordance of learning management system (LMS) have made most higher education institutions offering distance education to adopt both online and traditional face-to-face learning (Bervell & Arkorful, 2020). Indahsari (2020) studies the use of podcast for EFL students in language learning. The study reviews the effects of using podcast in supporting language learning. Podcast as a tool has the power to motivate students in learning English.

Similarly, Google Classroom is like a Learning Management System (LMS) that can be used to manage, document, track, report and deliver educational courses or training programmes. It can also be used to manage learning that is set up for students and teachers for teaching activities (Ellis, 2009). According to Heggart and Yoo (2018), Google classroom is a learning management system (LMS) which helps students easily retrieve learning material and connect with other students through online application. Nagelle (2017) states that by using Google classroom, teachers can create active lessons which are student-centered, collaborative and memorable since it provides easy-to-use learning features for students. This present study therefore investigated various online platforms that are appropriate for facilitating language and communication skills among adult literacy learners.

Statement of the Problem

The teaching and learning of language and communication skills have generated controversies among adult educators and researchers. How language is taught to adult literacy learners has been a major issue. However, in adult literacy learning programme, teaching and learning communication skills is important because these set of learners need these communication skills to tackle current challenges facing them in their daily life. They need the skills for them to solve learning challenges facing them. There are various studies carried out on instructional resources for teaching communication skills. Such studies include Ayuba (2017) who assessed instructional resources for teaching pronunciation. The findings of the study revealed that language teachers used resources mainly in the school domain.

In another study by Yayi, Yusuf and Jarumi (2018) studied effectiveness of blended learning on the ability level of upper-basic students in Social Studies in Ogbomoso, Nigeria. Their findings reveal a significant difference in the performance of high, medium and low ability level of students exposed to the blended learning. More so, Olumorin, Babalola, Ashaolu and Omolafe (2022) carried out a study on students' attitude towards the utilisation of Google classroom for learning. Their findings showed that there is a positive attitude of learners towards using Google-classroom for learning. However, to the best knowledge of the researchers, not many studies have been carried out on the assessment of online platforms for facilitating adult literacy learners' language and communication skills in Ilorin, Nigeria. Thus, this seeming neglect has created a research gap part of which this study intends to address.

Research Questions

The following research questions were answered in this study.

1. What are the common online platforms used by facilitators in teaching adult literacy learners' communication skills in Ilorin, Nigeria?
2. What is the attitude of adult literacy learners towards using online platforms in learning communication skills?

Methodology

This study adopted a mixed method of both quantitative and qualitative analysis otherwise known as triangulation. The population of the study comprised all the facilitators and adult literacy learners in Ilorin, Kwara State. Ilorin consists of four Local Government Areas (Asa, Ilorin-east, Ilorin-south and Ilorin-west). Multi-stage sampling technique was used to select respondents for this study. At the first stage, random sampling was used to select two (2) adult literacy centres from each of the four Local Government Areas. At the second stage, purposive sampling technique was used to select two facilitators who were teaching language and communication skills in each of the sampled centres making a total of sixteen (16) facilitators.

A researchers' designed instrument was used to gather data for this study. The instrument was divided into three sections A, B and C. Section A revealed the demographic data of respondents on facilitators' gender, qualification and their experience. Section B captured facilitators' preferred online platforms used in teaching adult literacy learners' communication skills, while section C was a free response on adult learners' attitude towards using online platforms for learning language and communication skills. Data gathered were analysed using both descriptive and qualitative analyses techniques. Demographic information of respondents was described using the percentage. Research questions 1 was answered using mean rating and rank order, while research question two was answer using qualitative analysis.

Results and Discussion

Demographic information of respondents was described using the percentage and the output is presented in Table 1.

Table 1: Demographic Information of Respondents

Gender	**Frequency**	**Percentage%**
Male	11	68.75
Female	05	31.25
Total	**16**	**100.0**
Qualification	**Frequency**	**Percentage%**
Qualified	14	87.5
Unqualified	02	12.5
Total	**16**	**100.0**
Experience	Frequency	Percentage%
Less Experienced	03	18.75
Experienced	08	50.0
Most Experienced	05	31.25
Total	**16**	**100.0**

Table 1 shows that out of sixteen (16) facilitators sampled, 11 (68.75%) were male, while the rest 5 (31.25%) were female facilitators. This means that male facilitators were more than their female counterparts. More so, out of sixteen (16) facilitators sampled, only 14 (87.5%) were qualified to teach language and communication skills, while only 2 (12.5%) were not qualified to facilitate

adult literacy learners in language and communication skills. On teaching experience, out of the sixteen respondents sampled, 3 (18.75) were less experienced facilitator because the just spent less than ten (10) years. 8 (50.0) were those who have spent more than ten years but less than twenty years, while 5 (31.25) were the most experienced facilitators sampled because they had spent above twenty-one years in facilitating adult literacy learners. dyyThis implies that the most sampled facilitators were the experienced facilitators, followed by the most experienced, while the less experienced were the least.

Research Questions

Mean and Rank Order was used to analyse the research question one, while qualitative analysis was used to answer the research question 2.

Research Question 1: What are the common online platforms used by facilitators in teaching adult literacy learners' communication skills in Ilorin, Nigeria?

Mean and Rank Order was used to answer the research question 1 raised in this study. The result is shown in Table 2.

Table 2: Mean and Rank Order Analysis on Common Online Platforms Used by Facilitators in Teaching Adult Literacy Learners Communication Skills

S/N	Online Platforms	Mean	Rank Order
1.	WhatsApp	3.28	First
2.	Facebook	3.10	Second
3.	Instagram	2.42	Third
4.	Telegram	2.15	Forth
5.	YouTube	2.08	Fifth
6.	Podcast	1.99	Sixth
7.	Google Classroom	1.24	Seventh
8.	Snapchat	0.89	Eighth
9.	LinkedIn	0.55	Ninth

Table 2 revealed that out the recognised online platforms used to facilitate adult literacy learners in learning language and communication skills, WhatsApp platform is the most frequently used with mean score (3.28) and ranked first as the highest mean, followed by Facebook with the mean score (3.10). Others include, Instagram (2.42), Telegram (2.15), YouTube (2.08), Podcast (1.99), Google Classroom (1.24), Snapchat (0.89), while LinkedIn (0.55) as the least. This implies that the most frequent used platform by facilitators for adult literacy learners learning language and communication skills is WhatsApp platform.

Research Question 2: What is the attitude of adult literacy learners towards using online platforms in learning communication skills?

In answering this question, responses of the respondents on adult literacy learners' attitude towards learning language and communication skills were collected, collated and subjected to qualitative analysis using ATLAS.ti. This is a strong workbench for qualitative data analysis and report, particularly for large sections of text, visual and audio data as this software offers support to the researcher during the data analysis process, in which texts are analysed and interpreted using coding and annotating activities (Smit & Scherman, 2021). The responses were run and the following statements or findings were generated.

Most responses from the responses attested to it that adult literacy learners are having low or negative attitude towards using online platforms for learning language and communication skills. Specifically, one of the facilitators claimed that:

"Adult learners find it difficult to submit their assignment online, to the extent that when they were forced, only few of them would submit on time, although those would submit performed better than those who answered using the conventional paper write-ups".

A Male Facilitator.

In another finding, it was discovered that adult learners complained about poor network. Some would even say they do not have data to assess the questions or join the class. Most often, only thirty percent of them would join the online class, while majority of them would stay away. Unfortunately, those that attended the online class perform better than those who did not. It was emphasised by a female facilitator that:

"Some adult literacy learners did not know how to use smartphone and those who know how to use it find it difficult to adapt it to learning."

A Female Facilitator. This implies that there is negative attitude of adult literacy learners towards using online platforms in learning communication skills.

Discussion

The first finding of this study showed that most frequent used platform by facilitators for adult literacy learners learning language and communication skills is the WhatsApp platform. This finding supports the findings of Asmara (2020) whose findings revealed that teaching English in a virtual classroom using Whatsapp during COVID-19 pandemic was the best and it helped.

The finding also corroborated the outcome of Issahaku, Agbotsu and Jibril (2020) who studied the effects of social network sites on teacher trainees' grammar and spelling skills in Ghanaian tertiary institutions and found out that social network sites assisted teacher trainees' performance in grammar and spelling skills.

The second finding of this study revealed that there is negative attitude of adult literacy learners towards using online platforms in learning communication skills. This finding contradicts the outcome of Awofala, Akinoso and Fatade (2017) whose findings revealed that students exhibited positive attitudes towards computer and computer self-efficacy as predictors of preservice Mathematics teachers' computer anxiety. This is because the students involved were young adult learners, while the present study focused on adult learners with peculiar characteristics.

Conclusion and Recommendations

The study concludes that the most commonly online platform used by facilitators for adult literacy learners learning language and communication skills was the WhatsApp platform, while

other online platforms were rarely used. More so, the study concludes that there was a negative attitude of adult literacy learners towards using online platforms in learning communication skills due to the fact that adult literacy learners were not accustomed to digital learning platforms. Based on the findings and conclusion, the following recommendations were proffered.

1. Adult literacy learners' facilitators should expose their adult learners into online learning platforms in order to improve their performance especially in language and communication skills.
2. Adult literacy learners should be exposed to the benefit of using online learning platforms because of numerous advantages and exposure it would give them in terms of using appropriate communication skills.

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