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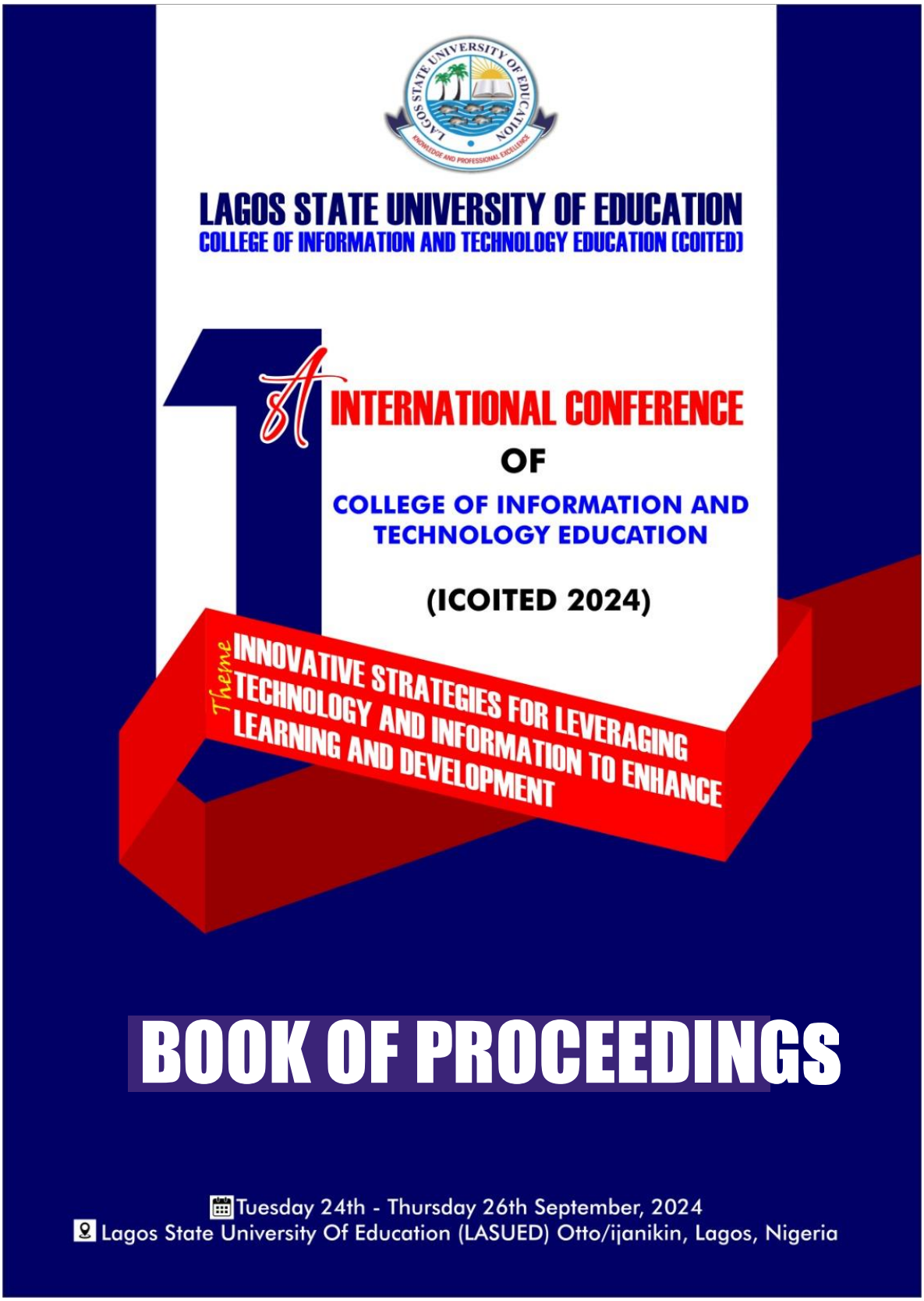

LAGOS STATE UNIVERSITY OF EDUCATION

COLLEGE OF INFORMATION AND TECHNOLOGY EDUCATION

PROCEEDINGS OF THE 1ST INTERNATIONAL CONFERENCE OF INFORMATION AND TECHNOLOGY EDUCATION

(ICOITED 2024)

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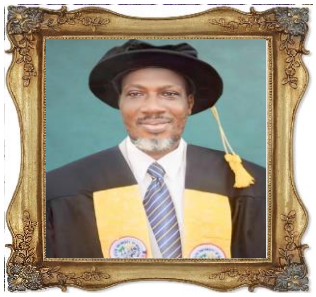

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24th -26th September, 2024

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PAPER PRESENTATIONS
2024 COITED – LASUED INTERNATIONAL CONFERENCE
CONCURRENT SESSIONS DAY 2 – Wednesday, September 25, 2024
THEME: INNOVATIVE STRATEGIES FOR LEVERAGING TECHNOLOGY AND EDUCATION TO ENHANCE LEARNING AND DEVELOPMENT.

VIRTUAL PRESENTATIONS
ROOM 2
FACILITATOR: Professor Rahman M.A
RAPPORTEUR: Dr. Akinrinola F.Y.

BREAKOUT PHYSICAL PRESENTATION
ROOM 1
CHAIRMAN: Dr. Owoso J.O.
RAPPORTEUR: Dr. Hodonu-Wusu O.J.

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Adedeji E.A. and Hodonu-Wusu J.O.	*Innovative Strategies for Leveraging Technology in Digital Libraries: A Study of Perception, Attitude, and Behavior*
Mustapha A.G., Jolaoluwa G., Oga O., Salami S.A., Ogundeji R., and Adigun H.O.	*Impact of Educational Technology Integration on Teachers' Professional Development in Biology.*
Ogunnowo T.A. and Ladega B.O.	*Impact of Digital Resource Access on Library Utilization Among Business Education Students in Lagos State*
Owoso J.O., Hodonu-Wusu O.J., and OLAYINKA, O	*Driving Global Connectivity, Artificial Intelligence, and Library and Information Science for Sustainable Skills Acquisition in Automobile Technology in the 21st Century*
Kehinde E.O., Adeyemi T.S., Abimbola G.O., and Lasisi S.O.	*Impact of Artificial Intelligence Tools on Computer Applications System Instruction and Learning in Junior Secondary Schools in Ibeju-Lekki, Lagos State*
Sulyman B.M., Makinde S.O., Abiodum A.I., Hassan-Ibrahim R.B., and Jimba-Na'Allah F.K.	*Accessibility and Skill Levels of Distance Level Students' Utilization of Information and Communication Technology Tools in Kwara State*
Fasinro K.S., Aremu V.I., and Aina J.O.	*The Influence of Social Media Platforms on Student Engagement and Information Literacy in a University Setting*
Samuel S.O. and Ifegbuyi .A.	*Evaluating the Impact of a Gamified Intervention on Seductive Detail Supervision Among Secondary School Students*
Olusiji O.L. and Adenuga B.A.	*Skills Improvement Required of Automobile Mechanics for Small Scale Automobile Workshop in Code Reading of Faults and Rectification of Fault.*

BREAKOUT PHYSICAL PRESENTATION
ROOM 2
CHAIRMAN: Prof. Rahman M.A.
RAPPORTEUR: Dr. Akinrinola F.Y.

AUTHORS	TITLE OF PAPERS
Ganiyu O.A., Hamzat O.A., and Enesi F. (Virtual Presentation)	*Transformer-Based Intrusion Detection System in IoT Devices*
Adeyefa A.K., Oyeyemi K., Akindoju O.G., Abiola, O.K., and Adekunle, A. O	*Ethical Implications of Artificial Intelligence Deployment in Nigeria: Navigating Challenges and Ensuring Equitable Access*
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Jimba-Na'Allah F.K., Makinde S.O., Bolaji H.O., Awolola F.O., and Abdulazeez B.T.	*Artificial Intelligence in Personalized Learning in Higher Education*
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AUTHORS	TITLE OF PAPERS
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Awofodu A.D., Ogbonnaya U.N., Zangonde G.S., and Ayena J.I.	*Prospects and Challenges of Integrating Mobile Learning in Teaching and Learning of Biology in Nigerian Tertiary Institutions*
Yusuf T.I., Adebayo O.A., and Oladapo Y.O. (**Virtual Presentation)**	*ICT Literacy Skills and Perceived Entrepreneurial Success of LIS Students in Tertiary Institutions in Kware State, Nigeria*
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PREFACE

It is with great pleasure and a profound sense of accomplishment that we present the Book of Proceedings for the **1st International Conference of the College of Information and Technology Education (ICOITED 2024).** This compilation reflects the collective efforts and intellectual contributions of experts, scholars, and practitioners from various disciplines who gathered between the **24th and 26th of September, 2024** at Lagos State University of Education (LASUED) to explore the conference theme, "**Innovative Strategies for Leveraging Technology and Information to Enhance Learning and Development."**

The theme of ICOITED 2024 was designed to address the rapidly evolving intersection of technology, information, and education. This conference was hosted by the **College of Information and Technology Education,** bringing together leading experts from the Departments of **Computer Science Education**, **Computer Science Technology Education**, **Library and Information Studies,** and **Educational Technology**. These departments served as the backbone of the event, providing a rich platform for discussions on the role of technology in education. The conference also saw significant contributions from fields such as **Science, Technology, Engineering, and Mathematics (STEM), Technical Vocational Education and Training (TVET),** and **Entrepreneurship Education.**

In addition to these core disciplines, the conference welcomed valuable input from fields like **Business Education, Language Studies, Educational Management, Social Sciences**, and other areas that contribute to the advancement of learning and development through technology. This multidisciplinary approach ensured that ICOITED 2024 addressed a broad spectrum of challenges and opportunities within the educational and technological landscape.

During ICOITED 2024, we explored cutting-edge strategies for leveraging **Artificial Intelligence (AI), Big Data, Digital Learning Platforms, and Emerging Technologies** to shape the future of education. It was a journey marked by collaboration, insight, and a commitment to finding sustainable solutions for some of the most pressing challenges facing education and industry today. From innovations in **STEM and TVET education** to advancements in **Business Education, Language Studies, and Entrepreneurship,** the conference highlighted how technology and information can be harnessed to create more inclusive, efficient, and impactful learning environments.

Within these pages, we present a compilation of research papers, presentations, and insights that encapsulate the rich tapestry of ideas shared during the conference. The contributions come from a diverse array of professionals and scholars whose dedication to their fields of study is commendable.

We extend our deepest gratitude to our sponsors, whose generous support made this conference possible. We are equally grateful to the keynote speakers, lead paper presenter, plenary presenters and all the contributors whose expertise enriched the discussions. Special appreciation also goes to the Vice Chancellor, Professor Bidemi Bilkis Lafiaji-Okuneye, the Dean of the College, Dr. Adeleke Imran Ademola, and the Conference Planning Committee for their tireless efforts in ensuring the event's success.

Finally, I would like to thank Lagos State University of Education and all supporting institutions for their unwavering commitment to the advancement of education and technology. We hope that this Book of Proceedings will serve as a source of knowledge and inspiration for researchers, students, and professionals alike.

Dr. Zosu S. Joseph
LOC Chairman,
iCOITED 2024.

Book of Proceedings 1st International Conference of College of Information and Technology Education (iCOITED 2024), September 24-26, 2024, Lagos State University of Education, Otto/Ijanikin, Lagos, Nigeria
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PAPER 1 - THE INFLUENCE OF SOCIAL MEDIA PLATFORMS ON STUDENT ENGAGEMENT AND INFORMATION LITERACY IN A UNIVERSITY SETTING

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ABSTRACT

The concept of social media and information literacy goes beyond simply accessing information and connecting people, it encompasses the capacity to determine the reliability, credibility, and relevance of sources, to differentiate between facts, recognize biases and misinformation which are essential for student engagement in these electronic information environments at a time when there is less desire to enter a library to clear misconceptions and buttress knowledge. This study adopted a descriptive research design. A self-structured instrument on the influence of social media platforms on student engagement and information literacy in a university setting Questionnaire on 4 Likert scale format containing 20 items was used to generate data. The instrument was validated by three experts in educational technology and construct validity was met. A Cronbach Alpha reliability method was used to determine the reliability of the instrument as 0.893 was the index value obtained. Chi-square statistics was used to analyse the hypotheses at a 0.05 level of significance. The study reveals that there is no significant difference in the information literacy skills of university students who primarily use social media for academic purposes compared to those who primarily use it for non-academic purposes. Among others, it concluded that the use of social media for academic purposes should not be condemned instead emphasis should be on improving the information literacy skills of students. The study recommended that digital literacy programs should be developed and implemented for undergraduates that focus on enhancing critical thinking, source evaluation, and effective information consumption skills.

KEYWORDS: Social Media, Information Literacy University Set

1. INTRODUCTION

The advent of the internet in the 1990s resulted in major developments in the world of communication which led to the introduction of social networking/media sites. The establishment of these sites revolutionized the world of communication and today we celebrate its improvements ranging from education, entertainment to providing information. Social network/media sites are web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system [Boyd & Ellison, 2007)

Social media platforms typically offer various features such as posting updates, sharing photos and videos, commenting, liking or reacting to posts, messaging, following or subscribing to other users' profiles or pages which as become the main sources for people to obtain information, acquire necessary skills and get entertained. Social media furnishes individuals with information in any sector of life and it is also an umbrella term for technologies that provide space for people to create, send content, link up, and connect with others (Angus, Thelwall & Stuart, 2008; Lewis, 2010)

Today, there are billions of people on social media platforms daily with a large percentage of them the youth (Anderson & Jaing, 2018). Howard and Park (2012) stated that social media platforms have three main parts which include the infrastructure and instrument to create and share content, secondly content; such as concepts, ideas, messages, information and news and lastly decoders, users and consumers, e.g., industries, organizations and individuals that provide space for people to create and send content, link up, and connect with others. There are many advantages of social media, such as using technologies through the web to adapt and convey information on social platforms (Kaplan & Haenlein, 2010). Utilizing social media in the university has

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several benefits, such as strengthening bonds, boosting motivation, providing individualized course materials, and fostering teamwork. This suggests that social media, especially when used by introverted students, can increase student participation in the classroom. Students who work in virtual learning groups can do so with less or no fear of having to ask questions before their classmates in person. (Fatokun, 2019).

Information literacy is the ability to effectively identify, locate, evaluate, use, and ethically create information in various formats. It involves the skills, knowledge, and critical thinking required to navigate the vast amount of information available in today's digital age and make informed decisions by utilizing information effectively and responsibly. The concept of information literacy goes beyond simply accessing information. It encompasses the capacity to determine the reliability, credibility, and relevance of sources, to differentiate between fact and opinion, and to recognize biases and misinformation. Information literacy empowers individuals to ask thoughtful questions, analyze information critically, and apply it effectively to their specific needs and contexts (Ilogho & Nkiko, 2014)

Information Literacy acknowledges the crucial role of information in our everyday lives and is of immense importance to institution of higher education. “Given that the information revolution has immensely increased the ability to access and employ information, using various sources including information published electronically, societies are required to have certain capabilities other than the ability to read and write to fully utilize these resources. Scholars affirm that society requires multi-skilled learners, who can think critically, pose and solve problems, and become independent and lifelong learners" (El Hassasni, 2015). When it comes to finding relevant material and assessing the reliability of sources for assignments, a lot of university students have difficulties with information literacy. It is essential that students understand how to conduct research and be independent in the electronic information environment at a time when there is less of a need to physically enter a library or reach lecturers to clear misconceptions and buttress knowledge. As an essential part of a proper university education, academic work emphasizes the importance of information literacy skills and connects them to critical thinking capabilities. (Kim & Shumaker, 2015; MacPherson, 2004; Tumbleson & Burke, 2013).

With the rise of digital technology, educators now have the chance to create real-world learning resources that are tailored to the needs of the students (Monahan McArdle & Bertolotto, 2008). The influence of social media to university students cannot be overemphasized which includes Communication and Connection, information and news, academics and skill acquisition, personal development, entertainment, mental wellbeing etc. Hence the use of social media platforms to impact students' behaviour is essential to developing the information literacy skills they possess by helping individuals handle the plethora of information available, assess sources critically, and decide which content to consume and share with others. When students possess strong information literacy skills, they approach social media platforms in a more critical and responsible manner. Information literacy affects students' use of social media in the following ways:

1. Source evaluation: Information literacy skills help students evaluate the credibility and reliability of the information they encounter on social media. They assess the authority, accuracy, and bias of the content shared on these platforms. This critical evaluation enables them to make more informed decisions about the information they consume and share thereby reducing the likelihood of spreading misinformation or falling victim to inaccurate contents knowledge and skills.

2. Media literacy: Information literacy encompasses media literacy, which involves understanding the media's messages, techniques, and potential effects. Students with information literacy skills enables them analyze the persuasive techniques used in social media posts, advertisements, and news articles, allowing them to recognize potential biases, propaganda, or clickbait. This helps them develop a more nuanced understanding of the content they encounter and avoid being swayed by false or misleading information.

3. Privacy and security: Information literacy skills also are an understanding of online privacy and security. Students who are information literate are more likely to be aware of the risks associated with sharing personal information on social media platforms and can take appropriate measures to protect their privacy. They critically evaluate privacy settings,

understand the implications of data collection practices, and make informed decisions about what information they choose to share online.

4. Digital citizenship: Information literacy skills enhance digital citizenship. Students can learn to engage with social media platforms ethically, respectfully, and responsibly. They understand the importance of verifying information before sharing, using appropriate language and tone, respecting others' privacy and intellectual property, and engaging in constructive discussions online. This fosters a healthier and more positive social media environment for themselves and others (Al Zou'bi, 2022).

The educational system is confronted with many challenges which have undoubtedly led to a rapid deterioration in the quality of education. Between social networking activities and students' academic work, there is a divergence and distraction of attention. This has shown that students spend more time on social media platforms for non-academic activities than they do in their studies (Apuke, 2016). It has been noted that students prioritize social media over their studies, with varying levels of exposure and addiction to different platforms. The role of social media as a means of interaction among students has also been considered in relation to its influence on academic performance. The challenge arising from the impact of social media platforms on information literacy pertains to the possibility of misinformation, manipulation, and the dearth of critical evaluation abilities exhibited by its users.

The crux of the matter revolves around the pervasive utilization of social media platforms as primary outlets for information. These platforms have emerged as significant conduits for news, viewpoints, and other forms of content propagation. Nevertheless, the widespread availability of information on social media has also presented several challenges. The proliferation of misinformation is a critical issue that has been facilitated by social media platforms. These platforms have enabled the rapid dissemination of information, including content that is inaccurate, misleading, or false. Unfortunately, many users lack the essential skills required to assess the reliability of sources, which results in the inadvertent spread of erroneous information. This phenomenon poses significant risks to individuals and society at large, as false information can significantly impact opinions, influence decisions, and perpetuate harmful narratives. The Influence of Social Media Platforms on Student Engagement and Information Literacy in a University Setting aims to investigate the relationship between social media platforms, student engagement, and information literacy within the specific context of a university. While the research may not directly solve the entire problem, it will contribute to understanding the dynamics between social media, student engagement, and information literacy, thereby informing potential solutions and interventions.

Purpose of the study:

1. Identify the effect of information literacy skills on students who use social media for academic and non-academic purposes.
2. Investigate the effect of the duration of social media usage per day and students' information literacy skills on consumed knowledge.

Research hypotheses

$H0_1$: There is no significant difference in the information literacy skills of university students who primarily use social media for academic purposes compared to those who primarily use it for non-academic purposes.

$H0_2$: There is no significant difference between the duration of social media usage per day and students' information literacy skills on knowledge consumed for academic purposes.

2. RESEARCH METHODOLOGY

For this study, a descriptive research design was adopted. This form of study design is appropriate because it facilitates the collection, organization, analysis, and presentation of data to describe an event among a group of people. The population for this study was comprised of all students in Lagos State University of Education, LAUSED, Lagos State. A simple random sampling technique was adopted to select 100 respondents from the population which was selected across the seven colleges in the

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university. The researchers adopted the use of a self-structured Questionnaire on a 4-Likert scale format to elicit responses from the respondents. Copies of the questionnaire were given to three lecturers in the Department of Educational Technology from the institution to validate the instrument, after which, construct and content validity were met. To determine the reliability of the instrument, the Cronbach Alpha reliability test was done and a reliability index value of 0.893 was obtained which deemed the instrument suitable for the study. A Chi-square inferential statistic tool was used to answer the research hypotheses which was tested at 0.05 level of significance.

RESULTS

Demographic Data

FIG 1. GENDER

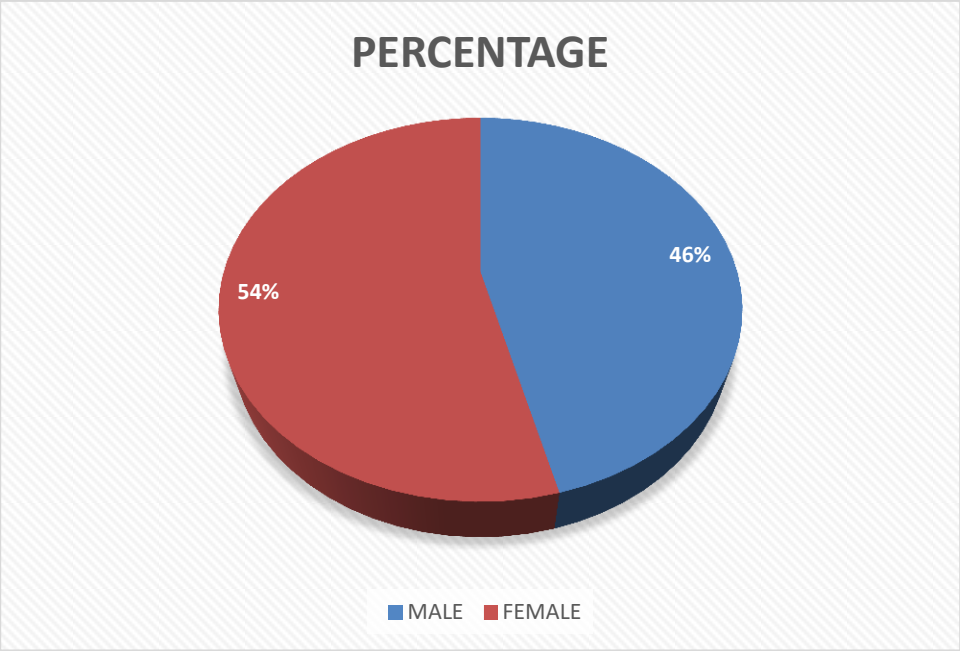

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FIG. 2. **COLLEGES**

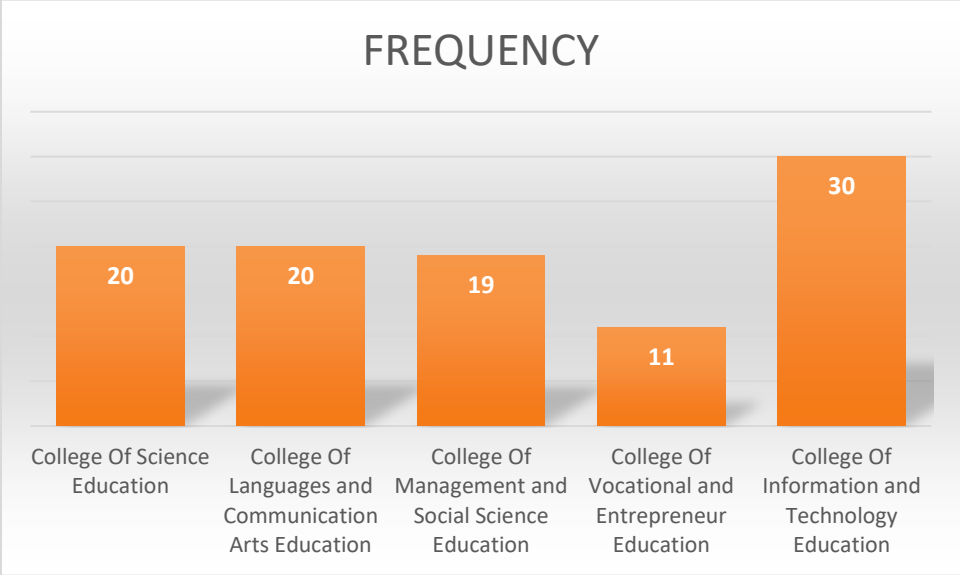

FIG. 3 **TIME SPENT ON SOCIAL MEDIA DAILY**

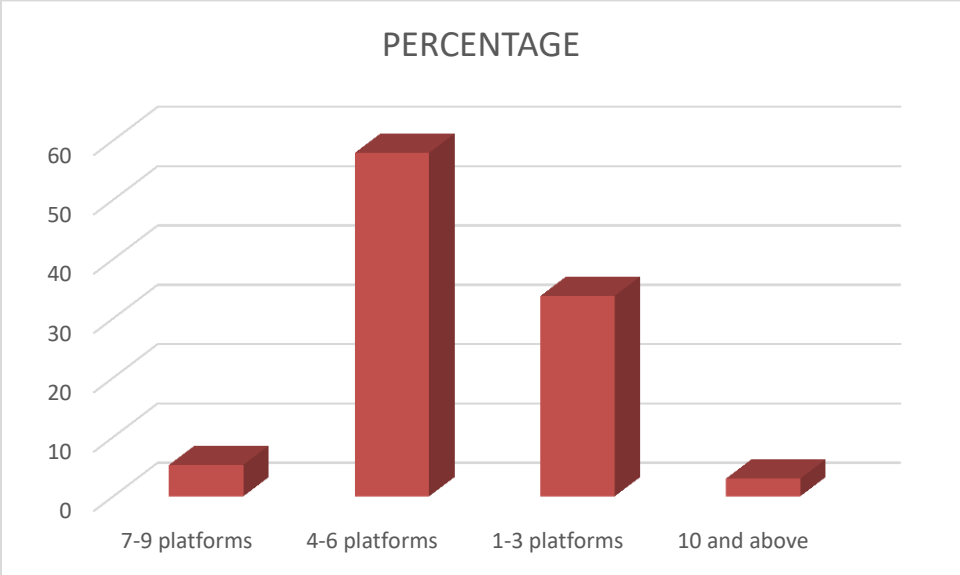

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FIG. 4. USE OF SOCIAL MEDIA FOR ACADEMIC PURPOSE

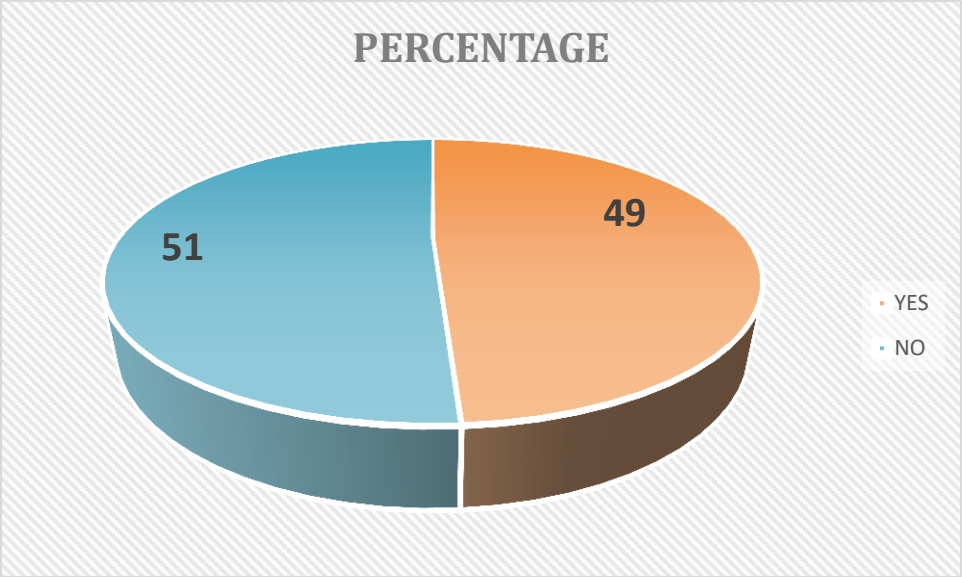
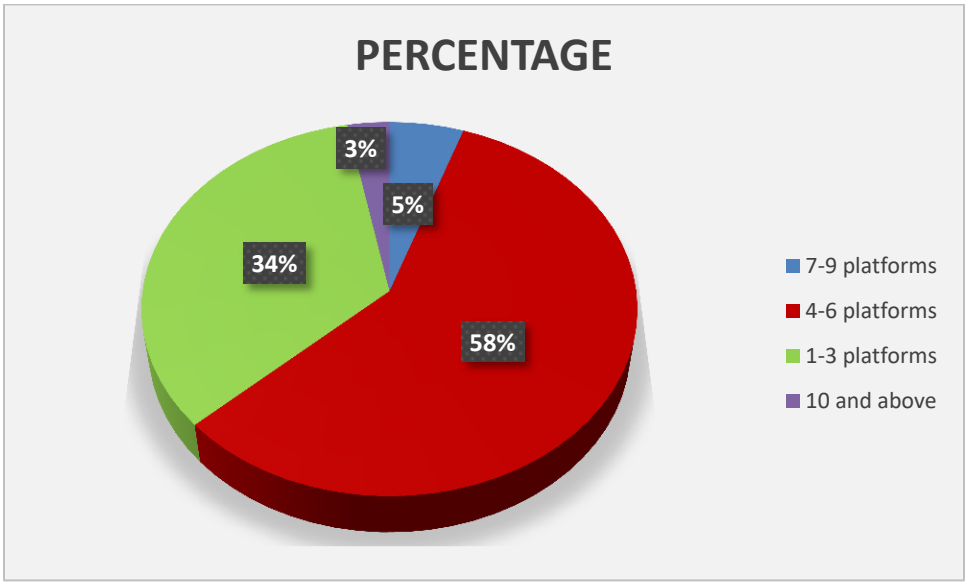


FIG.5. SOCIAL MEDIA PLATFORM USED BY STUDENTS



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Hypothesis One

$H0_1$: There is no significant difference in the information literacy skills of university students who primarily use social media for academic purposes compared to those who primarily use it for non-academic purposes.

TABLE 1.1

		Do you use social media platforms for academic purposes	
		Yes	No
ILSAP	Strongly Disagree	0	2
	Disagree	20	22
	Agree	23	22
	Strongly Agree	6	5

TABLE 1.2. Pearson Chi-Square Tests

		Do you use social media platforms for academic purposes
ILSAP	Chi-square	2.169
	Df	3
	Sig.	.538

INTERPRETATION

From table 1.2 above, (P) calculated value is .534, since the (P) calculated value is far greater than the significance value of .05, therefore, the null hypothesis which states that There is no significant difference in the information literacy skills of university students who primarily use social media for academic purposes compared to those who primarily use it for non-academic purposes is not rejected.

Hypothesis Two

There is no significant difference between the duration of social media usage per day and students' information literacy skills on knowledge consumed for academic purposes.

TABLE 2.1

		Duration spent per day on social media platforms?			
		1-3 hours	4-6 hours	7-9 hours	10 hours and above
		Count	Count	Count	Count
ILSCK	Strongly Disagree	1	5	3	2
	Disagree	12	14	14	5
	Agree	9	11	7	13
	Strongly Agree	0	2	0	2

TABLE 2.2

Pearson Chi-Square Tests		
		Duration spent per day on social media platforms?
ILSCK	Chi-square	12.044
	Df	9
	Sig.	.211

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INTERPRETATION

From table 2.2 above, (P) calculated value is .211, since the (P) calculated value is far greater than the significance value of .05, therefore, the null hypothesis which states that There is no significant difference between the duration of social media usage per day and students' information literacy skills on consumed information is not rejected.

3. DISCUSSION OF FINDINGS

From hypothesis one which reveals that there is no significant difference in the information literacy skills of university students who primarily use social media for academic purposes compared to those who primarily use it for non-academic purposes. This shows that there is no difference in how students process information based on their primary purpose of using social media/networking sites. According to Oluwaseye and Oyetola (2018) whose study found that information literacy skills were positively correlated with social media use among secondary school students in Ibadan, Nigeria. This suggests that students with higher information literacy skills were more likely to use social media effectively for both social and academic purposes. This further shows that regardless of students' information literacy skills they will use social media platforms for both academic and non-academic purposes. A study by Zai, Zabin, Siddharthan and Sowmya (2020) finds that since social media networks assist people grow in all spheres of life and thrive in the present period, it is impossible to prohibit them from utilizing them for a specific purpose.

Hypothesis two reveals that there is no significant difference between the duration of social media usage per day and students' information literacy skills on consumed information. Lawanson, Oyalowo, Faremi, John, Adio-Moses and Alabi (2016) found that across all disciples, students generally dedicated one to three hours to their various activities including studying and online activities. However, social media activities accounted for more time than time dedicated to exclusive academic activity. According to Tantarangsee, Kosarussawadee and Sukwises (2017) Social media has become an inevitable component of our routine and educational environments. The data indicates that a sizable portion of students utilize social media. However, an in-depth review of social media-based activities indicates that receptive language skills—rather than productive ones—are prioritized. This is consistent with research findings that suggest the amount of knowledge absorbed for academic work is unaffected by the amount of time spent on social media platforms.

4. CONCLUSION

The study draws the following conclusions. First, the study indicated that information literacy skills do not significantly influence the purposes for which students use social media platforms, whether for academic or non-academic reasons. Second, the research findings suggest that the time spent on social media does not necessarily correlate with the amount of academic information consumed. A crucial implication that arises from these observations is that rather than condemning the use of social media for academic purposes, there should be a concerted effort to enhance the information literacy skills of students. This shift in emphasis holds the potential to positively impact the effective integration of social media into academic pursuits.

5. RECOMMENDATION

Based on the findings the following recommendations are made

1. Digital literacy programs should be developed and implemented for undergraduates that focus on enhancing critical thinking, source evaluation, and effective information consumption skills.
2. Encourage school administrators to incorporate social media platforms into academic activities, fostering a positive and purposeful use that aligns with academic goals.
3. Encourage collaboration between information literacy educators, technology specialists, and subject-matter experts to develop interdisciplinary approaches to digital literacy education.

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PAPER 2 - DRIVING GLOBALIZATION, ARTIFICIAL INTELLIGENCE AND LIBRARY AND INFORMATION SCIENCE FOR SUSTAINABLE SKILLS ACQUISITION IN AUTOMOBILE TECHNOLOGY IN 21ST CENTURY

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ABSTRACT

This paper explores the intersection of Library and Information Science (LIS) and Artificial Intelligence (AI) in the context of sustainable skills acquisition in automobile technology to drive globalization in the 21st century. In an increasingly interconnected world, the automobile industry faces a myriad of challenges and opportunities, from sustainability concerns to evolving consumer preferences. Leveraging LIS principles alongside AI techniques presents a novel approach to address these complexities. This paper reviews existing literature on the integration of LIS and AI within the automotive sector, highlighting key applications such as data management, information retrieval, knowledge organization, and predictive analytics. Furthermore, it examines the role of AI- powered systems in enhancing vehicle safety, efficiency, and user experience. Through a synthesis of theoretical frameworks and practical examples, this paper elucidates the potential of LIS-AI synergy in driving innovation and facilitating the global diffusion of automotive technologies. Additionally, it discusses implications for research, industry practices, and policy making, emphasizing the need for interdisciplinary collaboration and ethical considerations. Overall, this paper contributes to the discourse on leveraging information science and artificial intelligence to propel the automotive industry towards a more sustainable, interconnected, and technologically advanced future.

KEYWORDS: *Globalization, Library and Information Science, Artificial Intelligence, Automobile Technology, Skill Acquisition*

1. INTRODUCTION

In a society increasingly driven by information, there is a perceived modernization of the library, an urgent need for redefinition and reorganization of information work. It is generally agreed that the days of the library as merely a storehouse of books are gone (Prapanna, 2015). The shift from an industrial society to an information society, with its complex technological changes, has forced the library community to reexamine the foundation of library and information science (LIS) and the purpose of the library in a changing and evolving global civilization (Sahu, 2008; Nwosu, 2010; Otolo, 2020). Yet in redefining LIS, libraries, and information work, by what means the profession should proceed and what directions should be taken has not been an easy question to answer. Classic library and information work, though confining to a restrictive and now outdated definition, has been and remains a noble cause. A trustworthy and viable information infrastructure is crucial to a functioning democracy, an informed citizenry, and preservation of cultural heritage (Hickerson, Lippincott & Crèma, 2022). However, with increasing pressure to keep pace with fast moving technological changes, the need for effective stewardship and utilization of information resources and technology, and the ethos of globalization has set forth a new agenda to expanding the roles of LIS, libraries, and information professionals (Nwosu & Ogbomo, 2010; Hickerson, Lippincott & Crèma, 2022).

The automobile industry is undergoing a significant transformation due to the advent of globalization, artificial intelligence and information science principles. The recent endeavors in designing driverless cars by Google have led to a new dimension in

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vehicle design, automation, and safety. The idea of a car being able to drive itself is not new, with research into the concept dating back to the 1920s (Nitecki, 1993). The recent developments in technology that have made this concept a reality were unimaginable at that time. This concept has tremendous scope in reducing accidents caused due to driver errors and may lead to better traffic management and energy conservation. This calls for a new era of automobile design and structural concepts and the need for an efficient global information system in sharing and managing large amounts of complex AI data with lesser investment of time and resources (Deekshith, 2023). As technology continues to advance at a rapid pace, the information science skills required to succeed in the automotive sector are constantly evolving. The rapid technological advancements witnessed over the years have greatly influenced the automobile industry in various ways. The application of these advancements in addressing the ever-increasing customer demands regarding vehicle design, quality, and performance has led to an increase in investments in research and development in this particular sector (Lemann, 2019). The use of technology has significantly improved the working conditions, making processes simpler and increasing productivity as well. Recent trends have also seen a shift in R&D investments from vehicle manufacturing to automobile design with a vision to utilize technology in creating new vehicle concepts with increased emphasis on safety and the environment (Lemann, 2019; Deekshith, 2023). It is here the automobile industry has to look way ahead and gear up for future technology. With the current rate of technology growth, much of the future design and structural concepts in vehicle manufacturing will change. It is an accepted fact that though driver safety is well addressed in current vehicle designs, there is a need to design a safe transportation system, removing the onus of driver errors in causing accidents (Salehian, 2022; Amster, 2024).Therefore, it is crucial for individuals working in this industry to adapt to these changes and acquire the necessary information science skills to remain competitive in the global marketplace. The general aim of this study is to explore the intersection of library and information science and artificial intelligence in the context of sustainable skills acquisition in automobile technology to drive globalization in the 21st century.

2 LIBRARY AND INFORMATION SCIENCE (LIS) IN AUTOMOBILE TECHNOLOGY

The intersection between LIS and automobile technology covers broad range of topics, such as the history of information science in automobile technology, global trends, manufacturing and technology, retails, marketing, statistical resources, industry news analysis, regulations and finding aids as well as organizational research (Green, Burclaff, 2020; Terrell, Herd, Marcus, Sams & Sullivan, 2023). In this scenario, LIS can play a critical role in organizing, managing, and facilitating access to the vast amount of data generated in the automobile industry. With the rapid advancements in AI, there is immense potential for leveraging AI technologies to analyze this data effectively and derive meaningful insights that can drive innovations in automobile technology.

Figure 1: The Intersection between LIS, AI and Automobile Technology (Authors, 2024)

2.1 The potential of LIS in Automobile Technology are as follows:

a) **Data Management and Curation:** Libraries and information science professionals are experts in organizing and curating information. In the context of automobile technology, they can help structure the massive amounts of data generated by vehicles, sensors, and connected systems. Efficient data management is crucial for training AI models effectively (Oyetola & Oyedokun, 2024).

b) **Knowledge Discovery and Insights:** AI algorithms can analyze data curated by LIS professionals to identify patterns, trends, and correlations that would be difficult for humans to detect manually. These insights can inform decisions related to vehicle design, safety, performance optimization, and more (Aldoseri, Al-Khalifa, & Hamouda, 2023).

c) **Predictive Maintenance**: AI-powered predictive maintenance can help automotive companies anticipate maintenance needs before they arise, thereby reducing downtime, improving safety, and extending the lifespan of vehicles. LIS can contribute by ensuring that historical maintenance data is appropriately stored and accessible for AI algorithms (Theissler, Pérez-Velázquez, Kettelgerdes, Elger, 2021).

d) **Autonomous Driving:** AI is at the core of autonomous driving technology. LIS can assist in managing the large datasets required for training autonomous vehicles and ensuring that the algorithms have access to accurate and up-to-date information for making split-second decisions on the road (Garikapati & Shetiya, 2024).

e) **Data Privacy and Security:** As vehicles become more connected and data-driven, ensuring data privacy and security is paramount. LIS professionals can help establish protocols for secure data handling and access control to protect sensitive information collected by vehicles (Ali-Muslam, 2024).

f) **User Experience Enhancement:** According to Aldona Krysiak-Adamczyk (2024), AI can be used to personalize the driving experience based on individual preferences and habits. By analyzing user data, AI algorithms can suggest optimal routes, adjust in-car settings, and enhance overall comfort and convenience for drivers and passengers (*See Figure 3*).

g) **Regulatory and Ethical Considerations**: Integrating AI in automobile technology raises important ethical and regulatory questions. LIS professionals can contribute by staying abreast of legal frameworks, ethical guidelines, and best practices for AI deployment in the automotive industry. By combining the expertise of LIS professionals in managing information resources with AI and Automobile Technology

2.2 The Roles of Library and Information Science in Automobile Technology

Library and Information Science (LIS) plays a crucial role in the field of Automobile Technology by providing a structured approach to managing information related to this complex domain. The roles of LIS in the context of Automobile Technology were as follows:

2.2.1 Role of Library and Information Science

2.2.1.1 **Knowledge Management:** Libraries in the context of Automobile Technology serve as repositories of valuable resources including books, journals, research papers, technical manuals, and databases that help professionals and enthusiasts stay informed about the latest developments in the industry.

2.2.1.2 **Information Retrieval**: LIS professionals facilitate the efficient retrieval of relevant information. In the context of Automobile Technology, this involves organizing technical documents, patents, part catalogs, repair manuals, and other resources, helping engineers and designers to access pertinent information quickly and accurately.

2.2.1.3 **Curation of Resources:** Libraries curate a collection of resources specific to Automobile Technology, ensuring that users have access to the most relevant and up-to-date information in the field.

2.2.1.4 **Research Support:** LIS professionals assist researchers and engineers in crafting effective search strategies, accessing relevant scholarly databases, and locating critical information for their projects.

2.2.2 Importance of Information Management

2.2.2.1 **Data Organization:** Efficient information management ensures that data related to Automobile Technology is organized, searchable, and accessible when needed. This aids in quick decision-making and problem-solving.

2.2.2.2 **Knowledge Sharing:** Effective management of information promotes knowledge sharing among professionals in the field, leading to innovation, collaboration, and the generation of new ideas.

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2.2.2.3 **Risk Mitigation:** Proper information management helps in preventing data loss, ensuring data security, and reducing the risk of errors or misinformation in critical tasks within Automobile Technology.

2.2.2.4 **Business Intelligence:** Data-driven decision-making is crucial in the automotive industry. Information management strategies help organizations derive insights from data, thereby enhancing strategic planning and competitiveness.

2.2.3 Integration of Library Science with Automobile Technology

Integrating Library Science with Automobile Technology might seem like an unconventional pairing at first glance, but there are potential areas where these two fields could intersect, particularly in the realm of information management within the automotive industry. The followings are some of the ways in which Library Science principles and practices could be integrated with Automobile Technology:

2.2.3.1 Digital Resource Management

In the era of real change in the global economy, automotive organizations must be able to respond to abrupt environmental changes (Olga, Patchara, & Sangkon, 2021), and with the increasing digitization of information, libraries in the context of Automobile Technology are focusing on managing digital resources efficiently. This involves developing digital repositories, implementing metadata standards, and ensuring the preservation of electronic resources.

2.2.3.2 Specialized Information Services

Libraries are tailoring their services to cater to the specific needs of the automobile industry, offering services such as patent searches, technical literature searches, and access to specialized databases related to automotive engineering and technology.

2.2.3.3 Knowledge Management in Automotive Companies

Libraries and information repositories within automotive companies can benefit from the expertise of library scientists in organizing, cataloging, and retrieving valuable information. This could include managing technical manuals, service bulletins, parts catalogs, and other crucial documents (Kim, 1997).

2.2.3.4 Digital Asset Management

Librarians can contribute their skills in digital asset management to help organize the vast amount of digital media used in the automotive industry, such as CAD drawings, design documents, marketing materials, and multimedia presentations.

2.2.3.5 Information Retrieval Systems

Developing advanced search algorithms and information retrieval systems can help automotive engineers, designers, and technicians access relevant information quickly, improving efficiency and productivity in their work.

2.2.3.6 Knowledge Sharing Platforms

Creating platforms for knowledge sharing and collaboration among automotive professionals can be greatly enhanced by utilizing principles from Library Science. Librarians can design and manage these platforms to ensure that information is organized, accessible, and preserved for future use.

2.2.3.7 Training and Education

Librarians can assist in developing training programs for automotive professionals, ensuring that they have access to the latest information and resources needed to stay updated in their field.

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2.2.3.8 Standards and Best Practices:

Applying principles of information organization and standardization from Library Science can help in establishing best practices for creating, storing, and disseminating information within the automotive industry.

2.2.3.9 Data Management and Analysis

Librarians can play a role in data management and analysis within the automotive sector, helping to structure data in a way that makes it easier to analyze trends, identify patterns, and make informed decisions.

2.2.3.10 Historical Archives:

Preserving the history of automobile technology through archives requires the skills of librarians and archivists to ensure those documents, photographs, and other materials are organized and accessible for researchers, engineers, and enthusiasts.

By integrating Library Science principles into Automobile Technology, there is an opportunity to improve information management practices, enhance knowledge sharing, and ultimately drive innovation within the automotive industry. This collaboration can lead to more efficient workflows, better decision-making, and a deeper understanding.

2.3. Application of AI in Automobile Industry

Artificial intelligence (AI) has numerous applications in the automobile industry, transforming various aspects of design, manufacturing, sales, and customer experience. According to the studies of Iyer et al. (2020); Zaidi et al., (2020) and Chen et al., (2019). The following are some of the key AI applications in Automobile Industry (*See Table 1*)

Table 1: Application of AI in Automobile Industry

Automobile Industry	**AI Applications**
Design and Development	1. Computer-aided design (CAD) optimization 2. Virtual prototyping and simulation 3. Predictive analytics for performance and safety 4. Autonomous vehicle design and testing
Manufacturing	1. Predictive maintenance for equipment 2. Quality control and defect detection 3. Robotics and automation 4. Supply chain optimization
Sales and Marketing	1. Personalized customer recommendations 2. Chatbots for customer support 3. Sentiment analysis for market research 4. Dynamic pricing and inventory management
Vehicle Safety and Security	1. Advanced driver-assistance systems (ADAS) 2. Autonomous emergency braking

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	3. Lane departure warning systems 4. Biometric authentication
Autonomous Vehicles	1. Sensor fusion and data processing 2. Machine learning-based decision-making 3. Navigation and route optimization 4. Vehicle-to-everything (V2X) communication
Customer Experience	1. Voice assistants (e.g., Alexa, Google Assistant) 2. Infotainment systems with AI-powered recommendations 3. Driver behavior analysis and feedback 4. Personalized driving profiles
After-Sales Service	1. Predictive maintenance scheduling 2. Remote diagnostics and troubleshooting 3. AI-powered customer support 4. Warranty analysis and optimization
Supply Chain and Logistics	1. Route optimization for delivery 2. Inventory management and forecasting 3. Predictive analytics for demand planning 4. Autonomous freight transportation

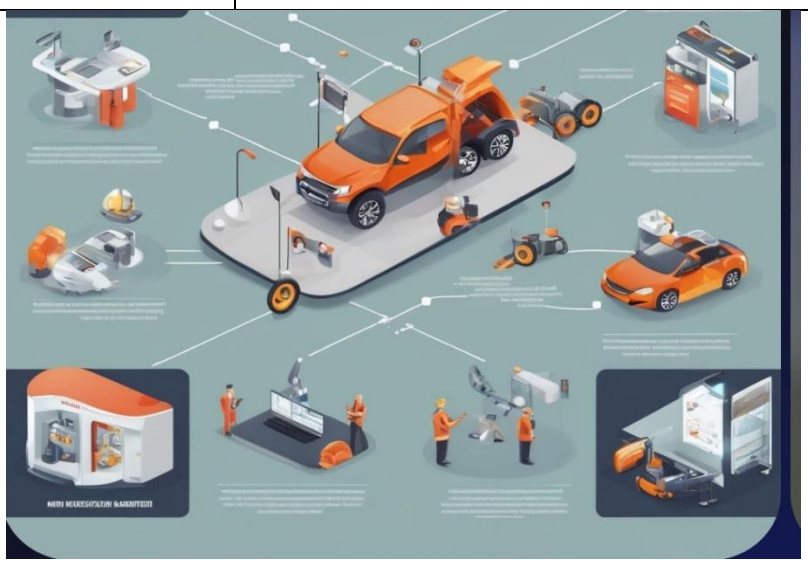

Figure 2: A robotics and automation, sales and marketing, customer experience with vehicle safety and insurance (Authors, 2024)

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Key Players in Automobile Industry are:

1. Tesla
2. Waymo (Alphabet subsidiary)
3. General Motors (GM)
4. Volkswagen Group
5. NVIDIA
6. IBM
7. Microsoft
8. Bosch

Technologies Used Include:

1. Machine learning (ML)
2. Deep learning (DL)
3. Natural language processing (NLP)
4. Computer vision
5. Internet of Things (IoT)
6. Edge computing

These applications demonstrate the significant impact of AI on the automobile industry, enhancing efficiency, safety, and customer experience. As AI technology advances, we can expect even more innovative solutions to emerge (*See Figure 2*).

Table 2: **Driving Globalization, Artificial Intelligence and Library and Information Science for Sustainable skills Acquisition in Automobile Technology in 21st Century**

S/N	Author(s)& Date	Title	Objectives	Problems/ Gaps	Method	Findings
1	Oyetola, S. O. & Oladokun, B. D., (2024).	Role of library and information science professionals in big data research: Opportunities and Challenges.	To examine the role of LIS professionals in big data research in Nigeria.	The big data revolution holds a lot of promise, but there are issues like data privacy, large amount of data, lack of big data specialists	Literature design approach	Finding shows that offering and facilitating big data analysis will guarantee our place as priceless and crucial resources in the global workplace.
2	Salehian, S. (2022).	How advancements in vehicle safety technology can eliminate traffic fatalities	To detect the 3D and 4D LiDAR and radar positions or distance to objects with higher level of accuracy than a camera.	The troubling trend of car accident fatalities continues to be on the rise. Studies showed that over 90% of traffic accidents are caused by human driver errors	Advanced driver assistance systems (ADAS) techniques	- To speed up the adoption of new technologies in vehicle safety systems, collective action is needed from regulators and automotive manufacturers. - Many of today's vehicles are not fully equipped to handle many common driving situations.
3	Sahu, A. K. (2008)..	Information Society: A New Challenge for Libraries and Library Professionals	The study consists of areas of information society, knowledge management, marketing of information product, quality management in libraries, digital library, electronic resources	As the pressure of global competition and the use of information and communication technologies increase, the way libraries and library professionals work are now changing	Content –based approach	Findings revealed that increased economic growth, improved social conditions, and the spread of democracy are changes that have been observed and credited to the rise and growth of ICTs.
4	Olga, A. S; Patchara, T, and	Organization leadership in	To investigate knowledge	- The growth of automobile	Statistical data using mixed	- Two automobile corporations

	Sangkon, L (2021)	automobile industry: knowledge management and intellectual capital	management factors that influence organizational leadership development of Korean and Thai automotive companies	industry depends on productivity of Transnational Corporations (TNCs). - High risks whether Thai auto industry can maintain its previous technological and economic positions with its technological capabilities.	methods, uses quantitative data and data collection through Open Source	from the Asia region were investigated. - The application of organizational leadership in the technological field of automobile companies and knowledge transferring processes was found - Discovery of an interdependence between the KM and organizational leadership
5	Vijayakumar A (2023).	Potential impact of artificial intelligence on the emerging world order.	This paper draws from a historiography of the First, Second, and Third Industrial Revolutions to study how technological innovations have altered relative power capabilities of nations, triggering a re-ordering of power hierarchies at a systemic level.	The global AI race will pave the way for another rise and fall of great powers in the international system. ii. similar to the impact caused by the three industrial revolutions of the past – namely, the United States of America (USA), China, and Russia, as the leading contenders in this AI race.	Qualitative method using historiography approach	The AI strategies of US, China, and Russia reflect their capabilities and intentions towards how they plan on employing the technology to elevate their prestige and power status in the international system.
6	Garikapati, D. and Shetiya, S. S (2024).	Autonomous Vehicles: Evolution of Artificial Intelligence and the Current Industry Landscape	This study investigates into the fundamental role of AI in shaping the autonomous decision-,making capabilities of vehicles.	Traditional development methods such as Waterfall and Agile fall short when testing the intricate autonomous vehicles for both lab and real world testing and validation of ADAS autonomous systems.	Operational design domain approach; AI Model Training – techniques and AI Model Generation method	The study presents statistical insights into the usage and types of AI Algorithms over the years revealing research landscape in the automotive industry

7	Turban, E., Pollard, C., Wood, J.W., & Sons, 2021	Information technology for management: driving digital transformation to increase local and global performance, growth and sustainability	Presentation of a pedagogy that is designed to help students with different learning styles and retain information	Over the years, IT roles in the sharing economy has been a challenge, this text proffers its roles, in the sharing economy and impact in the global society.	Blended learning approach	Findings show that students learn how IT is leverage to reshape enterprises, engage and retain customers, optimize systems and processes. Manages business relationships and projects.
8	Shiohira, K (2021). Understanding the impact of Artificial Intelligence on Skills development: Education 2030.	Understanding the impact of Artificial Intelligence on Skills development: Education 2030.	To assess the impact of Artificial Intelligence on Skills development on Education	Technical and Vocational education and training (TVET) have contributed to the sustainable development by fostering employment, decent work and lifelong learning. However, the effectiveness of a TVET system depends on its links and relevance to the labour market.	AI policy review method	As one of the findings showed that there is a need to better understand the impact of AI on labour markets, and consequently on TVET systems.

3 METHODOLOGY

The research method used in this study is a literature design. The literature research method is an approach to research that involves the collection, analysis, and synthesis of existing information related to a particular topic, found in books, journal articles, and other sources (Heriyanto, 2018; Rizkykawasati, 2019). This includes identifying the main themes, research questions, methods, and conclusions of these works to build a broader understanding of the area under study (Iryana, 2019). This research generally involves using electronic databases and libraries to search for relevant literature, as well as a critical selection process of the material to be included in the analysis (Dewi, 2019). The main purpose of the literature study is to find out about recent developments in the research field, identify gaps in existing knowledge, and provide justification for the proposed research (Zaluchu, 2020). The process of creating a literature study begins with determining the scope of the research, including the key words that will be used in the literature search. This is followed by screening and selecting quality and relevant literature. This process also involves assessing the methodology, validity, and relevance of each source to the topic at hand (Moha & Sudrajat, 2019). Next, information from various sources is brought together and synthesized to build a new argument or framework that will support further research or study (Sudrajat & Moha, 2019).

3.1 Analysis of Driving Globalization, Library and Information Science with Artificial Intelligence for Automobile Technology Advancements on EBSCO host Database

In order to analyze the evidence of the flow of search and selection technique for driving globalization, library and information science with artificial intelligence specifically focusing on the advancement in automobile technology, we presented a tree table of drivers globalization in LIS and AI – based approach on development in automobile technology after rapidly examined 8,453 articles related to globalization, LIS with artificial intelligence on the advancement in automobile technology in EBSCO host database (search was done in May 2024), with limitation to date of publication (2015-2024). The data was collected from EBSCO host database that consists of articles of standard and acceptable quality and peer reviewed (Mukhlif, Hodonu-Wusu, Noordin and Kasirun, 2018; Zhu, Jiang, Cao, *et al.*, 2015). The first search attempt with keyword "Driving Globalization""Library and Information Science""Artificial Intelligence" AND "Automobile Technology" as the title returned 50,939 articles, 8,453 articles were screened in this study while others are excluded. The citations source items indexed within EBSCO host database are reflected in this following report. 135 full-text articles were reviewed but 41 articles in all were relevant to our target, and others that are not so relevant to driving globalization, library and information science with artificial intelligence specifically focusing on the advancement in automobile technology were removed (***Figure 4***). Many of these articles are published in WoS, SCOPUS and EBSCO host databases and have passed through rigorous peer review.

3.2 Artificial Intelligence in Automobile Technology

3.2.1 Overview of Artificial Intelligence

Artificial Intelligence (AI) is revolutionizing the automobile industry by enabling vehicles to perceive, reason, and act autonomously. AI algorithms allow cars to make decisions, learn from data, and enhance driving. AI, with its ability helps to analyze vast amounts of data and make intelligent prediction possible (Hodonu-Wusu, 2024).

3.2.2 Applications of AI in Automobiles

I. Autonomous Vehicles

- **a. Self-Driving Cars**: Today, we have seen AI powers autonomous driving systems, enabling vehicles to navigate roads, interpret traffic signs, and avoid obstacles (*See Figure 3*).
- **b. Advanced Driver Assistance Systems (ADAS)**: AI enhances safety with features like lane-keeping assistance, collision warning, and adaptive cruise control.

II. Predictive Maintenance

AI predicts vehicle maintenance needs by analyzing sensor data and identifying potential issues before they lead to breakdowns.

III. Natural Language Processing (NLP)

AI-powered voice assistants like virtual co-pilots leverage NLP to interact with drivers, provide information, and control vehicle functions.

IV. Smart Manufacturing

AI optimizes production processes by enhancing quality control, monitoring inventory, and managing supply chains efficiently.

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V. Enhanced User Experience

AI personalizes driving experiences by adjusting climate control, entertainment systems, and seat preferences based on driver profiles.

3.3 Benefits and Challenges of AI in Automobile Technology

According to Yada (2023), the followings are the benefits of AI in Automobile Technology:

Benefits include:

- **Safety:** AI improves road safety by detecting hazards, preventing collisions, and optimizing driving behavior.
- **Efficiency:** AI enhances fuel efficiency, reduces emissions, and streamlines traffic flow through optimized routes.
- **Convenience:** AI-enabled features like autonomous parking and adaptive cruise control offer convenience to drivers.
- **Improved User Experience:** AI provides personalized in-car experiences based on user preferences and behaviors.

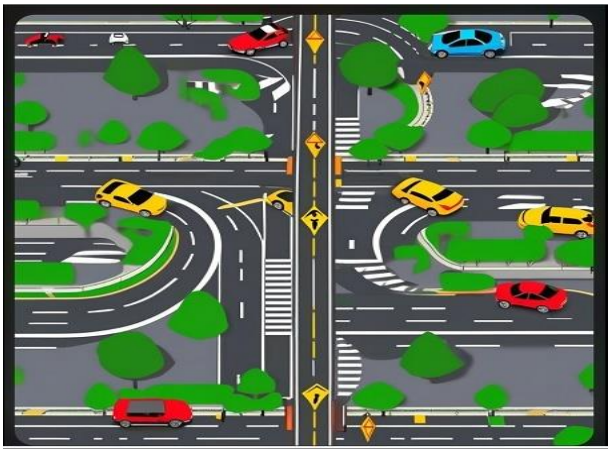

Figure 3: Self-Driving Car, Navigating Roads, Interpreting Traffic Signs, and Avoiding Obstacles

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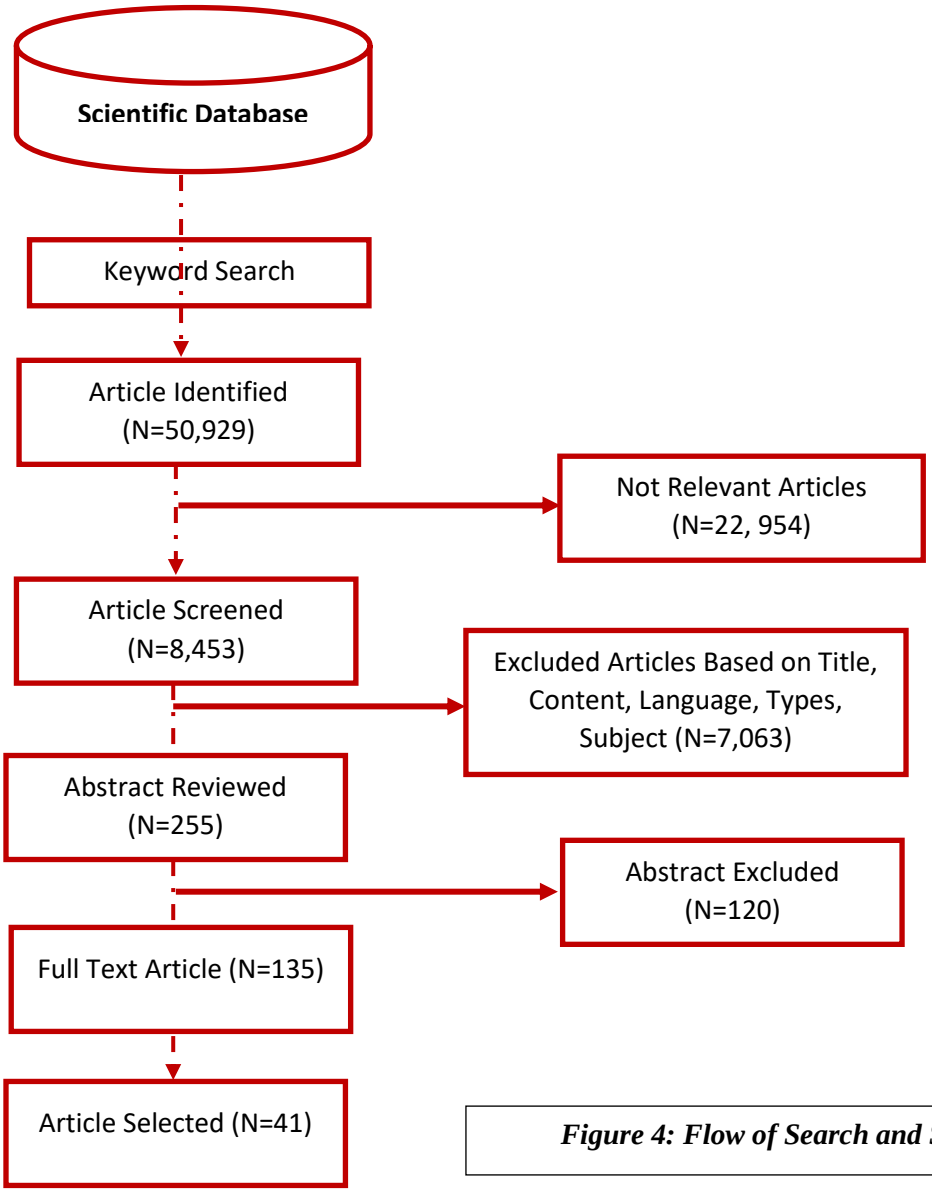

Figure 4: Flow of Search and Selection Technique

- **Predictive Maintenance:** AI reduces maintenance costs by predicting component failures before they occur.
- **Cost Savings:** AI helps in saving cost when you self-drive a car. Self-driving cars can also reduce downtime and improve overall reliability and detect potential problems before it occurs.
- **Autonomous Driving:** With the help of information science and data science and python in self-driving cars, autonomous driving is impossible. Analyzing data from sensors, cameras, and other sources, self driving cars can navigate the road and make decisions without human effort.

  Advanced Navigation: Another advantage of using AI in automobile technology is the ability to provide advanced navigation. By analyzing data from sensors, cameras, and other sources, self-driving cars can provide real-time information about traffic conditions, weather conditions, and other factors that can affect the driving experience.

- **Personalization**: The ability to provide personalization in automobile technology is possible. By analyzing data from user interactions, automobile industry cars can learn and adapt to the preferences of individual users. This can include things like preferred routes, music, and temperature settings.
- **Emission Reduction**: The ability to reduce emissions in automobile industry as well as analyzing data from sensors, cameras, and other sources will make self-driving cars provide more efficient routes and avoid traffic congestion. This can help to reduce travel time and improve overall performance.
- **Real-time Data Analysis**: The use of AI and data analytics tools in self-driving cars is an ability to analyze real-time data. By analyzing data from sensors, cameras, and other sources, self-driving cars can make more informed decisions and react more quickly to potential hazards.

Yada (2023) also postulated that the use of AI has revolutionized the automotive industry; however, there are also some significant disadvantages to this approach.

Challenges include:

- **Security:** Vulnerabilities in AI systems can be exploited by hackers, posing risks to the safety of autonomous vehicles.
- **Ethical Concerns:** Issues like accountability for accidents involving autonomous vehicles raise ethical dilemmas.
- **Data Privacy**: AI systems collect vast amounts of data, raising concerns about the privacy and security of this information.
- **Interoperability**: Ensuring seamless communication between AI systems from different manufacturers is crucial for future integration.
- **Regulatory Hurdles:** Developing comprehensive regulations for AI in automobiles poses challenges due to the rapidly evolving nature of the technology.
- **Cost:** AI requires a significant investment in technology and infrastructure, which can be costly for small and medium automobile firms. Additionally, maintenance and updates required to keep the systems running smoothly can also add to the overall expense of these organizations.
- **The potential for data breaches and hacking:** Automobile firms usually collect and store a large amount of data, they are vulnerable to cyber-attacks. A successful hack could compromise the privacy and personal information of the car's passengers and put them at risk.
- **The complexity of AI can also be a disadvantage:** Self-driving cars rely on complex algorithms and data processing to make decisions and navigate the road. This can make it difficult for automobile industry to diagnose and fix problems when they arise, and can also lead to errors or malfunctions in the car's operation.
- **The potential for bias in the data:** As self-driving cars collect data from a wide range of sources, there is a risk that the data may be biased in some way. This can lead to inaccuracies or errors in the car's decision-making, which can put passengers at risk.

4.0 Driving Globalization through LIS and AI

In today's interconnected world, the fusion of LIS with AI has the potential to revolutionize the globalization process. This synergy can enhance global connectivity, accelerate research and development, improve user experience, and address ethical and legal considerations, thus reshaping the way information is accessed, used, and shared on a global scale (Vijayakumar, 2023; Hodonu-Wusu, 2024).

4.1 Enhancing Global Connectivity

The integration of AI with LIS tools and practices has the capacity to break down geographical barriers and facilitate global connectivity. AI-powered search algorithms and recommendation systems can help users discover relevant and diverse information, transcending language and cultural differences. Virtual libraries enabled by AI can provide users across the globe with access to vast repositories of knowledge, regardless of their physical location (Bairagi & Lihitkar, 2024). Moreover, AI-driven translation tools can bridge language gaps, making information more accessible to a wider audience (Network, 2024).

Through natural language processing and machine learning, AI can enable real-time translation of texts and audiovisual content, fostering cross-cultural communication and understanding. This seamless exchange of information across borders promotes collaboration, innovation, and cultural exchange on a global scale (Team, 2023).

4.2 Accelerating Research and Development

The marriage of LIS and AI can expedite research and development processes by automating routine tasks, extracting insights from vast datasets, and identifying patterns that would be otherwise imperceptible to human researchers. AI-powered analytics can streamline information retrieval, analysis, and synthesis, enabling researchers to make evidence-based decisions more efficiently (Dwivedi, Kshetri, Hughes, Slade, *et al.*, 2023).

Machine learning algorithms can predict research trends, recommend relevant resources, and even generate new hypotheses based on existing data. This not only accelerates the pace of innovation but also enhances the quality and relevance of research outcomes. By empowering researchers with AI-driven tools, LIS can catalyze interdisciplinary collaboration and knowledge sharing, driving globalization through the rapid advancement of science, technology, and scholarship (Gligorea, Cioca, Oancea, Gorski, Gorski, Tudorache, 2023).

4.3 Improving User Experience

AI technologies embedded within LIS systems can personalize user experiences, making information services more intuitive, engaging, and tailored to individual preferences. Recommendation engines leverage user behavior data to offer personalized content suggestions, enhancing user satisfaction and retention. Chatbots powered by AI can provide instant assistance to users, delivering customized support and guidance in real-time (Hodonu-Wusu, 2024).

Furthermore, AI-enhanced metadata tagging and categorization algorithms can enhance information retrieval efficiency, ensuring that users can access relevant resources quickly and easily. By understanding user preferences and behaviors, AI can optimize the design.

Improving user experience in driving globalization through LIS and AI involves several key considerations. Addressing ethical and legal concerns is paramount to ensure the responsible and effective use of these technologies. The following are some strategies to enhance user experience while addressing ethical and legal considerations (Hodonu-Wusu, 2024).

4.3.1. User-Centered Design (UCD)

a. **Personalization:** Implement personalized services based on user preferences and behavior to enhance user experience.
b. **Accessibility:** Ensure that AI systems and LIS tools are accessible and cater to diverse user needs.

4.3.2. AI Integration in LIS:

a. **Enhanced Search Capabilities:** Use AI for improved search functionality, recommendation systems, and content curation.
b. **Text and Data Mining:** Leveraging AI for text and data mining can enhance information retrieval and analysis capabilities.

4.3.3. Globalization and Multilingualism:

a. **Translation Services**: Implement AI-powered translation services to bridge language barriers and promote global knowledge sharing.
b. **Cultural Sensitivity:** Develop AI algorithms that are sensitive to cultural nuances and diverse perspectives.

4.3.4. Ethical and Legal Considerations

According to Delfausse (2020). The followings are the ethical and legal considerations that need to be considered when dealing with users in respects to usage of AI

a. **Transparency:** Ensure transparency in AI algorithms and data processing to build trust with users.
b. **Data Privacy:** Implement robust data privacy measures to protect user data and ensure compliance with data regulations.
c. **Bias Mitigation:** Regularly audit AI systems to detect and eliminate biases, ensuring fair and impartial outcomes.

4.3.5. Training and Education:

a. **User Training:** Provide training to users on how to effectively use AI-powered tools and LIS services.
b. **Ethics Training:** Educate users and stakeholders on ethical considerations related to AI and information access (Delfausse 2020).

4.3.6. Collaboration and Partnerships:

a. **Interdisciplinary Collaboration:** Foster collaboration between LIS professionals, AI experts, ethicists, and legal experts to address complex challenges.
b. **Engagement with Stakeholders**: Involve stakeholders in the decision-making process to ensure that user needs and ethical considerations are prioritized.

4.3.7. Continuous Evaluation and Improvement:

a. **Feedback Mechanisms:** Collect user feedback to continuously improve AI systems and LIS services.
b. **Ethics Review Boards**: Establish ethics review boards to evaluate the impact of AI technologies on user experience and uphold ethical standards. By integrating these strategies, organizations can enhance user experience (Delfausse 2020).

5.0 CONCLUSION AND RECOMMENDATIONS

In exploring the intersection of Library and Information Science (LIS) with Artificial Intelligence (AI) to drive globalization, it is evident that these two fields can catalyze significant advancements in the dissemination of knowledge and information across borders. The integration of AI technologies in LIS practices can enhance the efficiency of information management, promote cultural exchange, and foster collaboration on a global scale. By leveraging AI tools such as natural language processing, machine learning, and data analytics, libraries can revolutionize access to information resources, support multilingual services, and empower diverse communities worldwide. Choi et al. (2018) underscore the transformative potential of AI in LIS, emphasizing how AI-driven applications can streamline cataloging processes, improve information retrieval, and facilitate personalized user experiences. These developments not only enrich the user engagement but also contribute to breaking down linguistic and geographical barriers, thereby promoting a more inclusive and interconnected global knowledge network.

Delfausse (2020) emphasizes the importance of ethical considerations in the adoption of AI in LIS, highlighting the need for transparency, accountability, and data privacy safeguards. As libraries embrace AI technologies to expand their reach and enhance services, it is imperative to prioritize ethical principles, ensuring that the benefits of AI are balanced with the protection of users' rights and interests.

RECOMMENDATIONS

1. **Invest in AI Education and Training:** Libraries and LIS professionals should prioritize continuous education and training in AI technologies to harness their full potential. Workshops, seminars, and collaborative initiatives can help librarians develop the necessary skills to effectively integrate AI tools into their services and operations.

2. Promote Multilingual Access: Leveraging AI for natural language processing can facilitate multilingual access to information resources, catering to diverse user populations worldwide. Libraries should invest in AI-powered translation tools and language processing technologies to enhance accessibility and broaden their global audience reach.

3. Foster Global Collaboration: Encouraging collaboration and knowledge sharing among libraries on an international scale can amplify the impact of AI-driven initiatives. Establishing networks, consortia, and partnerships can facilitate the exchange of best practices, resources, and innovative solutions, leading to collective advancements in global information services.

4. Prioritize Ethical Guidelines: Libraries must develop and implement ethical guidelines and policies governing the use of AI in information services. By upholding ethical standards, ensuring transparency, and safeguarding user privacy, libraries can build trust with their communities and uphold the principles of responsible AI deployment.

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PAPER 3 - PROSPECTS AND CHALLENGES OF INTEGRATING MOBILE LEARNING IN TEACHING AND LEARNING OF BIOLOGY IN NIGERIAN TERTIARY INSTITUTIONS

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ABSTRACT

The rapid advancement of technology and its widespread use in the education system has led to a new way of learning, with universities and colleges now incorporating mobile devices into higher education. Mobile learning harnesses mobile technologies, enabling students to learn anywhere and access learning materials anytime. To ensure the successful incorporation of mobile learning in higher education, it is essential to have a comprehensive understanding of the student's readiness to employ mobile technology for educational objectives. The adoption of mobile learning has greatly revolutionized the approaches to education in academic institutions. Mobile technological gadgets have facilitated the connection between teachers and students to the global village. Implementing mobile learning in Nigerian tertiary institutions is unavoidable in the technology-driven modern environment. This is necessary for efficient collaboration and optimal outcomes. The implementation and assimilation of mobile learning enables biology students in tertiary institutions to succeed, regardless of their location or time, with collaboration being crucial. This study provides an in-depth review of mobile learning, specifically focusing on its use in Nigerian tertiary institutions. The review delves into the possible advantages and prospects of implementing mobile learning within the framework of biology instruction in higher education. The research also looked at some of the obstacles to incorporating mobile learning in teaching and learning of biology and as well provided solutions to the challenges. However, recommendations were also made for the efficient integration of mobile learning for teaching and studying biology in Nigerian tertiary institutions.

KEYWORDS: Mobile learning, Teaching, Learning, Biology, Tertiary Institution

INTRODUCTION

The continuous advancement and strategic utilization of mobile technologies have facilitated the integration of connectivity, engagement, and productivity within education. The successful integration of technology in education has led to advancements in how teachers utilize and vary their instructional approaches, shifting from the conventional role of being the sole conveyor of knowledge to becoming facilitators, mentors, and motivators. Consequently, this has resulted in a more interactive and captivating learning experience for students (Edeh et al., 2019).

Mobile learning (M-learning) can aid students in working together in groups with the aid of group projects, discussion boards, and shared documents, (Monguillot Hernando et al., 2014). This promotes collaborative learning, cooperation, and the sharing of knowledge, regardless of geographical distance. In addition, there is a form of learning called M-learning or micro-learning, which breaks down educational content into little, easily understandable modules or lessons (Hug, 2015). Students utilize these modules on their mobile devices, facilitating expedient and focused study. Just-in-time learning enables students to promptly obtain pertinent information as needed, effectively meeting their immediate learning requirements (Alade et al., 2020). The combination of virtual reality (VR) and augmented reality (AR) technologies in M-learning aims to offer authentic and captivating experiences (Kiat et al., 2016). Higher Education Institutions utilize these technologies to replicate real-life situations, carry out virtual laboratory experiments, and organize virtual excursions, thereby enriching students' comprehension and practical abilities. In addition, M-learning incorporates gamification strategies, including instructional games, quizzes, and simulations, to generate interactive and engaging learning encounters. By ensuring that the learning process is enjoyable and engaging, this approach enhances student motivation, participation, and information retention (Carrión Candel & Colmenero,

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2022). In addition, M-learning platforms provide smooth evaluation and feedback procedures. Students can participate in tests, hand in assignments, and promptly receive feedback. This allows them to monitor their progress and pinpoint areas where they may make improvements (Naveed et al., 2023).

According to Kumar Basak et al (2018), the three primary trends in contemporary education are electronic learning (e-learning), mobile learning (m-learning), and distance learning (d-learning). The fundamental distinction between m-learning and other training methods lies in the utilization of personal devices (such as smartphones or tablets) to access instructional content at any given moment (Xie et al., 2019). These days, cell phones are believed to be the most popular technology in the world. According to Hargittai (2020), mobile activities contribute to around 50% of the global web traffic. For developing nations, m-learning represents an amazing choice for extended and less expensive distribution of educational products and services (Brandt et al., 2020). M-learning facilitates enhanced student-teacher contact and promotes active learner engagement in the educational process, therefore optimizing communication between teachers and students (Marcus et al., 2019). At the same time, to deliver a full-fledged education helped by mobile technology, it is important to build an appropriate atmosphere and communication culture (Navarro et al., 2016). As a rule, in m-learning, the student has access not only to the content of a particular educational platform but also to other Internet resources. Thus, the materials of the Massive Open Online Course (MOOC) and Learning Management System (LMS) in the m-learning environment should be supplemented by different informational resources, rather than developed from scratch (Purcell, 2017). For Generation Z, being the most generally involved in the education process, the utilization of smartphones and mobile applications is normal (Suartama et al., 2019).

As a result, m-learning may evolve into a setting where these students can be guaranteed constant presence as well as full access to training materials. In this setting, engagement, adaptability, and friendliness of m-learning approaches are crucial (Garca-Gutierrez et al., 2017). The limitations of mobile devices for m-learning activities include small screens, relatively limited processing power, and quick battery drain when used continually (Pimmer et al., 2019).

1. CONCEPT OF MOBILE LEARNING

Mobile learning is an essential component of higher education that allows students to share their ideas with other students via the Internet and other mobile-assisted technology. Due to its ambiguity, the term "mobile learning" is prone to debate. The term describes mobile learning's capacity to integrate formal education inside the classroom with informal or formal education outside of it, across a variety of devices, and in a variety of temporal and physical contexts. Mobile device engagement is only one piece of the jigsaw; the interactions that mobile devices enable and how these supports promote learning are crucially relevant to this study of mobile learning (Hockly, 2016).

Interpersonal or content engagement are two examples of the types of learning that are done using mobile gadgets. This is personal learning that is generally done using mobile gadgets. In this kind of learning, distance does not hinder the learning process as the student can receive knowledge at his/her convenience. Mobile learning has become part of humans' day-to-day behavior. Mobile learning is the future of learning (Ahmed et al., 2018). Technology is proving to be a powerful instrument in every aspect of life and it is dominating the educational sector swiftly. The availability of mobile devices and the internet has been made possible by the continuous improvement of technology in recent decades, and this has resulted in mobile learning. According to Shorfuzzman and Husseini (2016), mobile learning has become a popular trend in higher education globally.

M-learning is becoming increasingly popular among teachers and students as a more flexible and enjoyable approach to doing everyday tasks. Universities all around the world have been using M-learning to deliver education in a variety of ways, anytime, anyplace. The Interactive Learning Network (ILN) approach has been implemented at Canada College and San Francisco State University (SFSU) to evaluate student performance through pre- and post-tests using tablet PCs and wireless technology (Enriquez, 2010). The integration of M-learning with a Geographic Information System (GIS) module was investigated by Erkollar and Oberer (2012) in a pilot course at a Turkish institution. To increase communication among students, each student was given a tablet device with Google+ and Hangout Apps loaded. Pegrum et al (2013) regarded m-learning as the fastest-

advancing area in the realm of Information and Communication Technologies in education. They are known, perceived, and referred to as any sort of learning carried out using a mobile device or mobile technical gadgets.

The use of mobile phone devices, such as smartphones, tablets, multimedia players, and other portable gadgets in teaching and learning is known as mobile learning, according to Toteja and Kumar (2013). According to Chuang and Tsao (2013), mobile learning offers educational benefits such as exposing teachers and students to greater chances and keeping them relevant in the ever-evolving world of mobile technology. According to Park et al (2012), m-learning is an educational setup that enables the use of portable or pocket gadgets as the primary technology for instruction. McCaffrey (2011) described mobile learning as providing chances for expanded and enriched learning beyond the four walls of the classroom. Crompton (2013) described mobile learning as the form of learning possible by mobile devices via multiple social, cultural, and educational contexts.

One of the main benefits of mobile learning is that students can rapidly and conveniently retrieve information using smartphone technology for communication and learning purposes (Pena-Ayala et al., 2014). M-learning builds attitude and brings about positive conduct that assists in the educational environment. Ozdamli and Uzunboylu (2015) indicated that mobile devices help in learning when talking about the conventional system. The application of mobile devices has increased and seen huge improvements in several fields like economics, entertainment, banking and finance, health, government, research, and tourism. It has made it easier for teachers to impart knowledge to students in the classroom. It also brings sophistication and originality to the way courses are packaged and communicated, therefore making it enjoyable.

As the world changes, technological advancements have led to ongoing device upgrades, which have sparked the creation of new educational applications that can support management, instructors, and students in their pursuit of success. Students and instructors can communicate with each other at any time and from any location, which makes communication, one of the keys to success very easy. These days, each lecture has a group that which the professor communicates and sends vital information to the students. The best aspect of these technological improvements is that students and lecturers obtain fast feedback from their questions and allow them time to make revisions and assignments. With the technical improvement and educational adoption of these technologies, m-learning is gradually taking over educational sectors and becoming the more valuable means of learning as it is quick, efficient, and adaptable to utilize (Sunil, 2017).

2. MOBILE LEARNING IN NIGERIAN TERTIARY INSTITUTIONS

The problems with learning, homework, information access, and independent study that teachers and students encountered in the classroom were intended to be addressed via mobile learning. Mobile learning has drawn attention as having the potential to increase opportunities for learning personalization because of the diverse array of tools and resources that are constantly becoming available. Scholars who have investigated the characteristics of mobile learning within educational settings concur that m-learning allows students to collaborate, work in teams, or work alone to accomplish a variety of goals, including finishing assignments, resolving issues about their research, fulfilling special needs, and being given a voice and choice (Al-Emran et al., 2016; Santos & Bocheco, 2014). There are many chances for formal and informal learning, both within and outside of the classroom, given the abundance of knowledge that is available to us at all times and places (Knezek & Khaddage, 2012).

It is vital to first evaluate the state of mobile learning in Nigeria to understand the current state of mobile infrastructure in the nation. According to the data presented by Gabriela and Badii (2010), a significant segment of Nigeria's populace utilized mobile services. They estimated that there are 73 million mobile customers in the country, which translates to 49% of individuals using mobile devices. It was therefore expected that more individuals would recognize its usefulness and be in a better position to utilize mobile services to their fullest extent soon due to intense competition and continuous innovation from mobile service providers. Gabriela and Badii (2010), however, found that there was a rather low acceptance rate for mobile learning. This could have to do with the abundance of pointless articles on social media, which take up young people's time more often than they use these tools and resources for productive and active learning. The use of mobile phones for Project Based Learning (PBL) in privately owned universities in the southwest region of Nigeria was then investigated by Utulu and Alonge (2012). The findings showed that 95.9% of the participants had a cell phone, which they used for information collecting, knowledge exchange, PBL-

related communication, and interactions. By comparison, 0.8% of participants had misplaced their phone, and 2.3% of participants had no phone at all. It may be projected that mobile phones are viable in enhancing PBL as well as in establishing information services in institutions.

Nigeria, the most populated country in Africa and the country with the greatest economy is expected to have more than 140 million smartphone users by 2025. Presently, many sources indicate that the number of smartphone users in Nigeria ranges between approximately 25 and 40 million. Determining the precise number of users is challenging. Nevertheless, the available data indicates a robust projected expansion for the Nigerian smartphone market, with the number of users expected to increase by at least three times in the next five to six years (Taylor, 2023).

According to Chaka and Govender's (2017) research on the adoption of mobile learning in tertiary institutions, students believe that 26% of Nigeria's population does not have access to education. A case study in Nigeria with 320 students from colleges of education, and quantitative research created was delivered. The study carried out a descriptive and regression analysis. The results show that behavioral intention is positively impacted by effort expectancy, performance expectancy, social influence, and mobile learning conditions. These findings are similar to the use of the technology model and unified theory of acceptance. Mobile learning states, performance expectancy, and effect expectancy substantially determine students' decision to adopt Mobile learning. Even though mobile learning is not going to eliminate all the problems of learning in Nigeria, it plays a key role in reducing the challenges of accessibility to learning. Based on their investigation, the researchers discovered that Nigerian education college students view mobile learning favorably and are therefore prepared to accept it since it hasn't been used yet.

3. PROSPECTS OF MOBILE LEARNING IN TERTIARY BIOLOGY EDUCATION

Due to its flexibility and self-paced nature, mobile learning has made education more accessible to people whose daily schedules or other commitments would have prevented them from having the time to study. Self-paced learning can be done in a variety of ways, including using mobile devices to access specific courseware online as instructed by your teacher, watching pre-recorded classroom activities, or accessing online educational materials. According to Debrá and Qua-Enoo (2018) and Rabah (2015), mobile learning promotes education through online collaborative learning. This collaboration occurs when students use mobile devices to establish synchronous or asynchronous connections with their teachers. While synchronous interactions take place in real time, asynchronous interactions happen when students connect with their teachers or peers at different times. With the help of mobile learning, students may connect with teachers and other students while studying on the go, providing them with the assistance they require.

Furthermore, mobile learning supports the development of digital skills for lifelong learning, which is increasingly important for instructors and learners alike in the competitive knowledge society (Brown, 2017; Grand-Clement et al., 2017). Any educational program that does not equip students with the abilities necessary for lifelong learning is not doing enough to prepare them for the demands of contemporary society. Knowledge and information are increasingly vital to the modern world due to the paradigm change that globalization has brought about in the traditional approaches to teaching and learning. Due to these developments, curricula that frequently require access to a wide range of information and sources have become more important in education, as have programs and approaches that enhance productivity and skills. With these learner-centered approaches, the teacher becomes a facilitator rather than a subject matter expert and is based in an authentic setting.

Sufficient support for this new focus is provided by emerging and current technologies that are more crucial to the professional development of teachers and the dissemination of creative and improved practices to outside groups (Debra & Qua-Enoo, 2018). The benefits of mobile technology for higher education include fewer geographic constraints, more open systems of educational information and resources, and enhanced access. Al-Shboul et al (2017) asserted that the main benefit of mobile devices in the classroom is that they allow students to select their study locations and hours without interfering with the development of other students. This helps enhance the students' skills to access, retrieve, organize, provide information, use, and communicate with their colleagues and teachers, without classroom boundaries (Albugami, 2016).

Mobile learning in Biology education tends to influence the organization of both theoretical and practical classes. Mobile learning facilitates the efficient planning and utilization of virtual laboratories during practical lessons with students in physical laboratories. Biology courses could be facilitated by distinguished experts who are not physically present with the students. They could be connected online through mobile devices to enhance the learning process. Another potential application of mobile learning in biology education, particularly in higher education institutions, is the opportunity for students to participate in online conferences. This can greatly enhance their scientific skills and literacy in biology.

4. CHALLENGES OF MOBILE LEARNING IN TERTIARY BIOLOGY EDUCATION

There are many challenges confronting the integration of mobile learning in tertiary biology education. They are:

1. **Data security and privacy:** The issue of information security and privacy has consistently been a primary concern for IT professionals worldwide, given the escalating prevalence of cyber criminals. This concern extends to higher education institutions as well. Cybercrime encompasses illegal activities that involve the use of computers or computer networks as tools, locations for criminal activities, sources of crime, or targets (Pozar, 2014). The integration of mobile learning in tertiary biology education is confronted with a significant hurdle in the form of data insecurity and privacy concerns. In our current era, data is very permeable, resulting in a lack of assurance regarding security and privacy. Even a small amount of negligence can result in data being compromised and confidential information being exposed. Another significant aspect of information security pertains to the potential loss or theft of mobile devices. Once these mobile devices get into the hands of criminals, if not secured, might lead to greater harm done to the institution or the network. While it is possible to mitigate this issue by remotely deleting stolen or lost devices, the ultimate responsibility for this remains with the owner in certain instances, as the item in their possession. Educational institutions typically lack authority over personal gadgets in the majority of instances (Toperesu & Van Belle, 2018).
2. **Distraction:** This is one attitude militating against the integration of mobile learning into tertiary biology instruction. Most of these students divert their focus to social networking sites that have nothing to do with the ongoing lecture, assignment, or topic of discussion. Some educators believe that mobile devices cause too much distraction for learners, and or relate mobile device use during lectures with undesirable behavior (Ally, 2013). Most students while learning on mobile platforms or utilizing mobile devices become distracted down the line and in so doing the objectives of the lessons are compromised and this in turn affects the academic achievement of students in their biology lectures.
3. **Cost:** For most students, the expense of mobile devices is still another obstacle. Any technology equipment that gives people the ability to use it for their education must be used for mobile learning. It is possible, therefore, for someone to feel pressured into buying something they cannot afford. Even if people can buy such a device, it could need to be upgraded frequently after a year or two, which might get quite expensive. Additionally, there are standard monthly fees associated with data usage. For instance, it could be expensive and time-consuming to obtain a huge file that someone requests (Al Murshi, 2017).

Other challenges connected to the integration of mobile learning, as expressed by Ogbonnaya et al (2022), include the following:

4. **Designing learning resources for mobile devices:** Creating educational materials can be challenging while utilizing mobile devices. Developing mobile applications may involve huge costs and require a substantial amount of effort.
5. **Resistance to Change:** Change is inevitable but, certain individuals may feel anxious about enhancing their traditional approaches.
6. **Poor administration:** The administrative success of any organization is largely determined by decisions made by administrative leaders. An average administration may not fully utilize the potential of mobile technologies. Schools may have these technologies, while the administrative heads, due to a lack of understanding of their efficiency/usefulness in the teaching-learning process may decide not to use them.
7. **Lack of diligent implementation of mobile technology policies:** Policies are designed to be implemented and followed up to the latter. But unfortunately, this is often not the case in the Nigeria setting. The term “easier said than

done" applies to practically all segments of Nigerian society. Policies maintaining the usage of mobile technology in Nigeria are not an exception.

8. **Lack of qualified personnel:** Many staff both teachers and resource persons in the fields are not truly competent. Some do not possess or do not have the technical know-how; they may just have a paraphrase of these traits conceptually, and these can bring about a low result in the use of these mobile technologies in mobile learning in tertiary biology education.
9. **Inadequate Funds:** The effective integration of mobile learning into tertiary biology education needs a lot of funds. When funds are not adequate, it would affect the success of the integration because funds are needed to get the mobile devices and other accessories that would be needed.

5. MITIGATING THE CHALLENGES TO EFFECTIVE INTEGRATION OF MOBILE LEARNING IN TERTIARY BIOLOGY EDUCATION

For every difficulty, there is a demand for remedies to be offered to avert more damage. The following are some of the strategies to alleviate the challenges associated with the proper integration of mobile learning in tertiary biology education:

1. Students and lecturers need to be sensitized to the need to preserve their information against needless leaks. This can be done by ensuring that their mobile devices have a strong password to prevent unauthorized access by anybody. The issue of data security and privacy should not just be the concern of IT professionals or those in IT-related fields but it should be the concern of everyone irrespective of the field of endeavors, so the campaigns must be taken to every nook and cranny of the higher institution of learning and even into the larger society.
2. To address the issue of distraction, it is crucial to permit students in biology lectures to utilize devices that are specifically tailored for educational purposes.
3. Higher institution authorities are expected to procure mobile devices in large quantities for mobile learning and distribute them to students at reduced rates. Alternatively, they can implement a payment plan that allows students to pay for the device gradually instead of a lump sum. The payment schedule should be flexible to facilitate easy payment by students. In addition, it is expected that higher institutions provide free WiFi connections for their students, which should be easily accessible to all.
4. The challenge of creating learning resources suitable for mobile learning can be overcome by using resource personnel to carry out the task. Editors who work on publications and scholarly articles can also be hired and generously compensated for their work. It is also possible to provide training to both students and staff members on the proper handling and utilization of these skills.
5. Effective and consistent awareness can be achieved by various means such as workshops, training sessions, seminars, conferences, and other similar events. These initiatives can be planned specifically for the individuals involved to encourage their acceptance and adoption of such advances.
6. Routine checkups on these devices, as well as sufficient sensitization and training for these administrative heads, can be quite valuable. They can be trained to acquire a good maintenance culture to enable the integration of devices for mobile learning to endure longer and as well retain efficiency.
7. Simple and executable policies should be developed, not the fraudulent, non-executable ones. We should start with small and practical policies and apply them to the integration of these mobile technologies into mobile learning in tertiary biology education.
8. To attain the intended results in terms of qualified personnel, round pegs should be inserted into round holes, the qualified staff should be loaded with their responsibilities in the right dimensions.
9. To solve the problem of funds, special budgetary allocations must be made for mobile learning and everything needed for its successful integration into the teaching and learning of biology in tertiary education.

6. CONCLUSION

Mobile learning can bring about improvement in the teaching and learning of biology in higher education and hence should be incorporated into biology education in higher institutions of learning in Nigeria. This can be efficiently done with the help of all stakeholders in the educational system. As one facet of the education sector's digital transformation that will allow students to learn from the comfort of their own homes, mobile learning is here to stay. However, with the anticipated opportunities also come the hurdles confronting its integration into tertiary biology education and these problems also have remedies that should be the focus of stakeholders.

7. RECOMMENDATIONS

I. There should be involvement of professionals in the integration of mobile learning in tertiary biology education. More professionals should be trained and retrained to make up for the inadequate manpower needed for mobile learning in the teaching and learning of biology in tertiary institutions.

II. The government should as a matter of urgency resolve the infrastructural decay in our higher institutions as it relates to mobile learning and other areas that would aid the easy integration of mobile learning in tertiary biology education.

III. The issue with the power supply needs to be dealt with as these devices run on power. The government should boost its efforts in the energy industry through funding for solar energy as a complement to the already existent hydro-based electricity supply.

IV. There should be rules and regulations to guide the operation of mobile learning in tertiary biology education as this will build in the students the idea of self-control and discipline.

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PAPER 4 - IMPACT OF ARTIFICIAL INTELLIGENCE TOOLS ON COMPUTER APPLICATIONS SYSTEM INSTRUCTION AND LEARNING IN JUNIOR SECONDARY SCHOOLS IN IBEJU LEKKI, LAGOS STATE

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ABSTRACT
The learning process needs to be innovative and creative in order to meet the changing demands of education. In the twenty-first century, technology is developing at an ever-growing pace. In fact, with the speed at which technology is developing, everyone needs to possess a specific set of abilities in order to meet the demands of daily life. Meanwhile, it cannot be denied that Artificial Intelligence (AI) has a big impact on education. The way we teach and learn is being drastically and quickly altered by technological advancements. For this study, two research questions, two research hypotheses, and well-defined objectives were used. Mixed methods that combine qualitative and quantitative techniques was also used. Study materials are also obtained from a variety of sources, including Google Scholar, Semantic Scholar, and Science Direct. As a result, the environment of education is progressively shifting. In order to write this research study, the narrative literature review approach and the library research method are used. The results of the analysis indicates that artificial intelligence (AI) has been widely used as educational technology tools with a cumulative mean of 83.0%, 77.5%, 237.0% an 76.25%. As a result, the focus of this research study is on how artificial intelligence may help instructors develop lessons that will increase students' academic performance by using AI technology tools to make learning at the junior secondary level more flexible, engaging, and successful. The study also discusses the results of findings, draw conclusion and made recommendations.

KEYWORDS: Artificial Intelligent, Teaching and Learning, Junior Secondary School & Teacher

1. INTRODUCTION

In the 21st century, technology is developing at an ever-increasing rate. This rapid development necessitates that people possess specific abilities in order to meet the demands of daily life. This is a result of the significant impact that technology has had on our thoughts, emotions, behaviours, and interpersonal interactions. One of the newest technologies available now is artificial intelligence (AI). AI is defined as the ideas that include "artificial" and "intelligence." Artificial intelligence (AI) is "umbrella term" used to describe artificial intelligence performed by tools or robots that are linked to the data ocean and mimic human intellect (Pabubung, 2021). Artificial Intelligence is the study of how to make computers perform tasks that people can currently perform more efficiently. This includes researching human thought processes and developing machine translations for those thought processes. AI uses a variety of methods, including neural networks, deep learning, and machine learning, to accomplish this goal. Artificial Intelligence (AI) has numerous applications, including robots, image identification, and natural language processing. AI has the potential to boost production and efficiency in a variety of sectors, including manufacturing, transportation, and healthcare. Artificial intelligence (AI) technology is pervasive and encourages resource-based, intelligent development across a wide range of businesses (Huang, 2021).

In educational practice, AI has a big impact on the education industry (Yuskovych-Zhukovska, et al., 2022). The way we teach and learn is being drastically and quickly altered by technological advancements. The educational landscape is progressively changing as a result of the world's transition to the fifth generation of Internet of Things jobs in education and the growing interest in integrating artificial intelligence (AI) applications in teaching and learning processing. Artificial intellect (AI) is becoming more and more popular due to its strategic importance for education. AI was created with the intention of solving cognitive issues that are frequently linked to human intellect. Recent studies in the field of AI-based learning indicate that there are more opportunities to advance education, maintain systemic stability, and keep up with advancements when there is greater space for learning through contemporary applications. AI has the ability to have a major and genuine impact on students' present and future because it plays a number of crucial functions in the teaching-learning process and its components Mokhtar Mahmoud, (2020).

AI is a system that has been created and is capable of innovating in the field of research that is based on computers and machines that are able to have intelligence comparable to or greater than that of humans, which is defined by cognitive, learning, adaptive, and decision-making capacities (Manongga et.al., 2022). Because of its rapid growth, artificial intelligence has become a major force in all fields of study in the modern technological period. Artificial intelligence aims to increase work efficiency and decrease the requirement for human involvement (Li & Zhang, 2022). The field of artificial intelligence (AI) in computer science is concerned with creating technologies that allow machines to carry out tasks that would typically need human intelligence (Fitria, 2023). To put it simply, artificial intelligence (AI) is the capacity of computers to learn and do activities like language translation, face or facial recognition, and decision-making that would typically require human intelligence.

AI technology is advancing and has a wide range of applications. By enabling robots to think like people, it has opened up new possibilities for businesses, industries, transportation, hospitals, and educational institutions (Shen & Su, 2020). Growing interest in artificial intelligence (AI) and its successful use in education has occurred during the last several decades (Al Darayseh, 2023).

Artificial Intelligence (AI) is a technology that aims to build computers with human-like thinking and behavior (Fitria, 2021a). Artificial intelligence (AI) can manage complex activities and solve problems that are hard for people to solve because it uses sophisticated algorithms and strategies to process information and make decisions (Fitria, 2023). Artificial intelligence, has been applied in a number of fields, including education, in the current digital era. AI's potential in education can improve learning outcomes and assist in resolving some of the issues that arise during the teaching and learning process.

One of the newest areas of educational technology is artificial intelligence in education (AIEd) (Zawacki-Richter et al., 2019). The term "AIEd" describes how technology and algorithms are used to enhance the educational process and raise student achievement levels. Teachers can gather information about student performance and tailor instruction to each student's requirements by utilizing artificial intelligence. AI is also useful for creating adaptive learning systems, giving feedback, evaluating learning objectives, and streamlining distant learning procedures. There are two ways to put AIEd settings into practice. Initially, teaching assignments are transferred to the AI system, which serves as a tutor for every student. Smart tutor systems, a type of smart technology, are already extensively utilized in many classrooms to customize information to each individual student. Secondly, artificial intelligence can also be used to boost human intelligence and help people learn more effectively and efficiently. There are several ways to use AI into educational activities.

The best use of AI is as an extra tool to ease the workload of teachers. Whether or not artificial intelligence (AI) is required in the classroom is a matter of opinion, but since using AI as an extra tool can significantly improve student learning and teacher productivity, it is worthwhile to take this technology into account.

The goal of education is to equip students for life in the real world, and artificial intelligence is starting to take centre stage in a number of sectors. Teachers must train their pupils to cohabit with artificial intelligence in meaningful, productive, and appropriate ways if they want their students to be career-ready. If not, when they join the workforce, they won't be ready to perform it. It is envisaged that the use of AI in education will boost student learning efficacy and reduce learning outcome gaps. AI is capable of a wide range of activities that are challenging for humans to complete, including language processing, vision, and speech recognition. People believe that AI will replace human labour in various fields, including education, because of its intelligence. The rapid advancement of computing technologies has enabled AIEd applications (Hwang et al., 2020).

There are various applications of AI in education (Celik et al., 2022). AI has always made a major contribution to the field of education. Both teachers and students have always profited from AI. Four application areas for AIEd in academic support

services, institutional and administrative services are presented by Zawacki-Richter et al. (2019): intelligent tutoring systems, assessment and evaluation, personalization and adaptation, and profiling and prediction.

Learning in the classroom is shifting toward digital learning patterns that will foster creativity, participation, gaming, thoroughness, and other attributes. During online exchanges, teachers are crucial in providing context for the material shared and in providing guidance and education. An essential component of education is the teacher, who not only imparts knowledge but also serves as a mentor, inspirer, and role model for the students. This raises the question of whether AI will eventually take the position of teachers; and how artificial intelligence in education (AIEd) will affect computer studies instruction and learning in JSS in Lagos State's Ibeju-Lekki Area.

Statement of the Problem

Computer science education is a kind of training that significantly contributes to the accomplishment of the general educational goals at any given level. Its main goals are to prepare students for the workforce, for effective service, and for advancement from their current level to a higher level, all of which are important for their academic growth. With an emphasis on the opportunities and challenges it presents, this research study looks into how AI is affecting educational practice. Specifically, it explores how AI tools can improve the teaching and learning process, personalized education, foster creativity, and have ethical and social pedagogical implications. As a result, this study tends to offer insight into ineffective strategies for enhancing computer studies instruction at junior secondary schools and overcoming obstacles such as advocating moral standards, making sure AI techniques are used appropriately to empower teachers via cooperation and training, and using AI applications to create more favourable learning environments for all students.

The Research objectives

The following are the research objectives for this study:

1. To look into the state of AI integration in teaching and learning methods today, Including the kinds of AI technologies being employed and how they are applied in the classroom.
2. To investigate the possible advantages of incorporating AI technologies into the classroom, such as improving the efficacy of instruction, customizing the learning process, and encouraging student creativity.
3. To investigate practical approaches to the integration of AI issues in education, promote inclusive learning environments, and maximize the advantages of AI technology for all students.
4. To use empirical research and case study to examine how the incorporation of AI tools affects teaching methods, student engagement, and learning results.

Research Questions

1. How does the use of AI tools in education impact student creativity, individualized learning, and the efficacy of teachers? What are the main advantages and difficulties of this integration?

2. How can the ethical, social, and pedagogical implications of AI integration into education be effectively addressed by educators, policymakers, and other education stakeholders? What tactics may be used to encourage responsible AI tools usage while creating a supportive learning environment?

Research Hypotheses

H0: Is there no method in which artificial intelligence improves human life, education, society, or employment prospects?

H1: There is no doubt that artificial intelligence improves human existence in every aspect, including societal advancement, employment creation, and education.

Significance of the Study

This research will be of significance in the following areas:

i. It will aid in the knowledge of the application and advantages of artificial intelligence to improve productivity and effectiveness in each area of specialty and social development. This will benefit education, health, finance, security, engineering, manufacturing, research, and technology.
ii. The research project will also assist the general public in learning more about the benefits and drawbacks (if any) of using artificial intelligence, as well as providing teachers and students with a resource for academic endeavours.
iii. The study's conclusions and suggestions will also assist educators and other

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stakeholders from different sectors in choosing the kind of artificial intelligence to use and in pinpointing particular areas in which it can be used.

2. REVIEW OF THE LITERATURE

AI in Education (AIED) Tools

AI has advantages in the realm of teaching. Al is said to improve human learning and help people accomplish their educational objectives more successfully. To help the teaching and learning process be more useful and efficient, numerous innovations and discoveries based on Al are used (Hilir, 2021). Future AI applications in educational settings could be influenced by a number of tools and technologies asserted by (Fahimirad, 2018). In the field of education, "AI Learning Tools" are becoming more and more popular. Teachers and students can overcome several obstacles with the help of AI learning tools. By giving more pertinent feedback, accelerating learning, boosting learning retention, and enhancing learning, study, and performance, they can assist in raising student performance. Artificial intelligence is being used in education in the following ways:

1. **Online/Virtual mentors**

This AI tool facilitates learning, particularly for students who are learning online. Teachers at Nigerian junior secondary schools can share resources, assignments, practice questions, and other pertinent information by using this service facility. Teachers can more easily provide feedback on students' activities and development with the help of virtual mentors. Here, interactive communication between educators and students is possible. Pupils are free to ask questions regarding the content or anything related to the assessment process. This allows the teacher to determine the students' level of understanding and make any corrections. (Hilir, 2021) emphasized that AIs give students feedback on practice questions and learning activities in addition to content recommendations that should be examined again. One example of its utilization is Blackboard, which is widely utilized in American and European institutions. 169 professors and lecturers use this AI platform frequently to publish class notes, homework, quizzes, and examinations. Students can also submit questions and assignments linked to evaluations.

Figure 1: (Hilir, 2021).

2. **A Voice Assistant (VA)**

This emphasizes voice-based communication and interaction more. One of the most well-known and often used AI tools in education is the voice assistant. Voice assistants that are widely known include Microsoft's Cortana, Apple's Siri, Google Assistant, and others. With the help of voice assistants, students can do keyword-based or spoken searches for material, including books, articles, and reference queries. Additionally, voice assistants enable students to access clear and reliable information. The Voice Assistant (VA) can also orally describe the information. Furthermore, the VA will retrieve the requested information based on the specified keywords and show the material as text and graphics. Students can study freely without worrying about being confused in this way, even if they are not with an instructor or tutor, as all material, including knowledge that is not fully understood, can be delivered just through audio. This tool expedites students' quest for more resources in the classroom.

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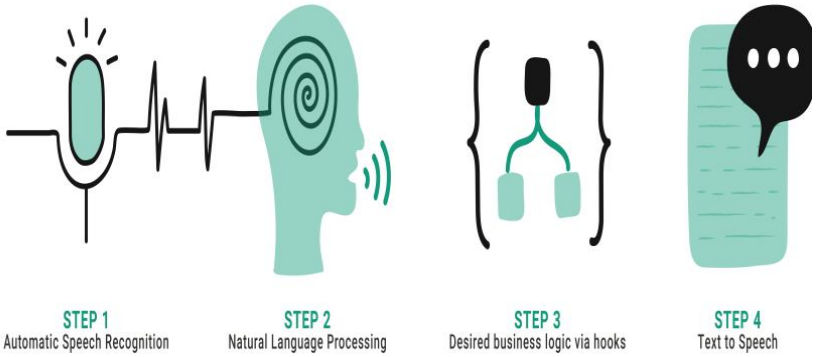

Figure 2: (Hilir, 2021).

3. **Interpreter for Presentations**

This aids in the explanation and presentation of a text written in a different language in the target language by teachers and pupils. Its purpose is to translate or explain a text published in a different language into the target language. Voice input is required for this technology to function. Users can listen to a range of text-based talks, articles, and digital publications without having to read. Speech recognition powered by artificial intelligence allows users to hear in their original tongue. We are more quickly and easily able to read and understand novels, essays, and magazines in any language. This technology has already been widely embraced for a number of uses since it is crucial for those who have vision and language difficulties. These days, "Voice Control" is a function found on almost all smart-phones. We may now type simply using our voices (voice typing), which is a solution for those of us who struggle to write long texts. With this application, it is simple to have spoken words instantly translate into text upon utterance (Hilir, 2021).

Figure 3: (Hilir, 2021).

4. **AI for education**

Educators can generate high-quality instructional materials for teaching computer operating systems in junior secondary, senior secondary and tertiary institutions in Nigeria by using this AI-assisted lesson development tool, which offers over 100 resource types. Such tools include:

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Figure 4: Source: Abu Ghali et al., (2018)

a. **Personalized learning:** Each student possesses different capabilities including unique learning styles, background and grasping abilities and not every student adapts to knowledge the same way. AI helps to take care of the above mentioned attributes by tailoring the lesson to meet the specific needs of the students.
b. **Enhanced Resource Compilation:** AI tools can quickly scan and retrieve the most recent and relevant academic texts and materials from database which will facilitate deeper understanding of the subject matter.
c. **Collaboration & Sharing among Educators:** AI-assisted tools can facilitate the sharing of lesson plans and resources among educators, fostering a collaborative environment where best practices can be exchanged (Al Ali, and Wardat (2024).
d. **Continuous Improvement:** AI-assisted Lesson development helps in providing feedback and improvement by analysing students' performance and provide insights into which areas of the lesson plan are most effective and which need improvement (Alalir and Wardat (2024).

5. The Intelligent Tutoring System

The Intelligent Tutoring System (ITS), also referred to as Intelligent Computer-Aided Instruction, is a teaching system that adjusts its content based on the skills of the students. One of the advancements in artificial intelligence for learning expert systems is ITS. Intelligent Tutoring System (ITS) for Law Learning, Intelligent Tutoring System (ITS) for Circular Learning, Intelligent Tutoring System (ITS) Based on Augmented Reality (AR) for Dimensional Geometry Material, and numerous other ITS are examples of ITS.

The Intelligent Tutoring System (ITS) is computer software that offers pupils individualized instruction and feedback without the need for human participation, according to Abu Ghali et al. (2018). The system advances students from an easier to a more difficult level based on their individual features. A group of students of all ages were given access to the intelligent tutoring system so they could test it out and see how it affected them.

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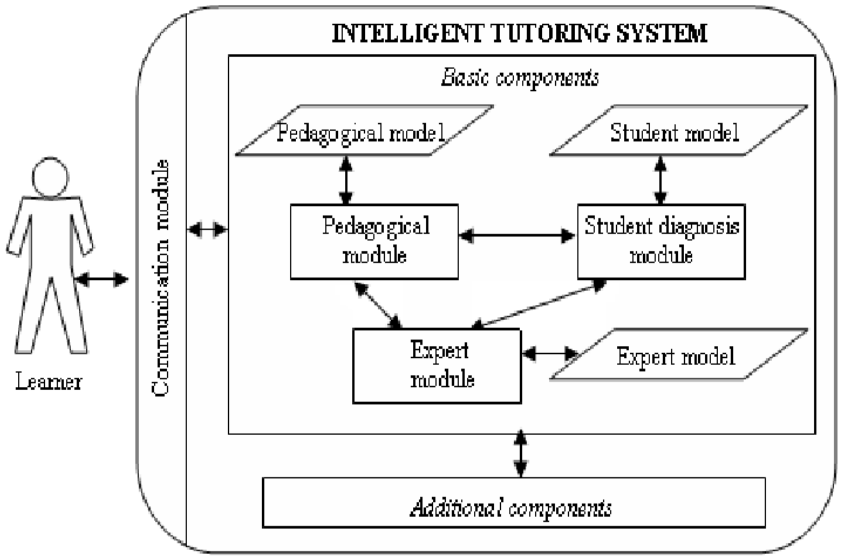

Source: Abu Ghali et al., (2018)
Figure 5

6. QNA Maker Content

It is a cloud-based service from Microsoft that allows educators to create a question-and-answer bot from their content. The QnA bot is available 24/7 providing support anytime outside regular class hours. It is mostly useful for students while studying at night or over weekends. QnA maker also help students to explore topics at their own pace, which encourage independent learning and critical thinking as students seek out information actively. The Content QnA Maker architecture is depicted in the image below, which shows screen grabs from the program.

Content QnA Maker Architecture

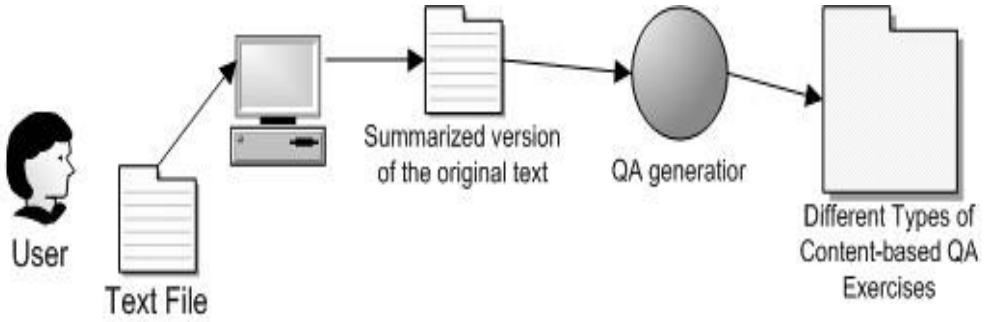

Figure: 6: Source: Huang (202

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3. METHODOLOGY

3.1 The Research methodology

The study employs a mixed-methods research methodology that combines qualitative and quantitative techniques to thoroughly examine how AI tools are incorporated into teaching procedures. This architecture enables a comprehensive investigation of the phenomena, incorporating quantitative data on the effects of AI tools on teaching and learning outcomes along with the viewpoints of stakeholders. The research paper utilized in this study was sourced from books and articles published in national and international journals. The process of evaluating data involves multiple steps: gathering relevant information from books and journals, examining the information (content) as it appears in words and images, and drawing a conclusion.

3.2 Design of the Research

The questionnaire in this study acts as a helpful manual for the process of gathering data for this goal. For the study, a survey research design utilizing questionnaire administration was employed.

3.3 Sample and Sampling Techniques

Five schools were selected using the basic random sample technique from among all the students enrolled in Ibeju-Lekki Junior Secondary School in Lagos State.
The schools are all in Ibeju-Lekki Local Government Area of Lagos State, Nigeria. The random schools are:
Magbon-Alade Junior Grammar School, Ibeju-Lekki
Idomu Junior Secondary School, Ibeju-Lekki
Yegunda Junior Secondary School, Ibeju-Lekki
Magbon-Segon Junior Secondary School, Ibeju-Lekki
Orimedu Junior Secondary School, Ibeju-Lekki

Teachers, students, and technologists actively participate in Lagos State Secondary School were also selected, to choose individuals with a range of backgrounds, experiences, and viewpoints pertinent to the study issue, purposeful sampling is used. Saturation principles are used to calculate the sample size, which guarantees that data will be collected until the theme reaches saturation

3.4 Research Instrument's Validity and Reliability

The test-retest approach was employed to assess the study's validity and reliability. In order to ensure the validity of the instrument, a sample of respondents were interviewed after the questionnaire to get their opinions on the matter.

3.6 Data Collection

Focus groups, document analysis, and interviews with educators, students and technologists are used to acquire qualitative data. The purpose of the interviews is to gain insight into the experiences, attitudes, and perceptions of the participants on the integration of AI tools into education. Through surveys given to a larger sample of students, educators, and learning outcomes, quantitative data are gathered. To measure attitudes and views, the survey includes likert scale items and closed-ended questions.

3.7 Analysis of data

Descriptive statistics (means, frequencies, percentages) are used in qualitative data analysis to summarize survey of responses. Regression modelling and correlation analysis are examples of inferential statistics that can be used to examine relationships between variables and assess the importance of findings.

4. RESULT AND DISCUSSION

A thorough understanding of AI's possible impacts, handling, and implications has been made possible by the investigation of incorporating it into educational practice. This investigation demonstrates AI's revolutionary potential to enhance instruction, personalize learning, and foster innovation. By using AI technologies, teachers may provide immediate feedback, tailor lessons to each student's unique needs, and improve learning results by changing learning pathways as necessary.

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The evolving importance of education presents opportunities as well as challenges for Al's integration. Even while AI technologies have the potential to improve educators' abilities, concerns remain. Digital literacy, data literacy, and ethical issues are prioritized in professional development initiatives and considerable training that AI successfully demands.

In addition, sustainability and scalability are shown to be crucial factors in the use of AI in education. Large-scale AI technology implementation requires substantial infrastructure investments, technical know-how, and continuing maintenance. Furthermore, in order for AI systems to remain effective and relevant in the rapidly changing field of education, there must be continuously adjusted and improved due to the rapid advancement of technology (Alnegedi and Wardat, 2023).

Socio-cultural factors play a major role in the integration of AI into the educational system, according to Alneyadi and Wardat 2023. Building a culture of trust, collaboration, and transparency is essential to encouraging educators, students, and other stakeholders to accept and adopt AI technologies. Furthermore, proactive interaction and communication with varied populations are necessary to address issues including employment displacement, privacy, and equity. In light of these revelations, the conversation focuses on how crucial it is to engage different stakeholders and collaborate across disciplines in order to successfully navigate the challenges of integrating AI into education. Collaboration between academics, educators, technologists, legislators, and other stakeholders can guarantee alignment with society values, ethical norms, and educational goals.

Alneyadi and Wardat (2023) stated that socio cultural issues are important in the incorporation of AI into the educational sector. Fostering an environment of transparency, cooperation, and trust is crucial to persuading educators, students, and other stakeholders to embrace and utilize AI technologies. Furthermore, in order to address issues like employment displacement, privacy, and equity, proactive involvement and communication with diverse communities are required. The discussion is on how important it is to work with many stakeholders and across disciplines in order to successfully traverse the hurdles of incorporating AI into education in light of these revelations. Alignment with society values, ethical norms, and educational goals can be ensured by collaboration between academics, educators, legislators, technologists, and other stakeholders.

4.2 Interpretation of Data

The quantity of completed and returned questionnaire copies by the respondents serves as the basis for the statistics. The chi-square test is used for analysis, and the data are displayed in tables.

4.2.1 Data Presentation and Analysis

The data presented below were gathered during field work:

4.2.2 Tables based on research questions

Table 1: Artificial intelligence has made life easier for man

	Frequency	Percent	Valid Percent	Cumulative Percent	Mean
Strongly Agree	62	62.0	62.0	62.0	83.0
Agree	18	18.0	18.0	80.0	
Disagree	10	10.0	10.0	90.0	
Strongly disagree	10	10.0	10.0	100.0	
Total	100	100.0	100.0		

Table 1 displays the respondents' opinions regarding how artificial intelligence has facilitated human life. It is strongly agreed upon by 62 respondents, or 62.0 percent, that artificial intelligence has made life easier for humans. Eighteen respondents, or 18.0% of the sample, concur that artificial intelligence has made life easier for humans. Five (5) respondents, or 5.0% of the sample, were unsure. It is disputed by 10 respondents, or 10.0 percent, that artificial intelligence has made life easier for people.

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In strong disagreement with the statement that artificial intelligence has made life easier for humans are 10 respondents, or 10.0 percent, with the mean of 83.0 %

Table 2: Artificial intelligence has more merits than demerits

	Frequency	Percent	Valid Percent	Cumulative Percent	Mean
Strongly Agree	50	50.0	50.0	50.0	
Agree	20	20.0	20.0	70.0	
Disagree	20	20.0	20.0	90.0	77.5
Strongly Disagree	10	10.0	10.0	100.0	
Total	100	100.0	100.0		

Table 2 shows the responses of respondents' opinions that artificial intelligence has more benefits than drawbacks are displayed in Table 2.

50 out of the respondents, or 50.0 percent, strongly concur that there are more benefits of artificial intelligence than drawbacks. Fifteen respondents, or 15.0 percent, concur that there are more benefits than drawbacks to artificial intelligence. Twenty respondents, or 20.0% of the sample, were unsure. Twenty respondents, or 20.0 percent, disagree that there are more benefits than drawbacks to artificial intelligence. 10 respondents, or 10.0 percent, strongly disagree that there are more benefits of artificial intelligence than drawbacks, with a mean of 77.5%.

Table 3: **Artificial intelligence has helped to encourage educators that AI learning tools is a supportive machine learning for students' academic achievement**

Frequency	Percent	Valid Percent	Cumulative Percent	Mean
42	42.0	42.0	42.0	
38	38.0	38.0	80.0	237.0
10	10.0	10.0	90.0	
10	10.0	10.0	100.0	
100	100.0	100.0		

Table 3 displays the respondents' opinions regarding how artificial intelligence served as a supportive machine learning in enhancing students' academic performance. 42 respondents strongly concur that students' academic performance in Ibeju-Lekki area has increased as a result of AI . 38 respondents also agreed that AI incorporation has helped to boost the academic performance of the students, 10 respondents disagree that AI has helped to increased students performance. 10 respondents of the respondents strongly disagree that student academic performance has improved as a result of AI, while the mean cumulative is 237.0%

Table 4: Lack of adequate Artificial Intelligence tools for teaching and learning may adversely affect the education and development

	Frequency	Percent	Valid Percent	Cumulative Percent	Mean
Strongly Agree	40	40.0	40.0	40.0	
Agree	35	35.0	35.0	75.0	76.25%
Disagree	15	15.0	15.0	90.0	
Strongly Disagree	10	10.0	10.0	100.0	
Total	100	100.0	100.0		

The replies of respondents who did not have enough artificial intelligence tools usage are displayed in Table 4, which could have a negative impact on education. A majority of 40 respondents, or 40.0%, strongly concur that the education could be negatively impacted by insufficient artificial intelligence tools and usage. A total of 35 respondents, or 35.0%, concur that the nation education could suffer from a lack of artificial intelligence tools. Fifteen respondents, or 15.0 per cent, disagree that the education would suffer from a lack of artificial intelligence tools. Ten respondents, or 10.0 per cent, strongly believe that the education would suffer from a lack of artificial intelligence tools for teaching and learning processes in Ibeju-Lekki area of Lagos State. Also, the mean is 76.25%

	Artificial Intelligent benefits human life
Chi square	111.900[a]
Df	4
Assymp. Sig.	.000

Based on the decision rule, the p-value (0.000) is less than the level of significance (0.05), we reject the null hypothesis and conclude that artificial intelligence improves human existence in every aspect, including societal advancement, employment creation, and education.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study's goal was to determine whether artificial intelligence is advantageous to people. The study's conclusions showed that artificial intelligence is advantageous to humanity. Man's life has become easier thanks to artificial intelligence. There are more benefits of artificial intelligence than drawbacks. Over time, artificial intelligence has advanced or changed. Artificial intelligence is mostly responsible for Nigeria's development. Nigeria's output and productivity have increased thanks in part to artificial intelligence. The education of the country would suffer if artificial intelligence tools were not developed properly.

Learning is not the only goal of education. Education is a multifaceted process that teaches us how to use our social skills to apply the principles we learn in the classroom to our everyday lives. Empathy, sympathy, and other feelings that are crucial to the formation of our personalities cannot be taught by machines. This implies that the function of

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teachers and educators will not be able to be replaced by AI, regardless of how advanced it is or how many examples it has been used in.

AI's function is restricted to supporting and enabling educators in creating an enjoyable learning environment for their students. Technology is also frequently utilized to support learning, whether it be for independent study or in classroom settings. Artificial intelligence will be used increasingly in learning activities in the future. AI can be used to deliver educational materials, carry out tests, and offer feedback on what students have learned. Artificial intelligence has been widely integrated into a number of technological platforms for teaching.

Even with these encouraging instances of AI applications, there are certain aspects of AI that may be seen negatively, particularly in the field of education. Artificial intelligence restricts interpersonal communication, social skill development, and connection formation. Because AI requires internet connectivity to function and is somewhat expensive, it might potentially present issues for underdeveloped nations.

AI solutions can increase the learning process's reliance on infrastructure and computer systems, which increases its vulnerability to cyber attacks and other technical issues. It's also said that AI technology is spurring the development of new plagiarism techniques. This tool can modify conjunctions; paraphrase the original material, and more without altering its meaning thanks to increasingly advanced AI algorithms. in order for this copied text to resemble the original.

AI has numerous advantages for both educators and learners. First, from the perspective of the student, learning can happen whenever they want, even though physically travelling to class takes time. AI-based apps provide you the option to study for ten or fifteen minutes during your free time without having to go to class. Additionally, tutors or instructors can provide immediate feedback to pupils. Artificial intelligence (AI) solutions are capable of adjusting to the knowledge level, interests, and other factors of the student. AI-powered tools will typically support pupils in their areas of weakness. It provides educational resources according to its shortcomings. Before using the app, for instance, pupils take a test. The app then analyzes their results and assigns the proper homework and courses. Online mentors/Virtual mentors are available on the AI-powered platform to monitor students' development. Even while only "human" professors are truly capable of comprehending students' needs, it is nonetheless beneficial to receive immediate feedback from a virtual tutor.

AI can be used to detect exceptional talent or pinpoint pupils' areas of difficulty in learning. AI systems use technology to deliver individualized, technology-based learning that will help students become more independent and enhance their overall learning process. Focusing on individual systems in AI learning can help students study more effectively. In order to later make adjustments and create new ways to support student learning, AI can recognize ideas such as those that students don't comprehend. Artificial intelligence can therefore be used to examine the best methods of instructing students.

AI is proving to be highly helpful in education, especially in the current pandemic scenario when learning must now take place online. In order to continue learning and to make it easier for teachers and students to communicate, traditional learning activities have been replaced with online ones. It is anticipated that education will improve and be able to change with the times as a result of AI.

Artificial intelligence specifically can work with natural intelligence to form an ideal totality. As science and technology advance, teaching tasks like correcting, monitoring student attendance, assigning daily assignments and examinations, disseminating knowledge, creating administrative reports, and other systemic labour may be turned over to technological equipment to finish. In situations where machines cannot, teachers can produce a golden generation with greater character and quality and natural intelligence by using less energy and concentrating more on non-systemic activities.

5.2 Conclusion

Artificial intelligence demonstrates intelligence in some form by introducing systems that are capable of learning new ideas and tasks, reasoning, and making meaningful inferences about their environment. The topic of artificial intelligence study is extremely specialized and technical, with numerous subfields that frequently don't interact with one another. Social and cultural reasons have contributed to some of the division: subfields have developed around certain institutions and the work of individual researchers. Reasoning, knowledge, planning, learning, natural language

processing (communication), perception, and the capacity to move and manipulate objects are among the main issues (or objectives) of artificial intelligence research.

5.3 **Recommendations**

As a result, stakeholders in a variety of industries, including health, finance, education, security, engineering, manufacturing, research, and technology, will benefit greatly from this study effort in understanding how artificial intelligence can be applied to improve the productivity and efficacy of these industries. The results of this study will also benefit the public who is interested in learning about the potential benefits and drawbacks (if any) of using artificial intelligence, as well as educators, students, and other academics who utilize the research as a reference.

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PAPER 5 - TRANSFORMER-BASED INTRUSION DETECTION SYSTEM IN IOT DEVICES

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ABSTRACT

The rapid growth of Internet of Things (IoT) devices has brought many benefits to areas like smart homes and industrial automation. However, this expansion also makes these systems more vulnerable to cyber-attacks, highlighting the need for strong intrusion detection systems. The proposed model introduces an optimized method for detecting intrusions in IoT networks using a transformer-based model, which is known for its high performance in various machine-learning tasks. This model was validated using the BoT-IoT Network Intrusion dataset, which includes many IoT network traffic scenarios. The Synthetic Minority Oversampling technique (SMOTE) was employed to balance the imbalanced dataset. We also applied Fisher's score to improve efficiency to select the most important features. The Transformer-based model, which uses a self-attention mechanism, was then used to classify network traffic as either normal or malicious. Our results show that this approach is highly effective, achieving higher accuracy, precision, recall, F1 score, and an Area Under the Receiver Operating Characteristic Curve (AUC). These scores indicate that our model can accurately detect and classify intrusions with very few or no errors compared to any deep learning implementations.

KEYWORDS: **Transformer, Fisher's Score, SMOTE, IoT, IDS**

1. INTRODUCTION

The security-related threats and vulnerabilities rise as the number of connected devices on IoT increases. The IoT nodes create dynamic topology and perform their tasks without human intervention, so handling the security issues in IoT becomes more complex. IoT's privacy and security challenges become more troublesome with limited resources. Moreover, the enormous growth and adoption of IoT devices in all aspects of human life indicate the necessity of considering these security threats before the implementation of the countermeasures. The security market from 2023 to 2028 is given in Figure 1.

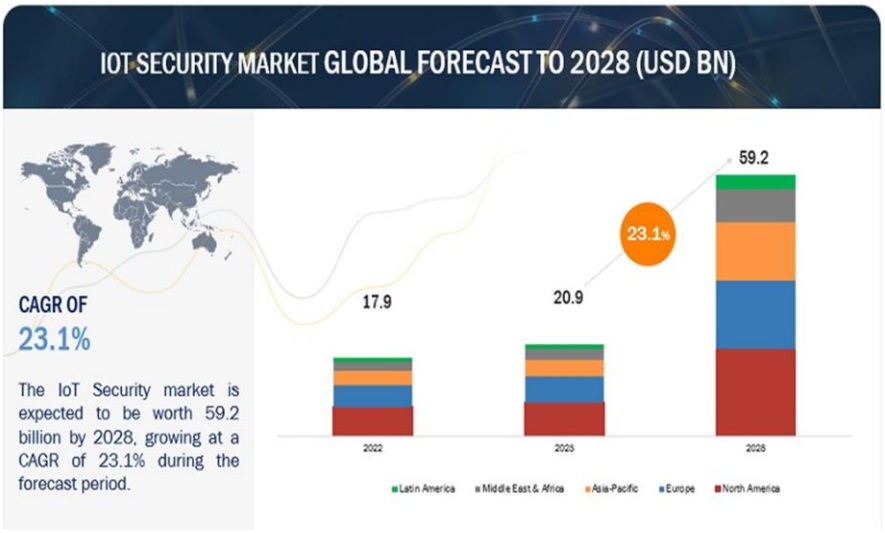


Figure 1: IoT Security Market (2023-2028) marketsandmarkets.com

MarketsandMarkets forecasts the global IoT Security size to grow from USD 20.9 billion in 2023 to USD 59.2 billion by 2028 at a compound Annual Growth Rate (CAGR) of 23.1% during the forecast period. The growth is fueled by a rapid increase in the number of industries 4.0 IoT security incidents stressing the need to strengthen cyber resilience, IoT vulnerabilities opening up new possibilities to hackers, a growing number of IoT security regulations, and rising security concerns for critical infrastructure.

An Intrusion Detection System (IDS) is a security mechanism designed to protect a system by alerting administrators of security breaches and taking measures to block intruders (Axelsson, 2019).

IDS can be categorized into three primary types:

c. Host-based IDS (HIDS), which monitors critical operating system files;

d. Network-based IDS (NIDS), which analyzes network traffic;

e. Hybrid IDS inspects network traffic and operating system files.

IDS can also be divided into two main categories based on their detection approach:

4 Signature-based IDS, which identifies malicious patterns;

5 Anomaly-based IDS detects deviations from normal behaviour. These methods often utilise machine or deep learning techniques (Bace and Mell, 2020).

Most IDS can be defined by three core functional components: These components are described in Figure 2.

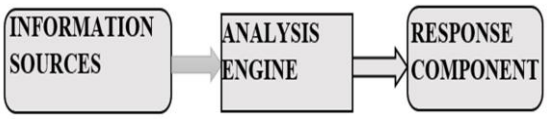


Figure 2: Three core components of IDS

- Information Sources: These are the origins of event data, such as incoming packets or system logs, used to detect intrusions.
- Analysis Engine: This critical component determines whether the collected events signify an intrusion. Common analysis methods include misuse detection and anomaly detection.
- Response Component: The system initiates a response when an intrusion is detected. Responses can be either active, where the system autonomously takes action, or passive, whichgenerates reports for administrators to review and act upon based on the findings.

The Internet of Things (IoT) refers to the interconnected network of physical devices, such as home appliances, industrial machines, and wearable technology, that communicate and exchange data over the Internet. These devices make our lives easier and more efficient by automating tasks and providing real-time information. However, as the number of IoT devices grows, so does the potential for security threats. Cyber-attacks on IoT devices can lead to significant issues, such as data breaches, loss of privacy, and even physical harm in some cases. This is where Intrusion Detection Systems (IDS) come into play (Khraisat and Alazab, 2021). IoT applications span healthcare, logistics, smart cities, smart homes, and agriculture. However, due to its limited resources, IoT is prone to vulnerabilities that attackers can easily exploit. The number of unsecured IoT devices connected to the global network is increasing rapidly (Colakovi and Hadziali, 2018).

Several researchers have focused on utilizing deep learning techniques for IDS in IoT environments. These approaches generally aim to improve detection accuracy and reduce false positive rates. For instance, Yazan et al. (2019) employed the Spider Monkey Optimization (SMO) algorithm and a stacked-deep polynomial network (SDPN) for detecting various types of attacks in IoT environments. Similarly, Cristiano et al. (2020) introduced a hybrid DNN-kNN model, which combines deep neural networks with k-nearest Neighbor (kNN) for binary classification of network records. The focus of these studies is on leveraging deep learning architectures to enhance intrusion detection in IoT systems.

Feature selection is a critical aspect of improving IDS efficiency by reducing the dimensionality of input data and focusing on the most relevant features. Daming et al. (2019) proposed a feature extraction method that combines feature selection with deep learning algorithms, aiming to enhance both accuracy and time efficiency. In a similar vein, Riyaz and Sannasi (2020) developed an incremental feature selection algorithm incorporating Conditional Random Fields (CRF) and Linear Correlation Coefficient-aware feature selection methods, which was used alongside Convolutional Neural Networks (CNN) for classifying network records.

Hybrid IDS approaches combine multiple methods, such as rule-based and machine learning-based techniques, to improve detection capabilities. Kelton et al. (2019) reviewed a variety of IDSs based on machine learning algorithms for IoT, discussing their respective merits and demerits. Fal et al. (2020) developed a hybrid IDS that integrates rule-based attack detection with machine learning-based anomaly detection, thereby enhancing the system's ability to identify new and unknown attacks.

DoS and DDoS attacks are significant threats in IoT environments. Some studies have specifically targeted these types of attacks using specialized defence mechanisms. Yizhen et al. (2020) introduced a Distributed DoS defence mechanism using classification algorithms, including CNN and LSTM, evaluated with the CICDDoS2019 dataset. This category highlights the importance of developing strong mechanisms to defend against large-scale, distributed attacks in IoT networks.

The existing body of research on IoT IDS is rich with innovations, particularly in using deep learning and hybrid approaches for improved detection capabilities. However, there are still gaps in terms of optimizing feature selection techniques and further reducing detection delay, especially in IoT environments with

limited resources. The existing methods of feature selection are outdated and inefficient. This study proposes Fisher's Score feature selection technique, to reduce the input dataset size by identifying the most significant features accurately. Additionally, a Transformer model is applied for efficient and effective record classification

1.1. Statement of the Problem

The increasing deployment of IoT devices has led to a surge in security breaches, posing significant risks to privacy, data integrity, and system functionality. Traditional IDS approaches may not be well-suited to IoT environments due to their dynamics and resource limitations. Machine learning approaches have recorded remarkable successes in IoT intrusion detection; nevertheless, the literature suggests that more research efforts are still needed to address the following gaps in the approach:

- Time-Consuming in Feature Selection: Identifying effective features for training machine learning algorithms is highly time-consuming during data processing.
- High Dimensionality: Extracting a large number of features can overwhelm the system and complicate the detection process.
- Imbalanced Data: Machine learning models struggle with imbalanced datasets, making it difficult to accurately detect specific attacks.

Related Work

Intrusion detection has been studied for over 25 years, with the RAID (Recent Advances in Intrusion Detection) workshop being one of the first dedicated events, held in 1998. Network Intrusion Detection Systems (NIDS) for IoT are software- or hardware-based systems designed to spot potential security threats like hacking, malware, or other malicious activities. Machine learning algorithms have improved IoT NIDS by automatically learning normal behaviour patterns and spotting deviations that might indicate an attack (Tahsien *et al.,* 2020).

Traditional NIDS often rely on signature-based methods, which detect known attack patterns by matching incoming data with predefined attack signatures (Masdari *et al.,* 2020). However, this method can have trouble detecting new or unknown attacks. Another approach is anomaly detection, which compares incoming data to a baseline of normal behaviour to find deviations that may signal an intrusion. The effectiveness of this method can be limited by the quality of the baseline and the accuracy of the deviation detection algorithms (Alsoufi *et al.,* 2021).

Deep learning (DL) has become popular in intrusion detection due to its ability to process large amounts of data and recognize complex patterns (Ferrag *et al.,* 2020). DL algorithms can achieve better accuracy and performance compared to traditional machine learning methods by learning and improving with more data. This has led to the creation of several DL-based NIDS models that have shown promising results in detecting different types of intrusions, such as network attacks, insider threats, and malware.

In 2022, Arp *et al.,* (2020) reviewed the effective and ineffective uses of machine learning in computer security at the USENIX Security Symposium. Advanced ML methods are now used in commercial IDS systems like Darktrace (2022).

Ashiku *et al.,* (2021) developed adaptive and resilient NIDS using deep learning to detect and classify network attacks. Satam *et al.,* (2021) proposed a Wireless Intrusion Detection System (WIDS) that uses anomaly detection to accurately identify Wi-Fi network attackers with few false alarms.

The diverse nature of IoT introduces unique challenges and security concerns that can affect the privacy and safety of smart home users. Various research approaches aim to improve NIDS solutions for this heterogeneous data (Oseni *et al.,* 2023).

Mahadik et al. (2022) proposed advanced NIDS to identify and counteract different types of DDoS attacks in IoT environments. Bertoli et al. (2023) discussed using stacked-unsupervised federated learning (FL) to enhance intrusion detection across diverse networks.

Recently, Transformer-based models have been adopted in intrusion detection systems to enhance both accuracy and efficiency in identifying threats. These models help Network Intrusion Detection Systems (NIDS) learn from past data, allowing them to recognize new and previously unknown threats, making them highly effective against cyber-attacks. Transformers are a type of deep-learning neural network often used in natural language processing tasks like language translation and text classification (Devlin *et al.,* 2019). They are also applied to network traffic generation and classification (Bikmukhamedov *et al.,* 2020), and are gaining traction in image classification and computer vision (Dosovitskiy *et al.,* 2020) due to their accuracy, generalization ability, parallel processing, and transfer learning features.

Wang *et al.,* (2021) combined scalable Transformers with a convolutional neural network (CNN) to detect distributed denial-of-service (DDoS) attacks in Software-Defined Networking (SDN). Wu *et al.,* (2022) proposed a comprehensive Transformer-based intrusion detection system, RTIDS, that uses self-attention to improve network traffic classification. Transformers use self-attention layers that learn from the context of input data. The self-attention mechanism calculates three vectors for each input element: query, key, and value vectors. These vectors

help compute a weighted sum of value vectors, where weights are determined by the dot product of the query and key vectors followed by a softmax function.

Wu *et al.*, (2022) introduced RTIDS, a Transformer-based system that uses positional embeddings to capture sequential information between features. This system employs a stacked Transformer encoder-decoder model, evaluated with the CICDDoS2019 dataset, and compared with various machine learning and deep learning models, including support vector machines (SVM), recurrent neural networks (RNN), fuzzy neural networks (FNN), and long short-term memory (LSTM) networks.

(Li *et al.*, 2022) developed the Extreme Semi-Supervised Framework based on Transformer (ESeT) for network intrusion detection. ESeT uses a small amount of labelled data and features a multi-level feature extraction module and a semi-supervised learning module with a dual-encoding transformer, credibility selector, and feature augmented. Evaluated on two large real-world datasets, ESeT showed improved performance compared to existing methods with limited labelled data.

Wang *et al.*, (2023) proposed a self-supervised network intrusion detection system using a Transformer-based architecture with a masked context reconstruction module. The algorithm was tested on three datasets: KDD, UNSW-NB15, and CICIDS-17, and found to be sensitive to the mask ratio but relatively stable concerning context size.

Nam *et al.*, (2021) introduced a method for detecting spoofing attacks in Controller Area Networks (CAN) using a Transformer-based language model (GPT) trained on normal CAN ID sequences. This method demonstrated better accuracy and efficiency compared to other leading techniques, though it assumes that attackers do not have access to normal CAN ID sequences, which may not always be realistic.

Nguyen & Watabe (2022) improved the domain adaptation of NIDS by using Bidirectional Encoder Representations from Transformers (BERT). This method models feature distributions using flow sequences and enhances detection by employing context information from these sequences. The BERT model is pre-trained with Masked Language Modeling (MLM) and fine-tuned for intrusion detection.

Han *et al.*, (2023) developed a new intrusion detection method for encrypted traffic called GTID, combining n-gram frequency analysis with a time-aware Transformer. This model processes packet header and payload features separately and considers the time intervals between packets. However, its performance varies with the proportion of encrypted traffic and is less effective with smaller payload sizes, while the use of n-grams increases computational complexity.

Hassan *et al.*, (2019) proposed a NIDS that integrates Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) architectures. CNN layers efficiently extract significant features from network data, while LSTM maintains long-term relationships between these features. The system achieved high classification accuracy (97.1% for binary and 98.43% for multi-class classification) on the UNSW-NB15 dataset.

Wu *et al.*, (2022), used position embeddings for linking feature sequences but were found ineffective in later studies (Liu & Wu, 2023). Visual Transformer (ViT) used a sliding window for local feature modelling and focal loss for data imbalance (Yang *et al.*, 2022), though it did not fully address data imbalance (Liu & Wu, 2023). CNN-Transformer, a fusion of CNN and Transformer, captures both local and global information (Zhang & Wang, 2022). Transformer-based transfer learning combined with CNN-LSTM.

2.1 Summary of Related Work

Based on the related literature survey of various approaches in IDS, it is concluded that:

- Intrusion detection has over 25 years of research history, with significant milestones such as the RAID workshop in 1998, indicating a mature field with a rich background of knowledge and advancements.
- Modern IDS systems, especially for IoT, benefit from machine learning and deep learning algorithms, which can learn normal behaviour patterns and detect deviations, improving accuracy and performance.
- Deep learning-based NIDS models can handle large datasets and perform complex pattern recognition, leading to better detection of various intrusions, including network attacks and malware.
- Recent advances include Transformer-based models, which have shown improved accuracy and efficiency in threat detection through learning from past data and identifying new threats.
- Various novel approaches, such as stacked-unsupervised federated learning, semi-supervised frameworks, and combined architectures (e.g., CNN-Transformer), enhance IDS capabilities in handling heterogeneous and complex IoT environments.

Based on the review, it is evident that while most Intrusion Detection System (IDS) methods have reached high accuracy levels, often exceeding 90%, further improvements in the field present significant challenges. To the best of our knowledge, the following challenges remain critical in the development and implementation of IDS:

- Traditional NIDS methods, like signature-based detection, rely on regular updates to detect known attack patterns. Many IoT devices do not receive consistent updates, leaving them vulnerable to new or evolving threats.
- Anomaly detection methods depend on the quality of the baseline of normal behaviour and the accuracy of deviation detection algorithms. Poor baselines can lead to false positives or undetected intrusions.
- Some advanced IDS methods, particularly those combining multiple deep learning techniques (e.g., CNN-LSTM), can have high computational costs, making them less feasible for limited resources IoT devices.
- Techniques such as Visual Transformer (ViT) and hybrid sampling methods attempt to address data imbalance but often do not fully resolve the quantitative imbalance, potentially affecting detection accuracy.

Proposed Model

In recent years, machine learning (ML) and deep learning (DL) techniques have shown promise in enhancing the capabilities of IDS. Among these techniques, the Transformer model, originally designed for natural language processing tasks, has emerged as a powerful tool for sequence modelling and classification tasks. Our proposed Transformer-based IDS, as shown in Figure 3, was evaluated through two major experiments. The first experiment involved employing Fisher's Score Algorithm for feature selection, while the second experiment will focus on using SMOTE techniques to balance our dataset.

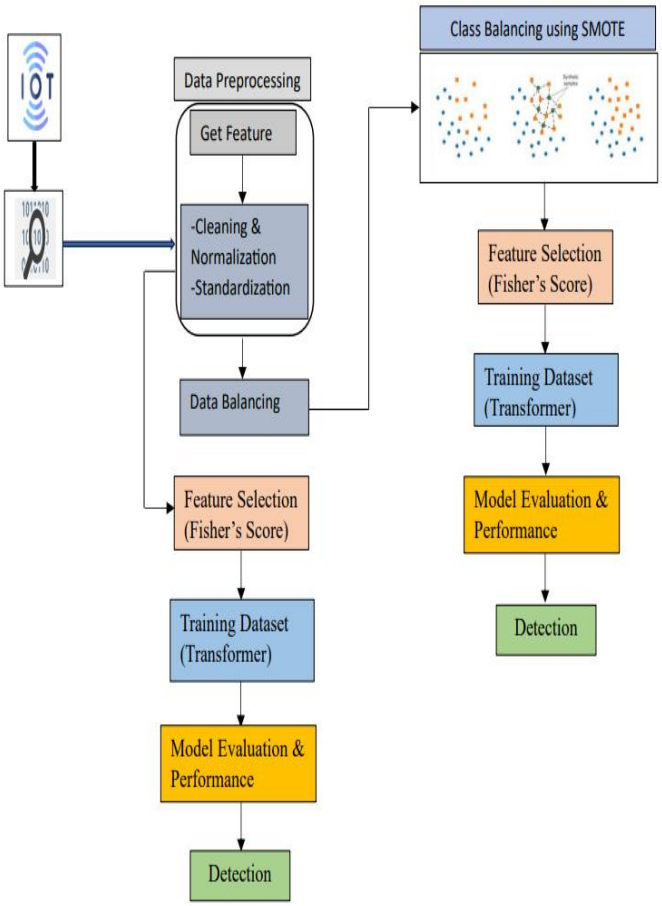


Figure 3: Proposed Model Architecture

A. Data Collection

The raw data used was collected from Bot-IoT Dataset - OneDrive (sharepoint.com), (BoT-IoT 2018) datasets repository. The raw network packets (Pcap files) of the BoT-IoT dataset were generated using the shark tool in the Cyber Range Lab of the Australian Center for Cyber Security (ACCS). This dataset includes both normal and abnormal traffic. Simulated network traffic was produced using the Ostinato tool for non-IoT traffic and Node-RED for IoT traffic. The dataset's source files are available in multiple formats, including the original Pcap files, Argus files, and CSV format. To facilitate the labelling process, the files were organized based on attack category and subcategory, to better assist in the labelling process.

B. Data Pre-Processing

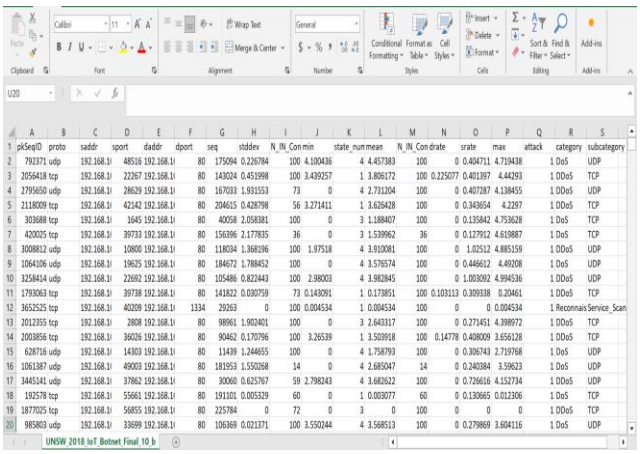
Data preprocessing: statistically analyzed the data for duplicates and nan values. We converted categorical columns to numerical features so they could be processed by the detection algorithm and we normalized the data. The steps involved in the data preprocessing are shown in Table 1.

Table 1: Attack Category and Sub-category

Category	Subcategory
DDOS	UDP
DDOS	TCP
DDOS	TCP
DOS	UDP
DDOS	UDP

C. Collection of Raw Network Packets

The captured pcap files amount to 69.3 GB, containing over 72,000,000 records. The extracted flow traffic, converted to CSV format, is 16.7 GB in size. The dataset encompasses various types of attacks, including DDoS, DoS, OS and Service Scans, Keylogging, and Data Exfiltration. The DDoS and DoS attacks are further categorized based on the protocol used. To facilitate dataset management, 5% of the original dataset was extracted using specific MySQL queries. This subset consists of 4 files, totalling approximately 1.07 GB and containing around 3 million records. The raw feature set values are shown in Figure 4.



pkSeqID	proto	saddr	sport	daddr	dport	seq	stddev	N_IN_Con	min	state_num	mean	N_IN_Con	drate	srate	max	attack	category	subcategory
792371	udp	192.168.1	48516	192.168.1	80	175094	0.226784	100	4.100436	4	4.457383	100	0	0.404711	4.719438	1	DoS	UDP
2056418	tcp	192.168.1	22267	192.168.1	80	143024	0.451998	100	3.439257	1	3.806172	100	0.225077	0.401397	4.44293	1	DDoS	TCP
2795650	udp	192.168.1	28629	192.168.1	80	167033	1.931553	73	0	4	2.731204	100	0	0.407287	4.138455	1	DDoS	UDP
2118009	tcp	192.168.1	42142	192.168.1	80	204615	0.428798	56	3.271411	1	3.626428	100	0	0.343654	4.2297	1	DDoS	TCP
303688	tcp	192.168.1	1645	192.168.1	80	40058	2.058381	100	0	3	1.188407	100	0	0.135842	4.753628	1	DoS	TCP
420025	tcp	192.168.1	39733	192.168.1	80	156396	2.177835	36	0	3	1.539962	36	0	0.127912	4.619887	1	DoS	TCP
3008812	udp	192.168.1	10800	192.168.1	80	118034	1.368196	100	1.97518	4	3.910081	100	0	1.02512	4.885159	1	DDoS	UDP
1064106	udp	192.168.1	19625	192.168.1	80	184672	1.788452	100	0	4	3.576574	100	0	0.446612	4.49208	1	DoS	UDP
3258414	udp	192.168.1	22692	192.168.1	80	105486	0.822443	100	2.98003	4	3.982845	100	0	1.003092	4.994536	1	DDoS	UDP
1793063	tcp	192.168.1	39738	192.168.1	80	141822	0.030759	73	0.143091	1	0.173851	100	0.103113	0.309338	0.20461	1	DDoS	TCP
3652525	tcp	192.168.1	40209	192.168.1	1334	29263	0	100	0.004534	1	0.004534	100	0	0	0.004534	1	Reconnais	Service_Scan
2012355	tcp	192.168.1	2808	192.168.1	80	98961	1.902401	100	0	3	2.643317	100	0	0.271451	4.398972	1	DDoS	TCP
2003856	tcp	192.168.1	36026	192.168.1	80	90462	0.170796	100	3.26539	1	3.503918	100	0.14778	0.408009	3.656128	1	DDoS	TCP
628716	udp	192.168.1	14303	192.168.1	80	11439	1.244655	100	0	4	1.758793	100	0	0.306743	2.719768	1	DoS	UDP
1061387	udp	192.168.1	49003	192.168.1	80	181953	1.550268	14	0	4	2.685047	14	0	0.240384	3.59623	1	DoS	UDP
3445141	udp	192.168.1	37862	192.168.1	80	30060	0.625767	59	2.798243	4	3.682622	100	0	0.726616	4.152734	1	DDoS	UDP
192578	tcp	192.168.1	55661	192.168.1	80	191101	0.005329	60	0	1	0.003077	60	0	0.130665	0.012306	1	DoS	TCP
1877025	tcp	192.168.1	56855	192.168.1	80	225784	0	72	0	3	0	100	0	0	0	1	DDoS	TCP
985803	udp	192.168.1	33699	192.168.1	80	106369	0.021371	100	3.550244	4	3.568513	100	0	0.279869	3.604116	1	DoS	UDP

Figure 4: BoT-IoT 2018 Raw Features Set Values

D. Fisher's Score for Feature Selection

Fisher's score is a feature selection method used to evaluate the importance of features in a dataset based on their discriminative power. It measures how well a feature separates different classes by comparing the variance between classes to the variance within classes.

Given a dataset with n samples, m features, and C classes:

i. Mean and Variance for Each Class:

$$\mu_{i,c} = \frac{1}{N_C}\sum_{x \in X_{i,c}} x,\ \sigma^{i}_{i,C} = \frac{1}{N_C}\sum_{x \in X_{i,c}}(x - \mu_{i,c})^2$$

Where N_c is the number of samples in class C, and $X_{i,c}$ *are the values of the* features i and class C.

ii. Overall Mean for Each Feature:

$$\mu_i = \frac{1}{n}\sum_{j=1} x_{i,j}$$

iii. Fisher's Score for Each Feature:

$$F_i = \frac{\sum_{c-1}^{C} N_c(\mu_{i,c} - \mu_i)^2}{\sum_{c-1}^{C} N_c \sigma^2_{i,C}}$$

Where $\mu_{i,c}$ and $\sigma^2_{i,C}$ are the mean and variance of features i in class C, and μ_i is the overall mean of feature i.

```
// Pseudocode to compute Fisher's Score for a given feature

Input:
   - X: a dataset with n samples and m features
   - y: class labels corresponding to each sample
   - feature_index: index of the feature for which Fisher's Score is to be calculated

Output:
   - FisherScore: Fisher's Score for the specified feature

Function CalculateFisherScore(X, y, feature_index):
   Initialize num_classes = number of unique classes in y
   Initialize overall_mean = mean of X[:, feature_index]

   Initialize between_class_variance = 0
   Initialize within_class_variance = 0

   For each class in unique(y):
      class_samples = all samples in X where y == class
      class_mean = mean of class_samples[:, feature_index]
      class_variance = variance of class_samples[:, feature_index]
      class_size = number of samples in class_samples

      // Calculate between-class variance
      between_class_variance += class_size * (class_mean - overall_mean)^2

      // Calculate within-class variance
      within_class_variance += class_size * class_variance

   // Calculate Fisher's Score
   If within_class_variance == 0:
      Return 0
   Else:
      FisherScore = between_class_variance / within_class_variance
      Return FisherScore

// Example usage:
fisher_score = CalculateFisherScore(X, y, feature_index)
```

Figure 5: Pseudo Code for Fisher's Score Feature selections

E. Classification Using Transformer Model

Transformers are a deep learning model that has revolutionised natural language processing (NLP) and other fields. Due to their ability to model long-range dependencies and their effectiveness in handling sequential data, the transformer model performs better when used to test intrusion behaviour. Here's an outline of the algorithm for using a Transformer for classification, along with the mathematical representation of key components.

1. Input Representation: Each word in a sentence is converted into a vector using an embedding layer. This vector captures the meaning of the word in a high-dimensional space.
2. Self-Attention Mechanism: The core of the Transformer model is the self-attention mechanism, which allows the model to weigh the importance of different words in a sentence relative to each other.
The self-attention mechanism can be described with the following equations:

i. Query, Key, and Value Matrices

$Q = XW_Q$, $K = XW_K$, $V = XW_V$
Where (X) is the input matrix, and (W_Q), (W_K), and (W_V) are weight matrices.

ii. Attention Score

Attention (Q, K, V) = softmax $\left(\frac{QK^T}{\sqrt{d_k}}\ V\right)$
Where (d_k) is the dimension of the key vectors.
3. Multi-Head Attention: Instead of performing a single attention function, the Transformer uses multiple attention heads to capture different aspects of the relationships between words.

MultiHead (Q, K, V) = Concat($head_1$, …, $head_h$)W_0
Each head is computed as:

```
    # Masked self-attention
    self_attn_output = MultiHeadAttention(x, x, x, h)
    x = LayerNorm(x + self_attn_output)
    # Cross-attention with encoder output
    cross_attn_output = MultiHeadAttention(x, encoder_output,
encoder_output, h)
    x = LayerNorm(x + cross_attn_output)
    # Feedforward
    ff_output = FeedForward(x)
    return LayerNorm(x + ff_output)

# Encoder
def Encoder(input_sequence):
    x = Embed(input_sequence)
    for i in range(N):
        x = EncoderLayer(x)
    return x

# Decoder
def Decoder(target_sequence, encoder_output):
    x = Embed(target_sequence)
    for i in range(N):
        x = DecoderLayer(x, encoder_output)
    return x

# Transformer model
def Transformer(input_sequence, target_sequence):
    encoder_output = Encoder(input_sequence)
    decoder_output = Decoder(target_sequence, encoder_output)
    return Linear(decoder_output, output_vocab_size)

# Inference
def Inference(input_sequence):
    # Assuming a start token for target_sequence
    target_sequence = [start_token]
    for i in range(max_seq_len):
        output = Transformer(input_sequence, target_sequence)
        next_token = ArgMax(output)
        target_sequence.append(next_token)
        if next_token == end_token:
            break
    return target_sequence
```

$Head_i = Attention\ (QW_{Qi}, KW_{Ki}, VW_{Vi})$

4. Feed-Forward Neural Network: After the multi-head attention, the output is passed through a feed-forward neural network.
$FFN(x) = \max(0, xW_1 + b_1)\ W_2 + b_2$
5. Layer Normalization and Residual Connections: To stabilize training, layer normalization and residual connection are used.
LayerNorm (x + Sublayer(x))
6. Positional Encoding: Since Transformers do not inherently understand the order of words, positional encodings are added to the input embeddings to provide information about the position of each word in the sequence.

$PE_{(pos,\ 2i)} = \sin\left(\frac{pos}{10000^{2t/d_{model}}}\right)$

$PE_{(pos,\ 2i+1)} = \cos\left(\frac{pos}{10000^{2t/d_{model}}}\right)$

```
# Define Transformer model parameters
N = Number of encoder/decoder layers
d_model = Dimension of the model
h = Number of attention heads
d_ff = Dimension of feedforward layer
input_vocab_size = Size of the input vocabulary
output_vocab_size = Size of the output vocabulary
max_seq_len = Maximum sequence length

# Input embeddings
def Embed(input_sequence):
    return EmbeddingLookup(input_sequence, input_vocab_size, d_model) +
PositionalEncoding(max_seq_len, d_model)

# Multi-head attention mechanism
def MultiHeadAttention(Q, K, V, h):
    heads = []
    for i in range(h):
        W_Q = Linear(Q, d_model // h)
        W_K = Linear(K, d_model // h)
        W_V = Linear(V, d_model // h)
        head = ScaledDotProductAttention(W_Q, W_K, W_V)
        heads.append(head)
    return Concatenate(heads) # Concatenate all heads

# Feedforward network
def FeedForward(x):
    return Linear(ReLU(Linear(x, d_ff)), d_model)

# Layer normalization
def LayerNorm(x):
    return Normalize(x)

# Encoder layer
def EncoderLayer(x):
    # Self-attention
    attn_output = MultiHeadAttention(x, x, x, h)
    # Add & Norm
    x = LayerNorm(x + attn_output)
    # Feedforward
    ff_output = FeedForward(x)
    # Add & Norm
    return LayerNorm(x + ff_output)

# Decoder layer
def DecoderLayer(x, encoder_output):
```

Figure 6: Pseudo Code for Transformer Model

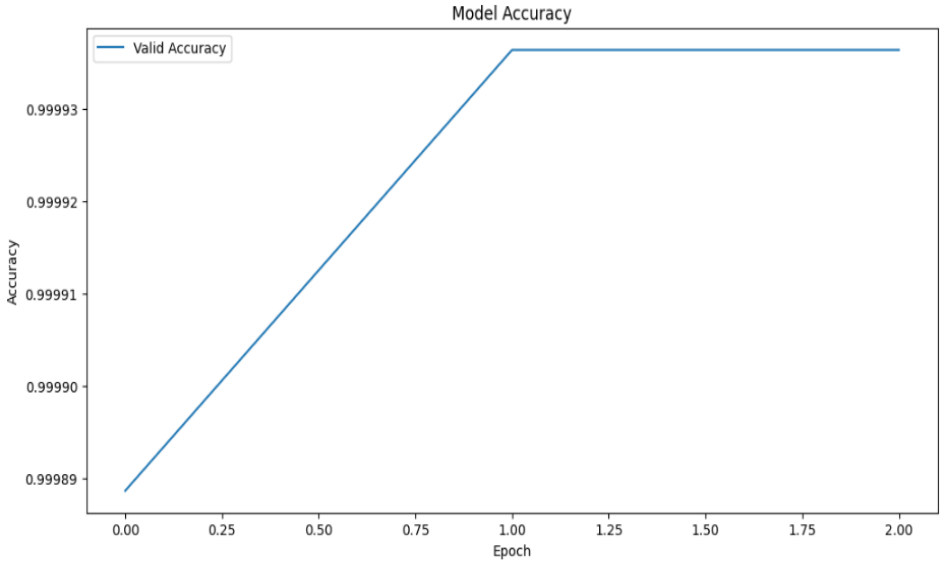


Figure 7: Validation accuracy

RESULTS AND DISCUSSION

A. Evaluation of Result

The proposed model's accuracy and loss were measured for both the training and validation sets at each epoch. This enables us to assess if the model has been adequately trained to detect various types of anomalies. The performance of the Transformer model is assessed using metrics such as accuracy, precision, recall, and F1 score. Accuracy measures the ratio of correctly identified instances to the total number of instances. Precision is the ratio of true positive (TP) instances to the sum of true positive and false positive (FP) instances. Recall is calculated by dividing the number of true positive instances by the sum of true positive and false negative (FN) instances. The F1 score is the harmonic mean of precision and recall. A higher F1 score signifies strong precision and recall.

$$\text{Accuracy} = \frac{(\text{TP} + \text{TN})}{(\text{TP}+\text{FP}+\text{TN}+\text{FN})} \quad (1)$$

$$\text{Precision} = \frac{\text{TP}}{(\text{TP}+\text{FP})} \quad (2)$$

$$\text{Recall} = \frac{\text{TP}}{(\text{TP}+\text{FN})} \quad (3)$$

$$\text{F1 Score} = 2 \times \frac{(\text{Precision} \times \text{Recall})}{(\text{Precision}+\text{Recall})} \quad (4)$$

Table 2: Confusion Matrix Indices

True positive (TP): this is when anomalous items are correctly identified as anomalous.
True negative (TN): this occurs when normal elements are correctly identified as normal.
False positive (FP): This occurs when normal activities are mistakenly identified as anomalies when no attack has happened.

A false negative (FN) occurs when the system mistakenly identifies an attack as normal activity. This means the intrusion detection system (IDS) fails to recognize a real threat.

B. Experiment I: Training BoT-IoT Dataset with Transformer and Fisher's Score

This experiment was conducted using Fisher's score for feature selection and the Transformer model for classification. The number of epochs we trained for, was three. Figures 7 and 8 show the validation accuracy and validation loss, while Figure 9 represents the Confusion Matrix.

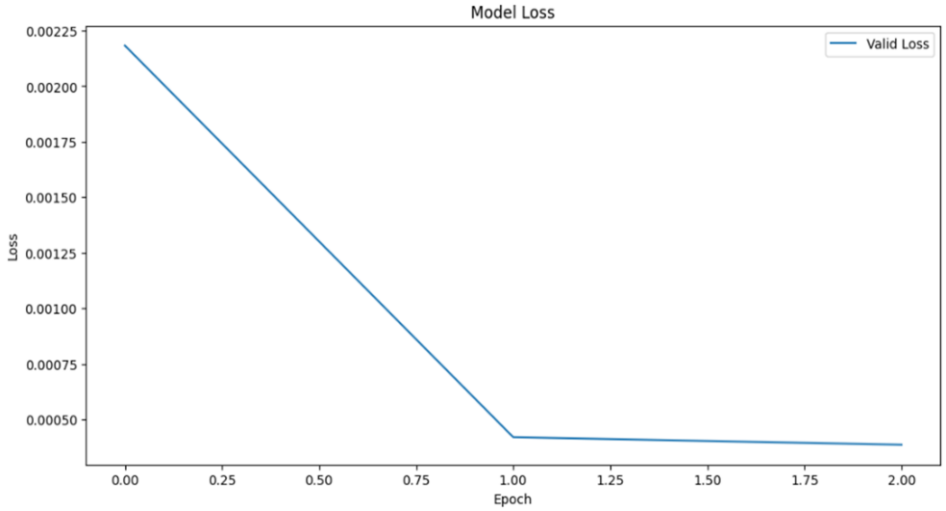


Figure 8: Validation loss

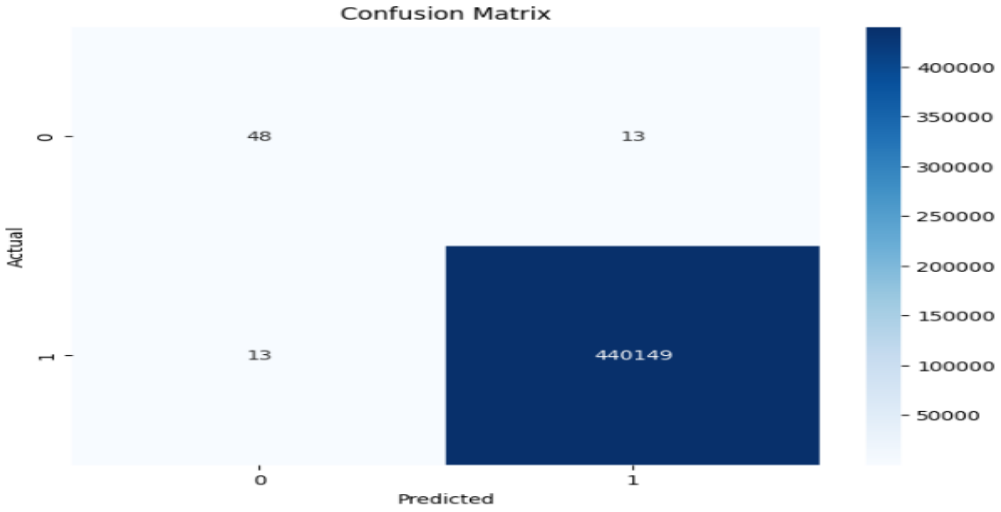


Figure 9: Confusion Matrix

	Precision	Recall	F1-Score	Support
0	0.79	0.79	0.79	61
1	1.00	1.00	1.00	440,162
Accuracy			1.00	440,223
Macro Avg	0.89	0.89	0.89	440,223
Weighted Avg	1.00	1.00	1.00	440,223

Table 3: Classification Report

Article	Model	Accuracy (%)	Precision (%)	Recall (%)	F1 Score
Hassan., *et al* (2020)	CNN	94.54	95.65	90.74	93.00
Li., *et al* (2020)	CNN	86.95	89.56	87.25	88.41
Khamis, *et al* (2020)	ANN	96.00	95.00	100.00	99.00
Kishore., *et al* (2020)	DNN	92.70	99.90	91.20	95.40
Ge., *et al* (2020)	FFN	98.07	99.03	99.03	99.03
Yin., *et al* (2020)	LSTM	99.62	98.78	97.20	97.98
Proposed model	Transformer	99.99	100.00	100.00	99.99

Table 4: Classification Report Summary

Accuracy	Precision	Recall	F1 Score	AUC
0.9999	1.0000	1.0000	1.0000	0.9920

Figure 10: Classification comparison

4.4 Discussion of the Result

This section presents the results of the Transformer-based IDS algorithm for detecting anomalies in IoT. The algorithm was developed with the following resources:

- **Platform**: Google Colab (Cloud computing)
- **Programming Language**: Python
- **Python Version**: 3.10.12
- **RAM**: 13GB
- **Disk Storage**: 108GB

The results from both experiments demonstrate the Transformer model's high performance in detecting anomalies within the BoT-IoT dataset. In Experiment I, the model achieved near-perfect precision, recall, and F1 scores, particularly for the majority class (attack instances), as evidenced by the high accuracy (0.9999) and AUC (0.9920). When SMOTE was applied in Experiment II, the model maintained its exceptional performance, achieving perfect scores across all metrics (accuracy, precision, recall, F1 score, and AUC). This indicates that SMOTE effectively balanced the dataset without compromising the model's ability to detect both normal and anomalous activities.

The consistently high performance in experiments II underscores the robustness and efficacy of the Transformer model, especially when enhanced with techniques like Fisher's score for feature selection and SMOTE for data balancing. These results validate the proposed approach for building an effective IoT intrusion detection system.

CONCLUSION

In this thesis, we have developed and evaluated a Transformer-based Intrusion Detection System (IDS) for Internet of Things (IoT) environments using the BoT-IoT dataset. Our approach incorporated several key methodologies, including data collection and preprocessing, feature selection using Fisher's score, and data balancing using the Synthetic Minority Over-sampling Technique (SMOTE). The results of our experiments demonstrate the exceptional performance and robustness of the proposed IDS.

Fisher's score was employed to identify the most relevant features, enhancing the model's ability to distinguish between normal and anomalous traffic. The proposed Transformer model outperformed other models in the literature, such as CNN, ANN, DNN, FFN, and LSTM, achieving a perfect score of 0.99% accuracy.

RECOMMENDATIONS

Given the exceptional performance of the proposed Transformer-based IDS, the following recommendations are made:

- It is recommended that this system be deployed in real-world IoT environments. The ability to accurately detect a wide range of attacks can significantly enhance the security of IoT systems.
- While Fisher's score has proven very effective, exploring other feature selection techniques or combining multiple techniques could further enhance the model's performance.
- Integrating the proposed IDS with existing security frameworks and protocols in IoT environments can provide a comprehensive security solution, addressing known and emerging threats.

- Future research should focus on the scalability of the proposed IDS to handle larger datasets and its adaptability to evolving threat landscapes. Continuous updating and retraining of the model with new data can ensure sustained performance and relevance.

ACKNOWLEDGEMENT

I would like to express my deep gratitude to my supervisors, **Dr. O.A. Hamzat** and **Dr. F.A. Enesi**, for their priceless guidance, support, and encouragement throughout my research. Their expertise, patience, and insightful feedback have been instrumental in shaping this research. I am sincerely grateful for their mentorship and the countless hours they dedicated to helping me achieve this milestone.

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PAPER 6 – A NATURAL LANGUAGE TRANSLATION FROM ENGLISH TO NUPE

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ABSTRACT

This research paper presents a rule-based approach to natural language translation from English to Nupe, a minority language spoken in middle belt region, of Nigeria. The system aims to address the translation needs of Nupe speakers by automatically translating basic English sentences into Nupe. Description, design and implementation of the rule-based translation system was carried out by focusing on the linguistic rules and strategies used to handle the translation process. Evaluation of the system's performance using a set of test sentences was carried out and compared with the existing machine translation systems. The results demonstrated the feasibility and effectiveness of the rule-based approach for translating between English to Nupe language, highlighting its potential for practical applications in facilitating communication and information access for Nupe speaking communities and its environs.

KEYWORDS: English, Nupe, Rule-based Approach, Machine Translation, Bilingual, Unified Modeling Language.

INTRODUCTION

The focus of this research is to explore the application of Natural Language Processing in translating Nupe, a widely spoken language in West Africa, to English, a globally recognized language with immense importance in various spheres, including business, education, and technology. The Nupe language, rich in cultural heritage and diverse expressions, provides a unique context for us to delve into the intricacies of NLP.

In today's interconnected society, language functions as a potent instrument for communicating, cooperating, and sharing cultures. Nevertheless, the extensive variety of languages spoken worldwide can pose notable difficulties in achieving successful communication and comprehension. Natural Language Processing (NLP), an interdisciplinary field at the intersection of linguistics and artificial intelligence, emerges as a groundbreaking solution to overcome these barriers (Brojo & Raghvendra, 2019). The task of machine translation between English and Nupe poses an intriguing difficulty because of the contrasting syntax, grammar, and subtle linguistic distinctions in these languages. However, recent strides in Natural Language Processing (NLP), powered by robust algorithms and neural networks, have displayed encouraging outcomes in overcoming these challenges and facilitating productive interaction among individuals speaking diverse languages. This study aims to delve into the core concepts of NLP, investigate strategies employed in machine translation, and evaluate a range of NLP models and resources tailored to this particular language combination. Additionally, we will discuss the potential impact of such NLP applications on cross-cultural communication, language preservation, and accessibility to information. As we delve into the world of Natural Language Processing, we embark on a journey to understand how technology can foster a more inclusive and interconnected global community. By bridging the gap between Nupe and English, we aspire to contribute to the growing body of knowledge that celebrates the diversity of languages and promotes mutual understanding among people from different linguistic backgrounds (Daniel, G., et al., 2023). Nwafor and Andy (2022) examined a Survey of Machine Translation Tasks on Nigerian Languages that in spite of the development in machine translation techniques, there is very limited work focused on translating low-resource African languages, particularly Nigerian languages. Nigeria is one of the most populous countries in Africa with diverse language and ethnic groups. In their work,they carried out a survey in the current state of the art of machine translation research on Nigerian languages with a major emphasis on neural machine translation techniques. We outline the limitations of research in machine translation on Nigerian languages and propose future directions in increasing research and participation.

This research is a response to the clarion call to address the information inequalities in Africa which is necessary for her Public heath, Political stability and social well-being as contained in the Common-Sense Advisory report (Hannah et al., 2023). Nigeria is the most populous country in Africa and the sixth in the world. It is also one of the most densely populated countries in Africa, with approximately 218.5 million people. (Stephen et al., 2022). Nigeria is a multilingual country with over 500 ethnic groups. This shows the level of linguistic and cultural diversity in the country. Nupe is one of the ethnic groups in Nigeria. Nupe language is deeply intertwined with the history of the Nupe people, an ethnic group predominantly located in Nigeria, particularly in the Niger and Kwara states. The Nupe language, classified as a Niger-Congo language, belongs to the Volta-Niger subfamily.

Machine translation is an important and very beneficial computing task that provides an automated mechanism for communicating across languages. In recent years, there has been an increase in available tools and techniques for machine translation such as statistical (Koehn et al., 2007b) and neural machine translation (Bahdanau et al., 2016; Luong et al., 2015) techniques. Also, Ogueji et al. (2021) developed AfriBERTa, an approach which involves training multilingual models on low6483 resource language. According to the authors, it is a general assumption that low-resource multilingual language models benefit from being trained in combination with high-resource languages. low-resource multilingual models do not need to be trained in combination with high resource languages and does not require as much dataset used for training high-resource languages. The authors accomplish multilingual model training on low-resource languages with a dataset consisting of 11 African languages of which Igbo, Yoruba, Hausa, and Nigerian Pidgin are Nigerian languages. They also show that the state of the art accuracy can be achieved with training on less than 1GB of data. Furthermore, they apply their pre-trained transformer model on downstream tasks such as name entity recognition and text classification task. Their model outperforms the state of the art multilingual models such as mBERT and XLM-R.

Ayegba et al. (2014) utilizes a rule-based approach for machine translation of English to Igala language. This approach utilizes noun phrases from English language while performing a series of processes such as parts of speech tagging, morphological analysis which analyzes words based on its root or base form, and comparing noun phrases to components contained in a bilingual dictionary. Their approach was tested on 120 randomly selected English noun phrases and achieves a Bilingual Evaluation Understudy (BLEU) accuracy of 90.9%. Nguyen and Chiang (2018) developed a model that improves the mistranslation of rare words. This approach is based on a modified version of attention based encoderdecoder models. Their approach hones on the premise that the output layer which consists of the inner product of the context vector and all possible word embeddings improperly rewards frequently occurring words. In their approach, instead of using the dot product, the norm vectors are set to a constant value. In the same vain, Ezeani et al. (2016) developed a model using the Igbo Bible corpus to detect and restore missing didactics in texts at word level toknization. Similarly, Hedderich et al. (2020) demonstrates that a transfer learning approach through multilingual transformer models (mBERT and XLM-RoBERTa) can be utilized for tasks such as name entity recognition and topic classification on low-resource languages. The approach involves fine-tuning the target language dataset on high-resource language models. Their approach is evaluated on three African languages Hausa, isiXhosa and Yoruba out of which two of the languages (Hausa, and Yoruba) are Nigerian languages. They produce results comparable to the state-of-the-art with as little as 10 or 100 labelled sentences. They achieve at least an improvement of 10 points in the F-1 score for a shared label of named entity recognition. Their result shows promise and is consistent with their hypothesis which also validates work shown in prior research. Their approach however does not produce good results for topic classification. This might be as a result of mismatch in the label set. In the absence of high-quality large training datasets, one can employ the use of unsupervised learning approaches (Artetxe et al., 2018), zero-shot learning (Johnson et al., 2017) and various data augmentation and transfer-learning approaches (Zoph et al., 2016; Nguyen and Chiang, 2017) which requires minimal training datasets.

Oladosu, & Olamoyegun. (2012) wrote on a Yorùbá -English language translator for doctor-patient mobile chat. They were motivated by the need to improve rural-urban health care by reducing communication barrier between semi illiterate patients and highly educated medical personnel who are of different ethnic background. Results show that the application has a high degree of novelty and relevance with about 60% and 80% scores respectively. Adéoyè (2012) wrote on web-based English to Yorùbá Noun-Phrases Machine Translation System was developed. The

research was carried out because of the need to address some of the challenges of English to Yorùbá language. Rule-based approach was used and the formulated rules were specified using context-free grammar. Finite state automata were used to formulate computational model and also for recognizing the grammar of the language. In a similar narration, the Yorùbá Language also known as (ede Yoruba) is spoken in three countries namely; Nigeria, Togo and Republic of Benin. The language is spoken in some communities in other parts of Africa, and it is even spoken outside the Africa continent as a great number of speakers of the language is found in Brazil, Cuba, Haiti, Caribbean Islands, Trinidad and Tobago, Europe and America. It is a tonal language with very little inflectional morphology and a strictly subject-verb-object (SVO) word order (Abiola et al., 2015).

Abiola et al. (2020) wrote on a web-based Yoruba to English bilingual lexicon for building
to reduce communication gaps, create an interactive platform for learning and enhance business transactions among building technicians. The implementation of the architecture is based on the direct approach to machine translations. The programming language tools used were ASP. NET C#, HTML, CSS, JavaScript and BOOTSTRAP as front end to provide a user friendly interface and Microsoft SQL (Structure Query Language) Server as backend to create the database for the data gathered. The system can be used by building technicians and all who are willing to learn basic terminologies from Yorùbá to English under the subject domain. Consequently, Nupe people have a rich history that dates back centuries. They are believed to have originated from the ancient Kwararafa Kingdom, which was located in present-day central Nigeria. The Nupe Kingdom emerged as a powerful and influential entity during the 15th century. It reached its zenith of power and prominence under the reign of Tsoede, a Nupe king who expanded the kingdom's territories and established a centralized administration. The Nupe language played a crucial role in the cultural, social, and political development of the Nupe Kingdom. It served as the primary means of communication among the Nupe people and was used in various aspects of their daily lives, including trade, governance, religion, and storytelling. Throughout history, the Nupe Kingdom encountered interactions and influences from neighboring ethnic groups and empires. The kingdom had connections with the Hausa, Yoruba, and Fulani peoples, among others, resulting in language contact and the incorporation of loanwords from these languages into Nupe Mohammed (2003).

During the colonial era, the British exerted their influence over the region, and the Nupe Kingdom eventually became part of the Northern Nigeria Protectorate in the early 20th century. This period brought significant changes to the socio-political landscape of the region, including the introduction of English as the language of administration and education. However, Nupe continued to be spoken by the Nupe people as their native language, maintaining its cultural significance and vitality within the community. In recent times, efforts have been made to document and preserve the Nupe language. Linguists and scholars have conducted research on its grammar, vocabulary, and linguistic features, contributing to a deeper understanding of Nupe and its place within the broader linguistic landscape of Nigeria. Today, the Nupe language remains an integral part of Nupe cultural identity and serves as a medium for expressing traditions, beliefs, and collective memory. It continues to be spoken by the Nupe people, both in their homeland and among Nupe communities residing in other parts of Nigeria and beyond.

MOTIVATION

The requirement for translation arises to tackle the issue of unequal access to information in Africa, with Nigeria being the most populous and linguistically diverse nation. It's evident that the Nupe people and their language carry substantial cultural and historical significance within Nigeria. The continent faces a notable scarcity of translation services, underscoring the necessity for automated translation. Creating an automatic translation system from English to Nupe language is an effort to alleviate the shortage of translation services. Consequently, this research aims to offer a remedy for a recognized challenge in African society.

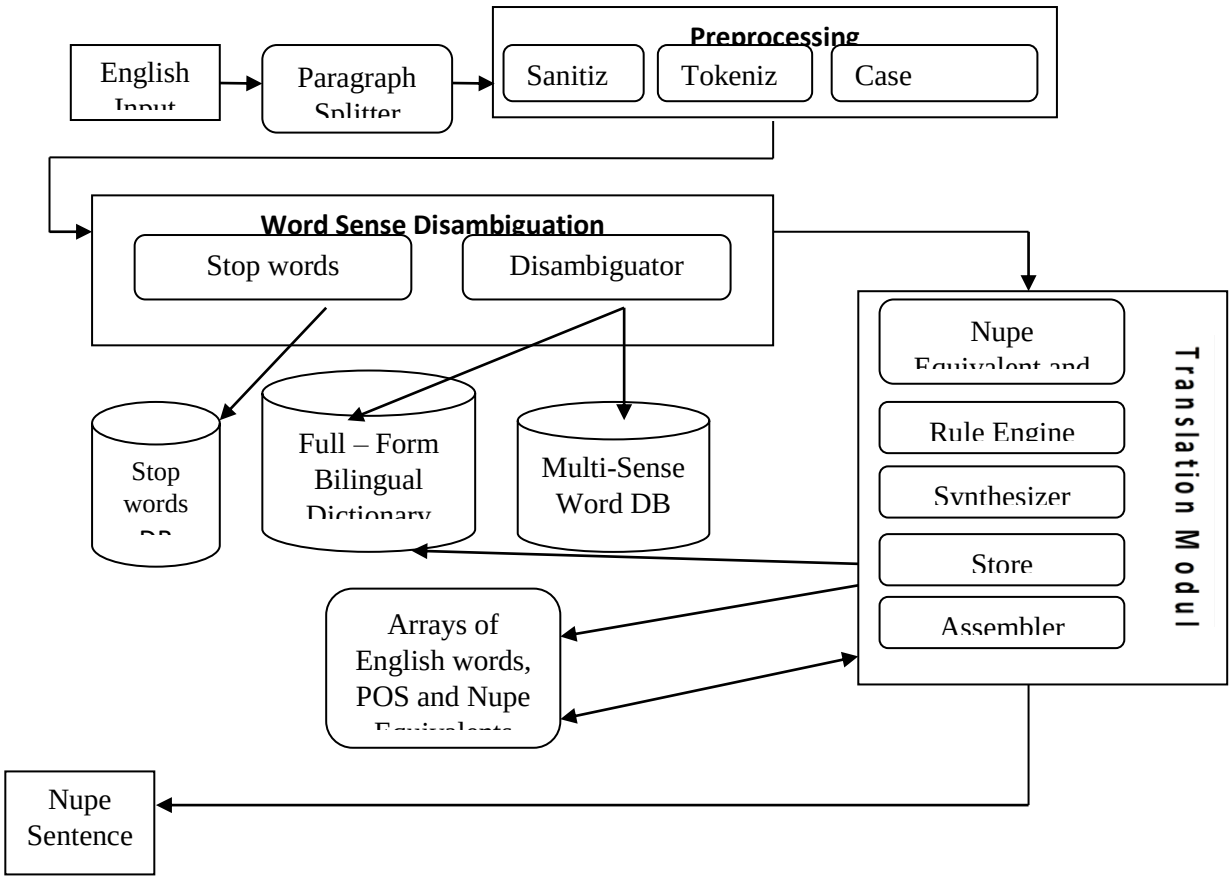
SYSTEM DESIGN

RULE-BASED MACHINE TRANSLATION (RBMT)

Rule-based Machine Translation (RBMT) also known as `Knowledge-based Machine Translation', `Classical Approach' of MT is a general term that denotes machine translation systems based on linguistic information about source and target languages. Basically, the linguistic information can be retrieved from (bilingual) dictionaries and grammars covering the main semantic, morphological and syntactic regularities of each language (Sani et al., 2020). Rules play major role in various stages of the translation: syntactic processing, semantic interpretation, and contextual processing of language. A noun phrase (NP) is a phrase in which a noun or pronoun is the head word, optionally accompanied by a modifier set. NP can be pre-modified or post-modified. If the modifier is placed before the noun, the NP is pre-modified. If the modifier is placed after the noun, then the NP is post-modified. English allows both forms of modification. Nupe allows only post modification, modifiers are placed after nouns.

A noun phrase consists of three parts, the head which is the principal part and other two optionally occurring parts. Possible modifiers of NP are: Definite Articles (the) Indefinite Articles (a, an) Demonstratives (this, that, such, these, those, none, neither) Quantifiers (few, every, several, all, no, some, any, more, most, less, enough) Cardinal numbers (one, two, three …) Ordinal numbers (first, second, third…) Possessive Pronouns (my, your, their, our, his, her, its, mine, ours, yours…)

CONCEPTUAL ARCHITECTURE OF THE PROPOSED MODEL



The structure of RENMTS Fig.1 breaks down into the following phases:

Phase (1) - English language text: The input to the system consists of text in English language.

Phase (2) – Paragraph Splitter: The input text could be a paragraph which is made up of a number of sentences. In this phase the system splits the text into sentences. It recognizes a sentence whenever a full stop is encountered which signifies the end of the sentence. The sentences are stored in an array.

Phase (3) – Preprocessing: This phase consists of three operations:

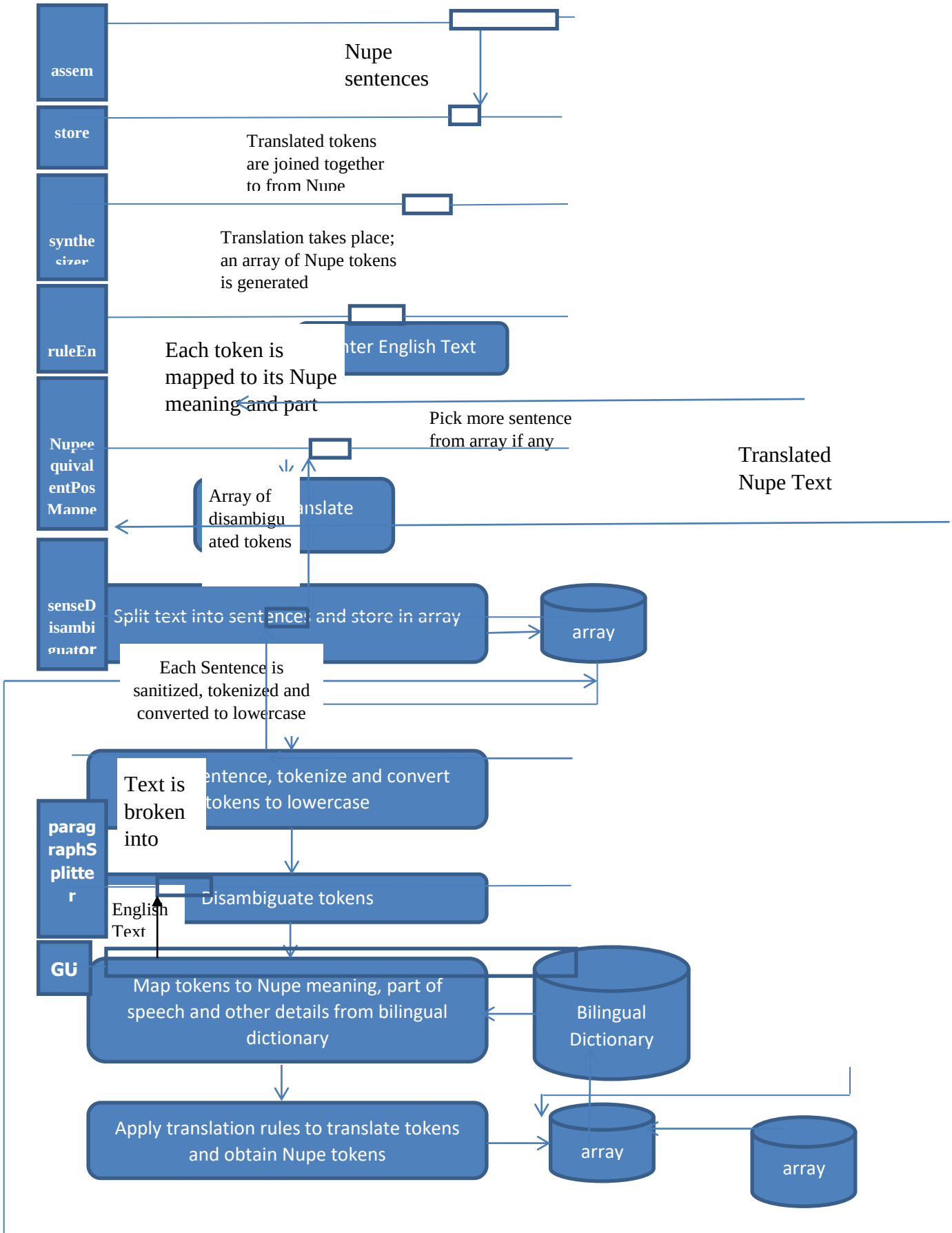
c. Sanitization: This is the process of formatting the sentence. It removes all punctuation marks such as coma, colon, semicolon, quotation marks etc. This is necessary because if a punctuation mark accompanies a word, the word will not be found in the dictionary. This function is performed by the sanitizer.
d. Tokenization: A basic text processing operation is tokenization which is the breaking up of raw text or sentence into words. This function is performed by the tokenizer. The input sentence is broken up at this point into words. It recognizes a word whenever a space is encountered which signifies the end of the word. The tokens are stored in an array.
e. Case Conversion: Tokens are converted to lowercases during this phase.

Phase (4) – Word Sense Disambiguation: The task during this phase is to computationally determine the sense of an ambiguous word that is activated by its use in a particular context in the sentence. It consist of two main operations:- stop word extraction and disambiguation carried out by stop word extractor and disambiguator function.

Phase (5) – Translation: This is the actual translation phase. The operations in phase 1-4 are preliminary operations. It consists of the following tasks:

1. Nupe Equivalent and Pos Mapping: Each token or group of tokens (ngrams) is searched for in database tables, if found their Nupe meaning, part of speech and other relevant information are retrieved and stored in arrays. Nupe Equivalent and Pos Mapper perform this function.
2. Translation Rule Application: A set of rules is applied on the tokens in accordance with Nupe grammar formation rules. The ruleEngine function carries out this operation. There are 250 rules in the ruleEngine function. An array of Nupe tokens is generated.
3. Synthesis: During this phase, translated tokens are joined together to form Nupe sentence. The sentence is stored in an array. The synthesizer function performs this operation.
4. Storage: If the input is a paragraph made up of a number of sentences, each translated sentence is kept in a store.
5. Assembly: This is the final stage. The translated sentence in the store as assembled together to form Nupe text which is display on the GUI for the user. This task is carried out by the assembler function.

The flow of events is graphically illustrated by the activity diagram and sequence diagram in figure 2 and 3



DESIGN OBJECTIVES

The objectives of this research paper are to:

i. Design an application module (a graphical User Interface) designed to receive either a sentence or complete documentation as input
ii. Conduct spell check in English
iii. Translate the sentence or full documentation from English to Nupe
iv. Design of query optimized lexical database called English-Nupe Full Form Bilingual Lexicon that stores English words and their Nupe equivalents and other relevant details that are necessary for language learning and understanding and
v. Design of software application module that will be used to retrieve words and their meanings from the Full Form Bilingual Lexicon

INPUT/OUTPUT SPECIFICATION

Figure 4: The layout illustrates how users input text for translation and view the translated text. Users enter text in the first section labeled "Enter English text to Translate" and click the "Translate" button. The translated text appears in the second section labeled "Translated Nupe text."

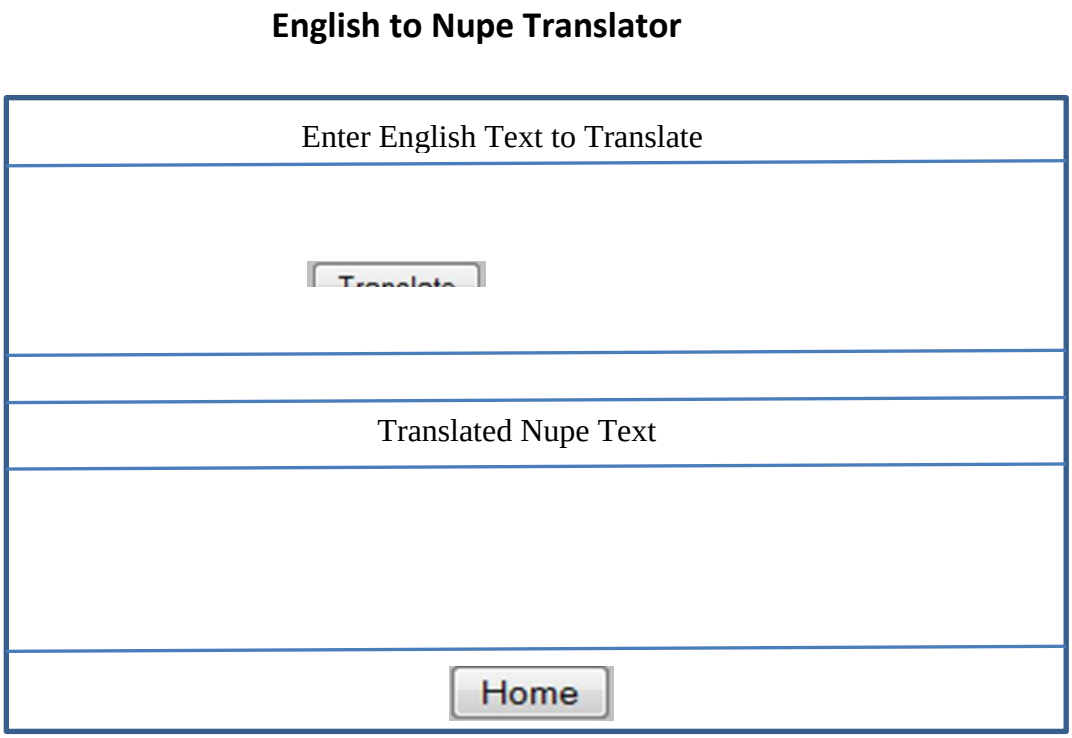


Figure 4: Input/output Layout

CONCLUSION

In conclusion, this paper has presented a rule-based approach to natural language translation from English to Nupe, offering insights into the challenges and strategies involved in this process. While rule-based systems have their limitations, particularly in handling complex linguistic structures and nuances, our approach has demonstrated promising results in translating basic English sentences into Nupe. The system's performance highlights the potential of rule-based methods in addressing the translation needs of under-resourced languages like Nupe. Future research could explore hybrid approaches that combine rule-based and machine learning techniques to improve translation accuracy and coverage. Overall, this study contributes to the growing body of research in machine translation and underscores the importance of developing language technology for minority languages to facilitate communication and preserve cultural heritage.

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PAPER 7 - COMBINED INTELLIGENCE AND STUDENTS' SUCCESS IN SCIENCE & TECHNOLOGY EDUCATION: ANALYSIS OF STUDENTS' NI AND AI

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ABSTRACT

Natural intelligence is capable of solving problems and generating products in a variety of ways likewise multiple intelligence can do more. According to intelligence theorists like Gardner, each person possesses many intelligences, which are what determine how they learn. Through their innate curiosity, students are kept interested in this intelligence-based training, and their curiosity also increases their involvement. Additionally, it might improve pupils' comprehension and academic performance. Likewise, Artificial Intelligence (AI) can assist in personalizing learning in several ways. AI can assist in improving the working environment so that educators can work with more challenging students. It might not be best to fully automate utilizing artificial intelligence (AI) until AI is complemented by human intelligence. As a result, we use combined intelligence—that is, natural intelligence (NI) and artificial intelligence (AI)—which is a clever application of both natural and artificial intelligence. This will maximize the benefits for students by improving their focus and concentration, lowering the likelihood of errors, and providing prompt and accurate problem-solving. This makes it feasible for teachers to work toward realizing their full potential as stewards of the well-being of all students. In order to achieve this, a sample of the population consisting of undergraduate students studying computer science and physics was exposed to three distinct achievement exams that tested natural intelligence, artificial intelligence, and combined intelligence. Together with the instrument's validation and reliability, the exercise took four weeks to complete. An analysis of variance was used. The analysis's findings demonstrated that the pupils' combined intelligence significantly improved their performance over that of NI and AI alone. AI came next, which improved student performance above NI. Finally, in order to improve students' intelligence in the areas of science and technology teaching and learning, educators are urged to integrate NI and AI.

KEYWORDS: Natural Intelligence, Artificial Intelligence, Combined Intelligence, Science, Technology

INTRODUCTION

The merging of Natural Intelligence (NI) and Artificial Intelligence (AI) is changing the face of science and technology education. This study investigates the synergy of NI and AI in improving student success in various domains. By examining the contributions of both types of intelligence, the study identifies critical elements that lead to better learning results. The study emphasizes the need of taking a balanced approach, harnessing the strengths of both natural intelligence and artificial intelligence to improve educational experiences and promote innovation. The findings emphasize how coupled intelligence can lead to major advances in science and technology education.

Science and technology education is crucial in equipping pupils to face the problems of the modern world. As the needs for these fields increase, there is a greater need to improve instructional practices that promote student achievement. Traditional educational paradigms rely heavily on Natural Intelligence (NI), the innate cognitive skills

of people, to promote learning. However, the introduction of Artificial Intelligence (AI) has opened up new potential to supplement and improve these traditional methodologies. Ahmed, Noor, and Hamdan, Allam (2024) explored the possible effects of artificial intelligence (AI) on education, specifically how it could improve teaching and learning. The study offered strategies for efficiently incorporating AI technologies into classrooms to improve the overall educational experience.

This study article investigates the concept of combined intelligence, which is an integrative strategy that uses both natural intelligence and artificial intelligence to examine and improve student success in science and technology education. The study looks into how the combination of human cognition and machine learning might result in a more effective and tailored learning environment. Artificial intelligence (AI) has emerged as a game changer in modern business (Hlatshwayo, 2023). AI and NI integration includes data analysis, automation, machine learning, and natural language processing (Hlatshwayo, 2023). The rapid growth of artificial intelligence (AI) has opened new opportunities in a variety of industries, including education (Tyagi et al., 2024).

According to Saleh (2019), artificial intelligence, also known as machine intelligence, is intelligence demonstrated by machines, as opposed to the natural intelligence showed by humans and other animals. Speech recognition, learning, planning, and problem-solving are some of the activities for which it is built. Because robotics is the study of the relationship between perception and action, Artificial Intelligence must play an important role if the connection is to be intelligent. Artificial intelligence addresses critical concerns such as what knowledge is required in any element of thinking, how that knowledge should be represented, and how that knowledge should be applied.

LITERATURE REVIEW

Natural Intelligence (NI) in Education

Natural intelligence refers to humans' natural cognitive abilities, such as problem-solving, critical thinking, creativity, and emotional intelligence. These qualities have long been the core of educational institutions. In scientific and technology education, NI is critical in helping students understand complicated topics, participate in creative thinking, and apply knowledge in real-world situations. NI's effectiveness can be seen in the development of scientific reasoning, invention, and the ability to manage the ethical implications of technological advances. Assessment methodologies must grow beyond traditional ways in light of the quickly evolving artificial intelligence (AI) tool technologies such as Copilot, Bard, and ChatGPT. These AI-powered Chatbots are meant to appear like human speech or text and conversationally provide information, making them viable solutions for student assessment help worldwide (Etxebarria et al., 2022).

Artificial Intelligence (AI) in Education

Artificial intelligence, which is defined as machines simulating human intelligence, is rapidly being used to improve education. AI technologies, such as machine learning algorithms, adaptive learning platforms, and intelligent tutoring systems, are being used in education to personalize learning experiences, automate administrative duties, and offer students with immediate feedback. AI has showed potential in science and technology education, particularly in data analysis, simulation of scientific events, and the provision of individualized learning pathways depending on individual student needs.

In order to evaluate the effectiveness of the AI tools in the assessment and the potential of the new method to discourage students from engaging in academic dishonesty, Etxebarria et al. (2022) conducted a comparative experiment on two different assessment methods: the alternative or modified strategy (Experiment II) versus the traditional questioning strategy (Experiment I). The AI chatbot in Experiment I demonstrated a 100% positive response correlation, but in Experiment II, its positive response correlation was startlingly low. In contrast, there are notable differences in performance between students who utilize AI Chatbot and those who do not ($\alpha = 0.05$, p-value < 0.001; 1.8331). Inferentially, the AI chatbot performed significantly better in Experiment I but much worse in Experiment II for students. Put otherwise, the questioning strategy used in Experiment II performs better than the AI

tools' degree of proficiency. The study concludes that human natural intelligence can always overcome the obstacles presented by these potent AI technologies if AI is properly harnessed. According to Ng (2022), education authorities should make it a priority to teach students about artificial intelligence (AI) as they prepare the future generation. To help students get ready for the demands of the workforce, researchers have started talking about a concept called "AI literacy" which refers to how teachers may help students develop their understanding of AI, particularly in elementary and secondary school settings.

Their primary findings shed light on the growth of AITL (AI Teaching Learning) and could assist educators and researchers in developing pedagogical methodologies and curricula that leverage appropriate technology to better prepare students for the expanding AI economy.

The Synergy of NI and AI in Education

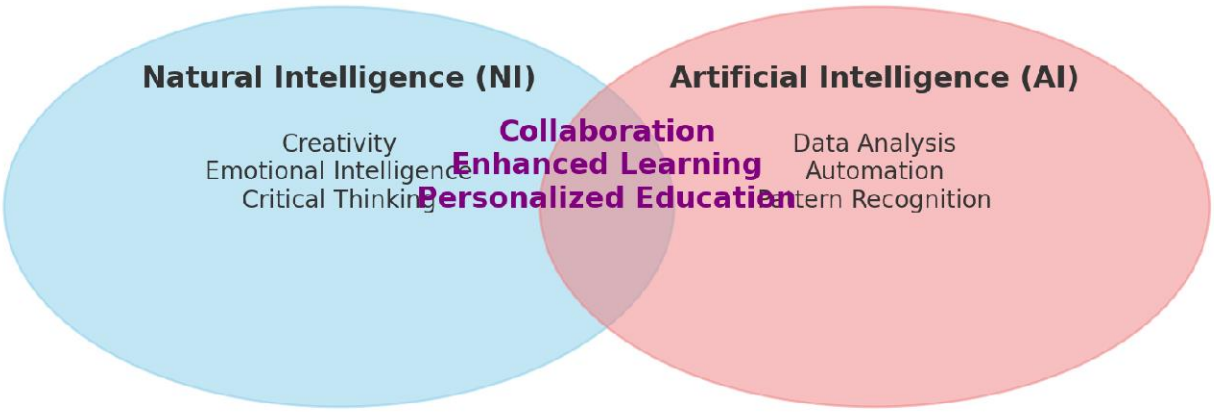

Fig.1: diagram that shows the comparison, integration, and collaboration between Natural Intelligence (NI) and Artificial Intelligence (AI) in education

NI focuses on human creativity, emotional intelligence, and critical thinking.
AI specialises in data analysis, automation, and pattern recognition.
NI &AI show the overlapping area highlights collaboration, where AI and NI work together to enhance learning and provide personalized education.

The combination of NI and AI presents a significant opportunity for improving educational performance. While natural intelligence (NI) provides the creativity, ethical reasoning, and contextual knowledge required for deep learning, artificial intelligence (AI) delivers scalability, precision, and individualized learning experiences. The synergy between these two types of intelligence can result in the creation of hybrid learning environments in which students benefit from the best of each. This integrated approach can overcome the limits of traditional education approaches, resulting in a more flexible and effective learning environment. The impact of artificial intelligence on education will become increasingly important in comprehending the potential alterations that can occur in teaching and learning processes. With AI quickly evolving, it is critical to study how it may be used to improve educational outcomes and prepare students for an increasingly digital future. By investigating the existing use of AI in education and recognizing the benefits and problems it offers, we may better teach educators about strategic implementations (Ahmed, Noor, & Hamdan, Allam 2024).

METHODOLOGY

Using a mixed-methods research methodology, this study combines student perspectives from the qualitative domain with quantitative analysis of student performance data. The study looks at how coupled intelligence affects the academic performance of students at Lagos State University of Education who are enrolled in science and technology programs. Information was gathered from 20 schools that included AI tools in their science and technology curricula. Student grades and AI-based learning platform utilization metrics are examples of quantitative data. Student interviews were used to acquire qualitative information about their experiences with combined intelligence in the classroom. The utilization of AI tools and student performance were found to be correlated through statistical analysis of quantitative data. Thematic analysis was used to examine how students saw and experienced the integration of NI and AI in their learning processes using qualitative data.

RESULTS

Quantitative Findings

The quantitative research demonstrated a beneficial relationship between the employment of AI tools and student performance in science and technology classes. Students who used AI-based learning systems regularly performed far better academically than those who did not. The statistics indicate that AI can significantly improve learning outcomes by delivering individualized feedback, recognizing knowledge gaps, and providing tailored learning experiences (see Fig.1). Similarly, NI and AI can successfully improve learning outcomes by providing more and better feedback, recognizing more knowledge gaps, and providing higher-quality learning experiences (see Fig. 1 & 2)

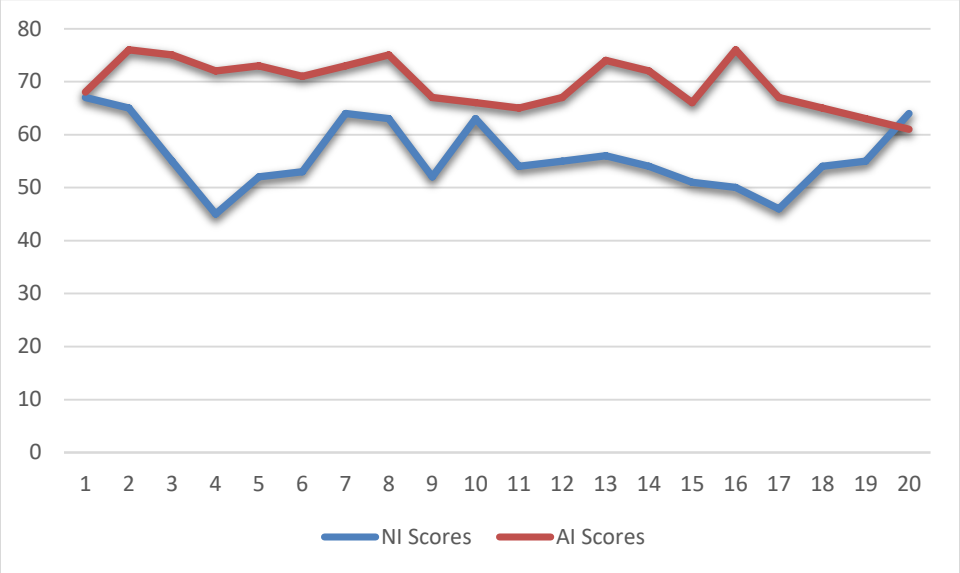

Fig. 1: Natural Intelligence Vs Artificial Intelligence

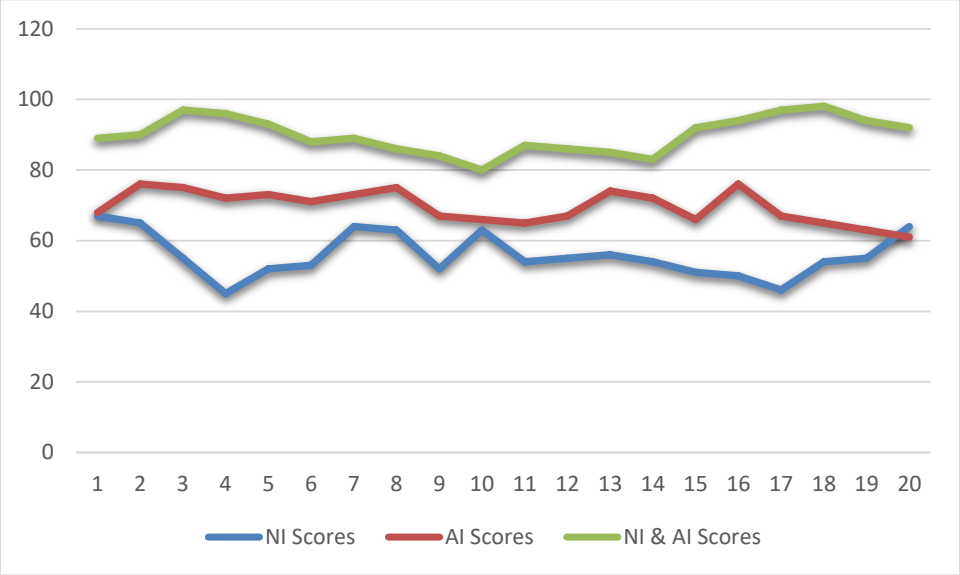

Fig. 2: Natural Intelligence, Artificial Intelligence, and Combined Intelligence

Qualitative Findings

Qualitative observations emphasized the complementary functions of NI and AI in education. Educators remarked that, while AI technologies are useful for reinforcing knowledge and giving tailored guidance, they do not replace critical thinking, creativity, and ethical reasoning given by NI. Students said AI helped them understand complicated topics and manage their learning pace, but they also stressed the significance of human interaction and support in their education. The findings indicate that a balanced strategy, in which NI and AI collaborate, results in the most beneficial educational outcomes (see Fig. 3).

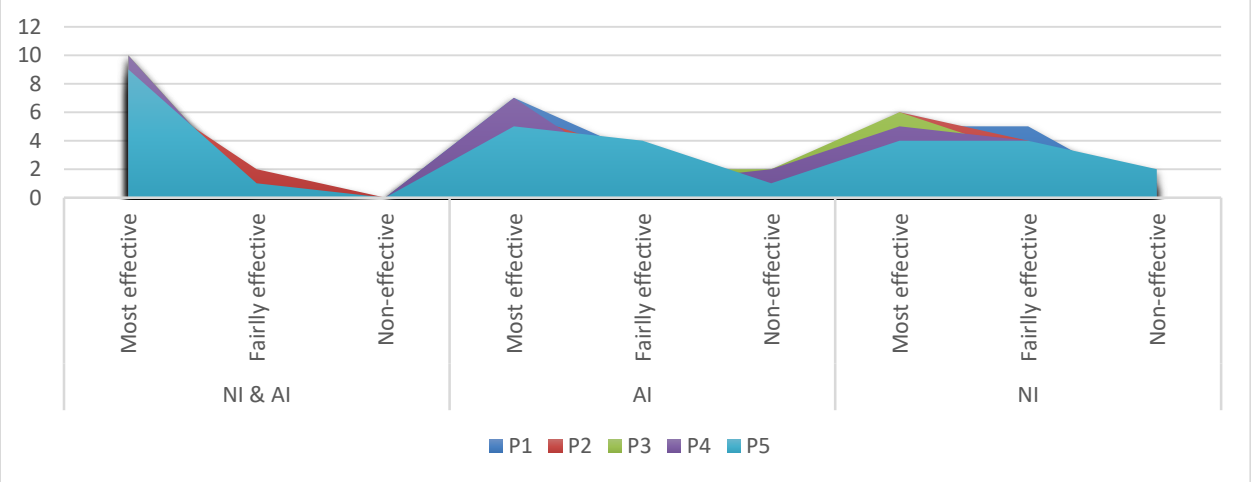

Fig. 1: Natural Intelligence, Artificial Intelligence, and Combined Intelligence for Interviewees

DISCUSSION

The study's findings highlight how coupled intelligence has the power to revolutionize science and technology education. Through the integration of artificial intelligence (AI) and neural intelligence (NI), educators can establish a learning environment that is more dynamic and responsive. This method makes it possible to tailor instruction to each student's unique needs while encouraging greater comprehension and memory retention. For students to successfully gain competencies in the competence-based model, using teaching-learning resources that support

many forms of intelligence is an adaptive technique (Etxebarria et al., 2022). Students' improved capacity to comprehend and evaluate the usefulness of AI applications in the classroom (Anastasia, 2024). Even if coupled intelligence has advantages, there are a few issues that need to be resolved. Concerns over data privacy, the digital divide, and the possibility of less human connection in education are raised by the use of AI. Teachers also require training on how to use AI tools into their lessons in an efficient manner. To guarantee that combined intelligence is implemented in education in a way that is both equal and successful, it is imperative to address these issues.

FUTURE IMPLICATIONS

Although NI and AI integration in education is still in its infancy, there are a lot of possible ramifications. AI technologies will probably play a bigger part in education as they develop further, opening up new avenues for improving student achievement. Future studies should look into how coupled intelligence affects learning results over the long run and how these strategies might be expanded to fit a variety of educational environments.

Conclusion

Analysis of combined intelligence shows that there is a great deal of promise for improving student achievement in science and technology education by integrating NI and AI. Teachers may design more efficient and individualized learning experiences by combining the best aspects of human and machine intelligence. Although there are still obstacles to overcome, this strategy has many advantages and presents a bright future for education in these important areas.

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PAPER 8 - ARTIFICIAL INTELLIGENCE IN PERSONALIZED LEARNING IN HIGHER EDUCATION

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ABSTRACT

This study explores the transformative impact of Artificial Intelligence (AI) on personalized learning in higher education, focusing on AI's ability to customize educational experiences based on individual student needs, preferences, and learning pace. By integrating AI into educational systems, institutions can create more flexible and adaptive learning environments that improve student engagement, retention, and performance. The study draws on constructivist learning theories, which emphasize learner-centered approaches where students actively build knowledge through social and personal experiences. AI's role in supporting these environments is examined, with a focus on tools such as automated assessments, AI-powered tutors, and personalized learning platforms that provide customized content and feedback. Despite its potential, AI implementation in higher education faces challenges. Key barriers include inadequate technological infrastructure, especially in developing regions, as well as concerns over data privacy, security, and ethical issues. The risk of algorithmic bias, which could perpetuate existing educational inequalities, is also discussed. Future advancements in AI, such as natural language processing and more sophisticated adaptive algorithms, are expected to further enhance personalized learning, making AI-driven education systems more responsive to students' evolving needs. The study also considers AI's potential to bridge the digital divide by providing high-quality, accessible education to underserved populations. Ultimately, the study concludes that AI has immense potential to create more inclusive, personalized educational environments, offering opportunities to enhance learning outcomes, boost student engagement, and expand access to quality education worldwide.

KEYWORDS: Artificial Intelligence, Adaptive Learning, Educational Technology, Personalized Learning, Higher Education

1. INTRODUCTION

The Integration of Artificial Intelligence (AI) in education has revolutionized traditional pedagogical methods, offering new avenues for enhancing learning experiences and outcomes. In higher education, Artificial Intelligence's role in personalized learning has attracted considerable attention for its ability to customize educational experiences to meet the special needs of each learner. By adjusting to different learning styles, speeds, and preferences, AI-driven personalized learning enhances learner commitment, retention, and educational accomplishment. As AI becomes gradually incorporated into educational systems, it is necessary to understand the complex interactions between AI technologies and the learning environment to maximize their potential and foster educational advancement.

According to Ayeni et al, (2024), posit Artificial intelligence, a field of computer science that focuses on creating intelligent robots with the ability to learn and solve problems, has made a special place for itself in the educational system, AI technologies are being integrated across a broad spectrum of applications, ranging from automating administrative tasks to creating personalized learning platforms. AI is swiftly revolutionizing traditional teaching and learning methods. One of its most significant advantages is its capability to adjust to the precise desires and learning styles of individual learners. By studying massive volumes of data, such as learner performance, advancement, and favorites, AI systems adapt learning skills to each learner, moving afar the traditional one-size-

fits-all method, generating dynamic and personalized instruction that changes according to the speed at which pupils pick up new information. This improves learning opportunities and gives teachers insightful feedback to help them improve their teaching methods. (Ayeni et al, 2024).

Today's fast expanding artificial intelligence is an unstoppable technological advancement, particularly in the area of education, one of the main strengths of AI is its ability to process and analyze data more rapidly and efficiently than humans. primary reasons it is becoming more and more in demand and used in a variety of industries, including education (Pratama, et al, 2023). In the submission of Selin and Christene (2021) provided a simple definition of artificial intelligence (AI) as the area of computer science concerned with simulating intelligent computer behaviors and their potential to emulate—and hopefully surpass—human behavior. The fields of research, engineering, and algorithm production are dominated by AI. For instance, artificial intelligence (AI) has many Algorithmic applications in education, such as automated assessment tools that assist teachers in evaluating student knowledge, facial recognition technology that provides insights into student behavior, and personalized learning platforms that foster student learning, are transforming the educational landscape.

According to Ali Al-Badi et al. (2022), the incorporation of AI into education is reshaping how learning occurs. AI-powered educational systems offer students tailored learning experiences that cater to their individual needs that adapts to their individual learning pace, style, and needs. Intelligent agents serve as virtual tutors, providing instant feedback and support, while autonomous scoring systems offer unbiased assessment of students' work. Furthermore, AI-powered chatbots facilitate seamless communication between learners and instructors, enhancing collaborative learning experiences. The progress in AI technology is enhancing the accessibility of education but also more engaging, helping to fulfill the growing demand for self-directed and flexible learning opportunities. This technological evolution holds the promise of a more inclusive and efficient global educational system is emerging (Pisica et al., 2023). Personalized learning marks a departure from the traditional uniform approach to education by emphasizing the customization of the learning experience to meet the individual needs of each student strengths, needs, skills, and interests (Peng et al, 2019). This educational strategy involves creating individual learning plans that are dynamic and adaptable, reflecting the ongoing progress and evolving goals of the student. Such plans are not meant to replace specialized intervention programs but to complement them, ensuring that all students, regardless of their learning requirements, can benefit from an education that is responsive to their personal journey (Pratama et al, 2023).

The success of personalized learning hinges on the collaboration between students, teachers, and families, making the learning process a shared responsibility that values transparency and regular communication. By fostering an environment where educational goals are not only personalized but also clearly articulated and regularly reviewed, personalized learning can enable undergraduates to take possession of their learning and thrive in a setting that acknowledges and nurtures their individuality (Pratama et al, 2023). According to Audu, (2020), opined that personalized learning, as highlighted by various scholars, is a dynamic approach that adapts to the unique preferences and abilities of individual learners. It's a strategy that not only considers the pace and style of learning but also empowers students to take an active role in their educational journey. By crafting personal learning plans and engaging in reflective learning experiences, students can optimize their learning outcome which indicates that personalized learning can lead to higher performance levels among students.

As education continues to evolve, the incorporation of personalized learning practices is becoming increasingly important in fostering an environment where every student has the opportunity to succeed (Audu, 2020). Higher education encompasses a broad range of institutions and activities that go beyond the traditional university model. It includes not only arts, humanities, and sciences within universities but also specialized institutions focusing on agriculture, engineering, science, and technology (Ogunode et al, 2023). Moreover, the sector comprises various post-secondary institutions such as polytechnics and colleges of education. This diverse array of institutions under the higher education umbrella signifies a commitment to professional development across numerous fields. The purpose of higher education, as conceptualized by Ogunode et al. (2023), is not just to impart knowledge but to foster the holistic development of individuals and transform society through teaching, research,

and community service. It represents an advanced stage of learning following basic and secondary education, aiming to cultivate a deeper level of expertise and contribute to community advancement.

The rationale for this review stems from the growing excitement about the potential of AI to revolutionize education through personalized learning, it's crucial to approach this topic with a critical eye. While AI offers promising opportunities, it also presents challenges such as ethical concerns, equity issues, and the readiness of educational institutions to adopt these technologies. This review aims to provide a comprehensive understanding of both the challenges and limits of AI in personalized learning within higher education.

Key Objectives:

1. To explore the theoretical frameworks sustaining the use of AI in personalized learning.
2. To examine existing AI applications in personalized learning within higher education institutions.
3. To identify the Challenges and Barriers that can hinder the Application of AI in personalized learning.
4. To assess the ethical considerations associated with using AI in educational settings.
5. To discuss potential developments and future directions in AI-driven personalized learning in higher education.

2. **LITERATURE REVIEW**

2.1 **Theoretical frameworks sustaining the use of AI in personalized learning**

AI has become increasingly popular in higher education as a tool for creating personalized learning skills that cater to the special needs of each learner. Several theoretical frameworks back this approach, particularly focusing on how AI can support personalized learning environments. Two key theorists whose work underpins these frameworks are Lev Vygotsky and John Dewey's constructivism. According to Vygotsky (1978), constructivist theory posits that learning is an active, constructive process where learners build new ideas or concepts based upon their current and past knowledge. The learner is considered an information constructor; Learning is a personal and social process where individuals actively create meaning from their experiences. This understanding implies that the focus of education should be on the learner, not on the subject matter, and that knowledge is subjective and shaped by individual or collective interpretations.

In the classroom, constructivist teachers provide students with opportunities to construct their own understanding and then to validate, through social interaction, these new ideas. This approach not only respects the individuality of learners but also acknowledges the complex nature of the learning process where multiple perspectives and interpretations are not only possible but beneficial in the journey to acquiring knowledge (Bada, 2015). Practical examples of constructivist teaching involve strategies that encourage students to actively participate in their learning process. Reciprocal teaching and inquiry-based learning are two examples of teaching methods that encourage deeper understanding. In reciprocal teaching, students work together to explain and discuss topics, while in inquiry-based learning, they actively explore their own questions through research and observation, promoting critical thinking and independent learning. Problem-based learning tasks students with solving real-world problems, requiring them to apply knowledge and reasoning to find solutions, thereby integrating new information with existing knowledge.

Cooperative learning is also a key constructivist approach, where students work in groups to complete tasks, share ideas, and learn from one another, which can lead to increased engagement and retention of knowledge. These methods align with the constructivist view that knowledge is actively constructed by the learner, and they emphasize the importance of hands-on experiences, collaboration, and reflection in the learning process (Bada, 2015). According to Dewey (1916), perspective on constructivism said is the process of forming knowledge in an active one in which the subject interacts with the environment to produce cognitive structures. As long as the subject itself creates the cognitive structure that organizes reality, there will be cognitive interaction. The cognitive structure

needs to be constantly modified and adjusted to meet the needs of the environment and the evolving organism. Through the reconstruction process, correction takes place on a constant basis (Andang et al, 2018),

2.2 **Existing AI Application in Personalized Learning within Higher Education Institution**

The incorporation of artificial intelligence into the education sector marks a significant shift towards a more personalized and efficient learning environment. AI systems facilitate the creation of customized educational content, enabling students to learn at their own pace and style (Chang & Lu, 2019). This personalization is crucial in addressing the diverse needs of students, making education more accessible and inclusive. Moreover, AI applications can assist teachers by transform higher education management by computerizing administrative tasks and providing valuable insights into learner performance. This allows educators to focus on teaching and learning, rather than paperwork. As technology advances, the role of teachers will shift towards guiding and facilitating learning, encouraging students to take ownership of their education (Pratama, et al, 2023).

AI can revolutionize higher education management by streamlining operations and personalizing teaching programs. By automating administrative tasks, AI can free up staff to focus on more strategic initiatives. Additionally, AI algorithms can adapt teaching programs to individual student needs, optimizing the learning experience, learning styles and needs, enhancing the educational experience (Eden et al, 2024). AI can also oversee the conduct of examinations, ensuring fairness and integrity through advanced monitoring systems. Virtual learning environments, powered by AI, can provide students with access to a wealth of resources and interactive tools, facilitating a more engaging and flexible learning experience. In research, AI can assist in data analysis, hypothesis generation, and even in the discovery of new research avenues, thereby accelerating innovation. Community service programs can be better matched to community needs through predictive analytics and trend analysis (Ogunode.et al, 2023).

In the submission of Ayeni et al, (2024), obliged personalized learning empowered by AI, as revolutionizing the educational landscape by offering a tailored experience that adapts to the unique learning journey of each student. By analyzing data on students' performance, AI can adjust the difficulty of tasks, suggest resources, and even predict potential challenges, ensuring that each learner receives the right level of support and challenge. This individualized approach not only enhances learning outcomes but also promotes self-paced study, keeping students engaged and motivated. As AI technology advances, the potential for creating a truly adaptive and responsive education system becomes increasingly tangible. AI holds the promise of a future where education is tailored to each individual student's unique needs, creating a personalized and enriching learning experience (Pisica, 2023).

Personalized learning is a dynamic approach that tailors educational experiences to individual learners' needs, preferences, and performance data. By leveraging technology, adaptive learning systems can curate and deliver content that aligns with each student's unique learning path. This method not only fosters a deeper engagement with the material but also empowers students to take charge of their learning journey (Chang et al,2019). As educators worldwide adopt these systems, they are finding that personalized learning can bridge gaps in understanding, allowing for a more equitable and effective educational environment. Continuous feedback provided by these systems ensures that instructors can monitor progress and intervene when necessary, making the learning process more transparent and success more attainable for every student (Al-Badi, et al, 2022: Chang, et al 2019: Peng et al, 2019)

This viewpoint is further supported by the World Economic Forum (2018), which notes that the introduction of AI into higher education courses is developing as a considered reply. The introduction of artificial intelligence (AI) into higher education is viewed as a proactive step to provide learners with the necessary skills for success in the face of an expanding digital age, where technology breakthroughs define the requirements of the workforce. In a 2018 report, the World Economic Forum emphasized the strategic importance of matching educational curricula to the needs of the modern workforce, where having AI skills is becoming more and more appreciated (Olatunde-Aiyedun, 2024).

2.3 **Challenges and Barriers that can hinder the Application of AI in personalized learning**

The integration of Artificial Intelligence (AI) in education offers the potential to transform teaching and learning. By personalizing learning experiences, adjusting to individual learner needs, and providing real-time feedback, AI can significantly enhance learning outcomes.. Moreover, it can program administrative tasks, permitting instructors extra period to emphasis on teaching. Yet, this integration raises substantial challenges, including ensuring equitable access to technology, protecting student privacy, and preventing preferences in AI systems among others (Ayeni, et al, 2024). The application of AI in personalized learning in Nigerian higher education surfaces numerous challenges, including biases in AI algorithms. These challenges, highlighted by Afolabi (2024), include

1. Infrastructure and technological readiness issues. Many institutions in Nigeria lack adequate infrastructure and technological resources necessary to support AI-driven personalized learning systems. This includes issues with reliable internet access, power supply, and the availability of computing devices
2. Cost and Funding: The high cost associated with implementing AI technologies, including purchasing software, hardware, and training staff, poses a significant barrier. Many universities in Nigeria struggle with limited funding, which make it challenging to invest in advanced AI system (Pisica et al, 2023)).
3. Lack of Expertise and Skills: There is a shortage of AI expertise and skilled professionals in Nigeria who can develop, implement, and maintain AI-based systems for personalized learning. This gap hinders the effective deployment and utilization of AI technologies in higher education.
4. Data Privacy and Security Concerns: Issues related to data privacy and securities are critical concerns when implementing AI in personalized learning. Higher education needs strong systems and programs to certify the confidentiality and protection of learners' data.
5. Resistance to change and Institution culture: Resistance from faculty, administrators, and learners who may be doubting or resistant to implementing new technologies can obstruct the successful application of AI in personalized learning initiatives (Afolabi, 2024).

2.4 **Ethical Considerations Associated with using AI in Educational Settings**

Ethical considerations must also be addressed, such as the implications of data usage and the role of teachers in an AI-enhanced educational landscape. It is crucial for stakeholders to collaborate in developing ethical frameworks and regulations that safeguard the interests of all parties involved in the educational system (Selin, et al, 2022). Even though AI technology has many benefits for both teachers and students, there are also risks and ethical issues that need to be considered. Both conceptual and empirical studies should carefully evaluate these risks in order to identify potential threats. The loss or violation of privacy is one of these main hazards. Users of AI technology built on algorithmic apps knowingly provide human data to be acquired; they are not informed about the nature or volume of data being collected. Even though user agreement is legally required before utilizing any AI technology (in many nations or geographical/political regions, such as the European Union), the user is actually unaware of what is occurring with their data in the system (Kilmova et al, 2023).

In the submission of Selin et al, (2022), opined AI algorithms are influenced by the values of their creators, which can lead to ethical concerns and biases. While AI systems are often marketed as objective and neutral, they are actually shaped by the data used to create them representing the systemic and historical prejudices in society is also produced, and this data eventually become algorithmic bias. Diverse gender and racial prejudices are observed in various AI-based platforms, t even though the algorithmic model unintentionally incorporates the bias. The study considered the various forms of preference and ethical problems, focusing on issues pertaining to privacy, surveillance, autonomy, bias, and discrimination (Selin, et al, 2022) surrounding AI uses in higher education settings. Nonetheless, it's critical to recognize that, depending on the grade and developmental stage of their children, instructors will face a variety of ethical dilemmas.

The followings were highlighted based on the general findings of this study:

Privacy and Data Security:

- *Data collection and storage:* AI systems often requires extensive data collection on students, including personal information, learning styles, and performance metrics. This educates anxieties about data privacy and the prospective for misappropriation or breaches (Eden et al, 2024)
- *Consent and Transparency:* It is essential to make sure that student, their parents, or their guardians give their informed consent before any data is collected or used. Openness on the gathering, storing, and usage of data to ensure trust.

Bias and Fairness:

- *Algorithmic Bias:* Biases in the data that AI algorithms are educated on may be reinforced. This may result in unfair or biased outcomes for particular student groups.
- *Equity and Inclusion:* It is necessary to ensure that AI systems are designed and implemented in a way that promotes equity and inclusion, avoiding biases that may disadvantage marginalized students (Pisica et al, 2023)

Accessibility and Digital Divide:

- *Equity of Access:* The availability and affordability of technology and internet access can create a digital divide, limiting the remunerations of AI-powered education for learners in detriments societies.
- *Universal Design*: Guaranteeing that AI systems are considered to be accessible to all learners, as well as those with disabilities, is necessary for promoting inclusivity.

2.5 **Potential Developments and Future Directions in AI-driven Personalized Learning in Higher Education**

The term "personalized learning" refers to a range of initiatives designed to meet the unique interests and learning requirements of students from various backgrounds. In turn, this quest for knowledge inspires kids to learn more effectively. The elements of flexible learning environments, student choice, student involvement, and individual learning pathways were all investigated as part of customized learning (Peter et al, 2020). Personalized learning systems, often called adaptive learning platforms or intelligent tutoring systems, are among the most well-liked and successful applications of artificial intelligence (AI) to support educators and learners. Students can access a variety of learning resources through these platforms according to their individual learning needs and subjects (Selln et al 2022).

Artificial intelligence (AI)-driven personalized learning holds enormous prospective for transforming higher education. As technology continues to advance, we can anticipate several exciting developments in this field:

Enhanced Adaptive Learning Algorithms:

- Advanced Data Analysis: AI algorithms will become more cultured in studying vast amounts of learner data, including performance metrics, engagement levels, and learning styles.
- Real-time Adjustments: Personalized learning systems will be able to adapt instruction in real-time based on learners' evolving needs and preferences.

Integration of Natural Language Processing (NLP):

- Human-AI Interaction: NLP will make it possible for learners and AI-powered systems to engage in a more organic and intuitive way, enhancing and personalizing the learning process.
- Intelligent Tutoring: AI-powered tutors will be able to provide more personalized and effective leadership through natural language conversations.

- 3. **Expanded Access to Quality Education:**
- Bridging the Digital Divide: Personalized learning driven by AI can help close the digital divide by giving students in underserved or rural places access to high-quality education.
- Flexible Learning: AI-driven systems can enable flexible learning options, such as self-paced learning and micro-credentials, to meet the diverse needs of learners.

4. ***Ethical AI Development:***
   - Transparency and Accountability: Efforts will be made to ensure transparency and accountability in AI development, addressing concerns related to bias, privacy, and data security.
   - Human-Centered AI: AI will be developed with a focus on human-centered values, ensuring that it complements rather than replaces human educators.
5. ***Integration with Emerging Technologies:***
   - Virtual and Augmented Reality: By utilizing virtual and increased reality technologies, AI-driven tailored learning can be improved, resulting in immersive and interesting learning environments.

3. Block chain**:** Block chain technology can be used to ensure data privacy and security, as well as to facilitate the creation of digital credentials and certifications.(Ferrara 2023; Saputra et al, 2023; Pisica,2023 & Eden et al, 2024)

CONCLUSION

Artificial Intelligence has the capacity to revolutionize personalized learning in higher education by enabling individualized educational pathways that cater to each student's unique learning style, pace, and preferences. This paper has highlighted the significant theoretical foundations and current applications of AI in education, as well as the numerous challenges that hinder its widespread adoption, such as technological readiness, data privacy, and ethical concerns. While the adoption of AI in education is still in its early stages, the potential for future advancements, such as enhanced adaptive algorithms and more sophisticated AI-powered tools, presents opportunities for creating more inclusive and efficient educational systems. By addressing these challenges, AI has the potential to transform higher education and help bridge the digital divide, ensuring that all students have access to personalized learning experiences.

4. RECOMMENDATIONS

1. **Institutional Readiness and Investment:** Higher education institutions should invest in the necessary infrastructure to support AI-driven personalized learning platforms, including ensuring reliable internet access, power supply, and computing devices.

2. **Ethical Guidelines:** Educational policymakers must develop robust ethical frameworks to guide the use of AI in education, ensuring data privacy, security, and the avoidance of algorithmic biases that could affect marginalized groups.

3. **Teacher Training:** Educators should receive training on AI applications and their role in facilitating personalized learning, ensuring they can effectively integrate AI technologies into their teaching strategies.

4. **Research and Development:** Institutions should support ongoing research into the development of AI technologies tailored for personalized learning, with a focus on improving adaptive algorithms and natural language processing capabilities to enhance student engagement.

5. **Collaboration and Policy Support:** Policymakers should collaborate with educational institutions and technology providers to create supportive policies that encourage the adoption of AI technologies while addressing challenges such as cost, funding, and equitable access to resources.

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PAPER 9 - STUDENTS' PERCEPTION OF UTILIZING HYPERMEDIA PACKAGE IN BIOLOGY INSTRUCTION

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ABSTRACT

The study focused on hypermedia as a relevant innovative instructional strategy that has the potential of boosting the acquisition of knowledge and technological development, and investigated its influence on biology students' perception of using computer applications for learning in Lagos State Secondary schools. The sample selected for the study was 138 students selected randomly from five senior secondary schools in Lagos State. Two research questions and one null hypothesis guided the study. A hypermedia-based computer package called Foodkanal was developed and used to teach a topic in Biology. A questionnaire captioned Rating Scale on Content and Methodology (RSCM) was used to determine students' perception of learning with Foodkanal. Statistical t-test of mean differences was used to analyze the responses of male and female students. The content, structure and strategies of the hypermedia package were perceived by the students to be adequate for achieving the stated instructional objectives. Results revealed no significant difference between the mean responses of male and female respondents. The study recommends that science instructional text should be enhanced with contemporary computer-based tools like hypermedia and hypertext for better comprehension and to improve the knowledge base of learners in their subject areas. There should be support towards promoting local development of computer-based instructional package to enhance meaningful learning.

KEYWORDS: Computer-based Instruction, Hypermedia, Instructional Package.

INTRODUCTION

Technological development has come to be a prominent yardstick by which a nation is considered developed. The status of technology is one of the determinant factors for considering a nation as being great or otherwise. The skills and competencies needed by students' to survive in this era of globalization according to Colace, De Santo and Greco (2014) are: (i) Decision making skills (ii) problem-solving skills (iii) autonomous thinking skills (iv) diffused-thinking skills (v) effective thinking skills (vi) effective communication skills (vii) computer manipulation skills (viii) interpersonal-relation skills (ix) independent and autonomous learning skills.

The dynamics of technology have created a complete new world of learning in recent times that can assist learners acquire the required skills. Davies & Hewer (2012), & Nwaboku (2014) asserted that every country of the world is embracing new technology in order to stay current and be relevant in professional fields like medicine, transportation, manufacturing, entertainment, and education. Newly developed instructional software that integrates text, sound, and computer animation can now present content to students in a multimedia and hypermedia form that may maximize its effectiveness.

Hypertext/hypermedia system has been described as, providing a number of benefits for the learner, including: self -pacing, self -selective learning, individualized learning, allowing experimentation in a safe environment and much more (Alavarce & Pierin, 2011). By virtue of its enabling, rapid, non-linear access to multiple forms of information, hypermedia technology is considered a major advance in the development of educational tools to enhance learning.

According to Scheiter, Gerjets & Heise, (2014) hypermedia is the term used to describe software applications that facilitate navigation through associative linking within an information space. Unlike forms of media such as books or films, which the user can only go through in a straight sequence, hypermedia is a non-linear form of media; meaning that there are multiple ways you can see and navigate through the information stored within the program. Hypermedia environments have the potential to be powerful learning tools for fostering students' learning about complex topics. Hypermedia environments provide students with random, dynamic, nonlinear access to a wide range of information represented as text, graphics, animation, audio, and video (Hariri, & Roberts 2015). The potential use of hypermedia for learning is quite vast. Scheiter, Gerjets & Heise, (2014) reported that hypermedia has the ability to improve support in regards to learner motivation and retention of both knowledge and the use of knowledge. Hypermedia products that are designed well both in their aesthetic look and variety of media formats have a much higher chance of holding onto a learner's focus and attention span.

One other advantage of hypermedia is its ability to quickly allow users to follow associations and look up related material. References can be traced both backwards and forward in a way which can be difficult and time consuming with printed media, in addition, the user can annotate the material and create new references. According to Alavarce & Pierin, (2011), hypermedia has a strong potential for facilitating learning of applications since it encourages learning by exploration. They affirmed that while the students browse the materials, new information could be found and that new concepts can be triggered, which may result into chains of associations. The mixture of text, graphics, audio and video is not enough in itself to make a document a hypermedia document. Many multimedia systems are based mostly on displaying various forms of media to a passive user who does not get to control the navigation. Only when users interactively take control of a set of dynamic links among units of information can we define the system a hypermedia system.

Research reports have for instance positioned hypermedia as a flexible instructional environment that can accommodate variety of individual learner differences and cognitive styles. (Alavarce & Pierin, 2011, Scheiter, Gerjets & Heise 2014, Njoku, (2017). When viewed collectively, these studies report that advanced technologies, especially hypermedia instruction, which often involves introducing or enhancing the visual aspects of the presentation of course contents, created an active learning environment, improved students' performance, fostered positive attitudes toward learning complex concepts, increased communication, and could be adapted to all learning styles and levels of instruction. Hypermedia lessons which enhance visual have been considered as an urgent necessity for the teacher to explain biology in the classroom.

Since Vannevar Bush's ground-breaking article "As We May Think", the idea of using technology to link the world's information resources in new ways has been heralded by some as a revolutionary opportunity to design new instructional media. The term hypermedia is commonly used to refer to this type of information resources and is based on the term hypertext, coined by Ted Nelson around 1965 to refer to "non-sequential" or "non-linear" text where authors and readers were free to explore and to link information in ways that made personal sense for them (Davies & Hewer (2012). This technology is based on nodes or chunks of information that are linked together and which a user or learner can explore by following links they deem relevant. As abstract as this sound, the most obvious example of such an information space is the World-Wide Web, where the linked structure provides a practically never-ending opportunity for a user to explore multiple documents and to follow paths of exploration as they fancy. As with many new forms of media, hypermedia was initially touted as the harbinger of a new learning revolution as confirmed by Davies & Hewer (2012). . Hypermedia also caters for various learning styles and individual learning needs by providing information in a multitude of media formats. (Njoku, 2017).

In a study by Tondeur, van Braak, Sang, Voogt, Fisser, Ottenbreit-Leftwich (2012), students were introduced to various teaching principles verbally, which were then reinforced by one of four methods: the principle accompanied by a text example; the principle accompanied by a video example; the principle accompanied by a visual example from the teacher; or the principle not accompanied by any example. Each student was then given a conceptual test, an application test, and an opinion based survey. Students who were provided with video or in-person visualization showed enhanced

interest, as well as a stronger grasp of the material. Contrarily, students who were not given further explanation, and those who were given explanation via text did not show a difference in enthusiasm or comprehension of the material compared to the control group.

Despite all the advantages of hypermedia utilization in the teaching and learning situation, Nigerian schools are yet to harness this important instructional software for higher performance amongst learners. This prompted the study on the perception of the students on the use of hypermedia package on Biology as regards ease of use, navigation through pages, and access to more information.

The usefulness of ICT in Nigerian educational system is now generally accepted. It has been used in various forms in our educational system; like PowerPoint presentations, surfing the net (hypermedia/ hyper linking), computer assisted instruction (CAI) and various other relevant uses. However, actual classroom utilization in self-paced instruction is uncommon. For this reason, the hypermedia has been grossly underutilized by students of different cadres of learning.

This study utilized a hypermedia software application in developing an instructional package (Foodkanal) on Digestion. Specifically, the study sought to investigate the perception of students on hypermedia instructional package used for teaching.

Two research questions were raised to guide the study.

i. What was the students' opinion/perception on the use of hypermedia package for instruction?
ii. Will the package be similarly accepted by both male and female students?

The following null hypothesis guided the study:

Ho1. There will be no significant difference in the perception of male and female students on the use of hypermedia strategy for instruction?

METHODOLOGY

A descriptive survey was adopted for the design of this study. The study was carried out in five secondary schools in Education District VI of Lagos State. The population of the study comprised of all Senior Secondary II Students offering biology in Lagos State school system.

The sample for the study consisted of 138 (68 male and 70 female) year II biology selected students. The sample was purposively selected from five secondary schools (three of which were private and two public secondary school). The selection of schools was based on the following criteria:

i. Schools that have functioning computer systems.
ii. Willingness on the part of management to allow their teachers and students participate in the project.
iii. The students were not pre-occupied with any major examination for the period of the study.
iv. The students had been exposed to some pre-requisite biology concepts at SSI level on the SSCE biology syllabus.

The topic treated for the study (digestive system) was designed for SSII curriculum. The instruction was delivered through a hypermedia instructional package prepared by the researchers. A Rating Scale on Content and Methodology was used for data collection.

The instructional Package called Foodkanal was developed using an Interactive multimedia courseware production model adapted from Nicholson and Ngai (1996). A conceptual linking approach guided the development of the hypermedia procedure which involved the use of text, sound, still pictures, motion pictures, graphics and video. The package is basically learner-controlled and was designed using both linear and non -linear formats of programming. Learners had the option to choose the path, pace and sequence of learning. It is exclusively learner controlled thereby allowing the students to freely navigate at will. One distinguishing feature which is the learner-controlled feature is that

the learners could choose to navigate text, or listen to audio or watch the animation video of the lessons. Learners' access to the package is 'one student per computer'. The users were therefore provided flexibility in their navigation choices.

Foodkanal consisted of 102 screens; 4 screens were introductory, 3 were advance organizers, 6 were main menus, 50 were lessons content, 19 were dictionary, 10 were practice, and 10 were feedback. The hypermedia learning material provided participants with two types of navigation paths back-and-forward navigation tools. The users had a chance to navigate through the path structured by the programmer/researcher via the menu provided on each screen according to his or her own interest. Furthermore, the student could direct his learning process and evaluate his learning; the package has a dynamic structure that enabled the student to see if the answers s/he gave to the questions were correct or not.

The RSCM was used to collect learners' opinion on *Foodkanal* support for biology learning. This rubric for assessment was adopted from Fordon and Poast (2010) and consists of twenty four statements related to various educational aspects inviting response on four point scale. i.e. from strongly agree to strongly disagree. Scoring was done by assigning values of one to four for strongly disagree to strongly agree responses respectively. This instrument elicited students' perception of content presentation, questioning, individualization, and the whole impact of *Foodkanal* as compared to the traditional method of instruction.

The instruments were face and content validated. *Foodkanal* was packaged on CD-ROM. Copies were given to subject experts for appraisal of its suitability for the target population, coverage of content, adequacy and relevance of items. Vital inputs were made, corrections were effected on the package and the instrument was found fit for the study. The product was field tested to ascertain the relative effectiveness in the teaching of biology. The RSCM had a reliability of 0.75.

RSCM was administered directly on the respondents after they were taught using the Foodkanal Hypermedia package. Data collected from the RSCM was analyzed using mean scores and t-test at .05 level of significance.

FINDINGS

Results obtained from the analyzed data are presented in tables below based on the research question and hypothesis.

Students' perception of hypermedia package for instruction

Table 1 reveals that all responses given to the items on the RSCM had average mean rating of 3.39. This finding therefore, implied that the Hypemedia package Foodkanal explains vital points better and clearer as compared to their regular traditional method. The learners' preferred all subjects to be treated this way, it is effective and pleasurable, and brings reality into classroom and is more dynamic.

Table 1: Student's Perception on Hypermedia Package, *Foodkanal.*

s	ITEM	SA	A	D	S	Mean
1	The content of the package is well organized for learning.	65	69	-	-	3.49
2	The amount of information presented in the package is adequate to ıble me learn digestive system	76	57	1	-	3.54
3	The length of the package is adequate.	81	26	1	8	3.34
4	The content of the package is fully developed to help a weak learner.	60	62	6	6	3.31

5	The content explains the subject matter in a way that I can understand etter.	50	65	1	-	3.23
6	The package helps in understanding the lesson content and gives me ıfidence to explain the content to other students any time.	59	68	7	-	3.38
7	The information presented in the package is clear and not confusing.	47	71	1	-	3.23
8	The images do not distract attention from the content of the lesson.	58	66	1		3.35
9	I will prefer all other subjects to be treated this way.	70	60	2	2	3.46
1	The package motivates me and makes me want to learn more.	56	78	-	-	3.41
1	The package brings reality into the classroom.	53	79	2	-	3.38
1	The package makes biology teaching more creative.	64	62	6	2	3.42
1	The screen displays are readable, logically arranged and interesting to k at.	56	71	6	1	3.35
1	The images and animations make the whole lesson interesting.	63	68	2	1	3.44
1	The programme runs smoothly	56	76	-	2	3.38
1	The method keeps me glued to the screen to enjoy the lesson.	50	74	1	-	3.29
1	Package is very well designed and easy to use.	45	79	1	-	3.28
1	There is Glossary key for seeing the definition of difficult terms.	118	1	5	-	3.82
1	Slides are attractive and appealing.	49	70	1	2	3.23
2	Slides have clear titles, descriptions, and image captions.	69	62	2	1	3.51
	Grand mean					3.39

Perception of male and female students on hypermedia package for instruction?

Table 2. Independent t-test analysis comparing the perception of male and female Biology students exposed to hypermedia package of instruction.

Variables	N	Mean	SD	Df	t-cal	t-critical	Decision

Male	68	11.746	0.503	136	0.155	0.877	Do not Reject Ho1
Female	70	11.605	0.502				

Table 2 revealed that there was no significant difference in the perception of male and female learners exposed to hypermedia strategy of instruction. The mean of the responses obtained from male and female learners yielded a p value not significant at 0.05 alpha (t=0.15, df=136, p =0.877, α= 0.05). Since there was no significant difference between the mean responses of male and female learners that utilized hypermedia strategy, the null hypothesis of no significant difference was upheld. This implied that both male and female students find the strategies useful to enhance their learning of biology. This finding suggests that when students, whether male or female, are exposed to technological based strategies, level of acceptance will not vary.

In addition to the data analysed above, general observation on the attitude of students and their remarks showed a highly positive response to the use of *Foodkanal* for biology instruction. These obsevations are also discussed below.

Discussion of findings

Foodkanal improved the interest of SSII students towards learning biology. The majority of the respondents agreed with positive item and disagreed with negative items of the students rating scale on hypermedia on visual delivery which implied that the strategy was visual driving by making the content of the lesson more meaningful, more effective in retaining students' attention, making the content more understandable and faster to assimilate.

The positive responses could have been as a result of the distinctive pictorial features of concepts in the hypermedia package which attracted attention and made them make effort to decode and encode visual messages in the package. Most of the respondents stated that the use of *Foodkanal* as instructional technique was innovative, stimulated their interest and served to improve their study habit and also aided the recall of previously learnt concepts. They remarked that they felt challenged as they were compelled to read, interpret and understand the information presented in the *Foodkanal*.

The presentation of the animation prior to each lesson provided solid background knowledge to the subjects before the actual lesson. Their concentration during the course of using the package was enhanced by interest, ambition, novelty of the instructional strategy and utility. The respondents stated that the package was informative, educative and also served as a prompt in wanting to answer questions. They suggested that there was need to increase the scope beyond digestive system and that *Foodkanal* as an instructional strategy should encompass other subjects (not just biology). They also clamored for its incorporation into the normal everyday class lecture.

These remarks from the students were supported with those of Colace and De Santo (2014), Aman, Broege and Steinmetz (2006) who all mentioned in different studies that using hypermedia as instructional strategy creates a learning which is made richer and more meaningful as it provides enjoyable experiences which have specific purposes. The students also revealed that the strategy is not stressful, it is preferred to teacher and chalk-board, it gives confidence to explain content to other students any time and it supports individual learning. With these facts, the strategy is said to meet the lesson objectives. The strategy received favourable judgment in general objective delivery.

Students' rating scale on *Foodkanal* on visual delivery, Content Delivery and General Objective Delivery have proven the worth and impact of *Foodkanal* as instructional strategy that enhances learning and it is capable of delivering teaching objectives and influencing students' achievement. It is believed, that the effects of hypermedia instructional package, used in the current study, resulted from the use of animations that were attractive and age appropriate. Most relevant issues in teaching and learning process are to grasp and maintain the students' interest and concentration.

The instructional animation clip in *Foodkanal* was able to grab the students' attention. The educational agents, visuals and dubbing used in the software were designed in a way to attract student interest and students were highly interested in the software. Direct and active participation may have resulted from the fact, that *Foodkanal* was appropriate to students' mental development levels, suitable to their interests and social experiences, and inherently motivational and made lessons more interesting, fun and pleasant.

In recent times, students are fond of using technology. They use them so willingly and have more positive attitudes towards technology compared to the previous generation before them. Students' positive attitudes towards learning material affect their attitudes towards science and the learning subject positively. For this reason, using instructional materials preferred by students is inevitable because testimonies from the students during the course of the study exposed the fact that students non-recognition of computers as tools facilitating learning processes is as a result of the teaching - learning approaches in our educational system, the physical conditions and attitudes, beliefs and approaches of our teachers among others. Therefore, teachers should find alternative teaching methods for learning.

Most of the subjects stated that the use of hypermedia as instructional technique was innovative, stimulated their interest and served to improve their study habit and also aided the recall of previously learnt concepts. They remarked that they felt challenged as they were compelled to read, interpret and understand the information presented in the package. All the remark of the subjects are supported with those of Colace and De Santo (2014), Scheiter, Gerjets & Heise, (2014) who all mentioned in different studies that using hypermedia as instructional strategy creates a learning which is made richer and more meaningful as it provides enjoyable experiences which have specific purposes.

This finds relevance in the empirical findings of earlier studies which established positive effects of computer use, whether CBI or CAI, over the conventional method of instruction. For example, previous studies such as Egbunonu, & Ugbaja, (2011) and Akindoju (2013), found that computer software improved academic confidence and achievement of learners.

There is no significant effect of gender with regards to student perception in biology when the hypermedia package was utilized in learning. The non-significant effect of gender could be attributed to early exposure to technology for boys and girls. This finding corroborates the results of similar studies carried out by Aman, Broege and Steinmetz (2011) and Akindoju (2013). They also reported no significant gender effect on achievement in learning with computer strategies. The results of these studies are indicative of the fact that the male and female students enjoy about the same degree of academic freedom, with exposure to the same learning experiences, instructional facilities and resources.

In summary, it can be stated that *Foodkanal* in the classroom can effectively enhance the quality of student-instructor interaction, and engage the most vulnerable students who do not thrive in a conventional instruction environment. However, it is quite telling that in their comments, 75% of our students indicated that technology should supplement, and not replace, student-instructor interactions. We should therefore remember that technology is not a panacea for problems in the educational system, and that *Foodkanal* alone cannot equitably replace human interactions that contribute to learning.

CONCLUSION

Based on the findings of this study, it is concluded that utilization of hypermedia strategy which is a computer strategy of learning encourages high academic performance from students. The strategy made the learners to be involved in the teaching learning process. It has been found to improve cognitive achievement of students and could be regarded as a powerful tool to reinforce learning and motivate students. Hypermedia strategy of instruction can enhance students' understanding of biology concepts and acquisition of skills and improve their performances in the subject.

Gender of learners is not a factor in learning with ICT strategies, as both male and female students exposed to hypermedia strategy performed equally well.

RECOMMENDATION

Based on the findings of the study, the following recommendations are advanced

i. Hypermedia Instructional Package should be adopted to teach biology in secondary schools.

ii. Science instructional text should be enhanced with contemporary computer-based tools like hypermedia and hypertext for better comprehension and to improve the knowledge base of learners in their subject areas.

iii. Teacher training programs (both in-serving and pre-serving) also need to include courses on the use of computer-based tools and strategies in the curriculum. Where these courses already exist, it is important that teacher trainees be exposed to new and emerging tools and software that are relevant for the classroom and can motivate students.

iv. Education providers (government and private) should inject more funds into the provision of computer facilities in Nigerian schools.

v. Educational Technologists should be encouraged to develop varieties of hypermedia instructional packages on topics outlined for students in secondary schools curriculum. There should be support towards promoting local development of computer-based instructional packages to enhance meaningful learning.

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PAPER 10 - PRAGMATIC STRATEGY TO TEACHING AND LEARNING ELECTRICAL ELECTRONIC TECHNOLOGY IN THE 21ST CENTURY

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ABSTRACT

Education philosophers, school administrators, policymakers, parents, teachers, and students have all expressed great concern over the issue of what and how to educate in our schools. Idealist Plato holds that the teacher should be at the centre of all instructional activities in the classroom, whereas proponent of child-centred education Rousseau feels that students should be given thought and allowed to share their thoughts. A pragmatic finds a middle ground between the two viewpoints. They contend that instruction should make it possible for both educators and learners to actively engage in the teaching and learning process. In order to maximise the benefits for both teachers and students, it is critical to assess emerging technologies before incorporating their effects into traditional learning and teaching environments. Therefore, trustworthy approaches are needed to assess the efficacy of such emergent technologies for the benefit of educators, students, parents, and policymakers alike. Evaluating technology's impact on education is difficult, though. As a result, in this setting, the usefulness of conventional impact evaluations in education needs to be re-examined. Here, we offer a practical method for evaluating how developing technologies will affect electrical and electronic technology education in the twenty-first century. Three aspects of the study's testing of the pragmatic method on students include time, accuracy, and performance. 25 students were used in the study, which used a pragmatic method to introduce students to the fundamentals of electrical and electronic technology. After that, parametric analysis was applied to the achievement exam. The instrument's dependability index of 0.879 indicated that it was deemed legitimate and trustworthy. It took six months to administer the instrument. When compared to the previous method, the results demonstrate that employing a pragmatic strategy offers students more accurate tasks, a reduction in task completion time, and a performance improvement. In conclusion, a means of offering a shared understanding of the possibilities for pragmatic instruction and the most effective approaches to foster pragmatic development in the classroom should exist.

KEYWORDS*:* Pragmatism, Pragmatic Strategy, Electrical Electronic, Technology, 21s Century

INTRODUCTION

Higher education institutions face new challenges in the linked world of today, including how to help students launch new jobs, advance their professional growth, and acquire the skills they need to engage successfully in the twenty-first century (Berti, 2020). A pragmatic strategy is one that solves strategic difficulties by striking a balance between ethics, innovation, and pragmatism. It seeks to succeed while taking cultural quirks and practical limitations into account. Instead of rigorously following preset patterns, it necessitates originality, which promotes innovative problem-solving and adaptation to particular settings. It also involves ethics, which is a crucial factor. In addition to businesses, it aims to benefit communities, society, and the environment. To do this, it necessitates cultural sensitivity by comprehending local contexts and cultural variations, which are essential for practical solutions that work. The definition of pragmatics is the ability to approach an issue in a way that makes sense and fits the actual circumstances, as opposed to adhering to rigid theories, concepts, or regulations. According to the educational

concept of pragmatism, learning should equip students with life skills and help them develop into better individuals (Rai & Lama, 2020).

Rapid technological improvements in the 21st century have had a significant impact on many disciplines, including education. Electrical and electronic technology is one such field that has shown substantial advancement (EET). The methods used in EET teaching and learning must change as we move through a period marked by innovation and digital transformation to satisfy the evolving needs of the students and the industry. Pragmatism, according to Axtelle (1968), enhances the teaching of philosophy when it is applied to issues in the subject. It accomplishes this by demystifying and elucidating the nature of its issues and offering methods for comprehending and assessing their impact on educators and learners.

Using cutting-edge technological tools and contemporary pedagogical approaches to improve the educational process is a pragmatic approach to teaching and learning electrical and electronic technology. This approach aims to make learning more interactive, engaging, and successful by reconsidering established teaching methods in addition to integrating new technologies into the curriculum.

In this sense, pragmatism in education stresses real-world, hands-on experiences that get students ready for issues they'll face in the real world. It promotes a dynamic, adaptable curriculum that can change to meet industrial norms and technological breakthroughs. It also emphasizes the value of critical thinking, problem-solving, and ongoing education—three abilities that are crucial for any professional in the quickly evolving field of electrical and electronic technology.

The main components of a pragmatic approach to teaching and studying EET in the twenty-first century will be covered in this introduction. The integration of digital resources, the value of experiential learning, and the responsibility of educators in creating a supportive learning environment will all be covered. Adopting these tactics can help educational institutions better educate students for success in the Electrical and Electronic Technology profession, which will benefit the industry and society at large. Lumpkin (2020) outlined five components of an effective teaching and learning process: teachers introducing the course's disciplinary content; teachers conveying information in a way that persuades students of the value of listening to them; teachers facilitating interactive classes that use a range of instructional approaches interspersed with stimulating learning activities; teachers reinforcing learning through learning assessments; and students applying newly acquired knowledge and skills.

LITERATURE REVIEW

The subject of Electrical Electronic Technology (EET) has seen tremendous improvements and changes in the twenty-first century. Effective teaching and learning techniques are essential as technology advances to guarantee that students are ready for the demands of the workforce. This literature review examines practical approaches to teaching and learning EET, highlighting the significance of modifying instructional tactics to align with pedagogical theories and modern technology breakthroughs. The literature review was done based on the following subheadings:

Technological Integration in EET Education

Digital Tools and Resources

The teaching and learning process has been completely transformed by the use of digital tools and resources in EET education. Research indicates that the utilization of virtual reality, online laboratories, and simulation software can improve students' comprehension of intricate electrical principles. (Gustavsson, 2003). Students can virtually develop and test circuits, for example, using programs like MATLAB and Multisim. This is a safe and affordable way for them to learn theoretical topics. Digital technologies have enormous potential to change professional development activities for teachers and the way that teacher education is delivered during the course of their careers, according to Andreea (2020). Similarly, digital teaching aids have been demonstrated to be a promising addition to

this aim, according to Jasmin et al. (2023). The need to create digital learning tools that can be used in instruction is still important, even though the associated demands in teacher education have been rising recently.

Blended Learning Approaches

In EET education, blended learning—which blends traditional in-person instruction with online learning—has shown to be successful. Blended learning environments, according to Graham (2006), are flexible and can accommodate various learning styles, which improves student engagement and outcomes. With this method, students can gain practical experience and face-to-face interaction with teachers in the classroom while simultaneously having the flexibility to access materials and resources at their own speed online. Promoting meaningful teaching and learning in higher education is both possible and strongly supported by it (Moraes, 2023). Through an efficient fusion of traditional classroom instruction with online, mobile, and trainer-focused activities, blended learning offers creative alternatives for education to educators, trainers, and students. The fundamental tenet of blended learning is that education is a continual process rather than a one-time occurrence (Rao, 2019). Blended learning, as defined by Lalima & Kiran (2017), is a novel idea that combines the benefits of both conventional classroom instruction with ICT-supported learning, including both online and offline learning.

Pedagogical Strategies for EET

Problem-Based Learning (PBL)

PBL, or problem-based learning, is a student-centred method in which students collaborate to find answers to real-world problems. Because it mimics the problem-solving character of the sector, this approach has been very successful in EET education (Hmelo-Silver, 2004). PBL fosters critical thinking, creativity, and the application of information in real-world contexts—all crucial competencies for EET professionals. In higher education institutions, problem-based learning (PBL) contributes to the teaching and learning strategies of the twenty-first century (Hawamdeh & Adamu, 2021). According to Ali's (2019) research, problem-based learning is an instructional approach where students gain knowledge by solving challenging, open-ended issues. These are real-world issues that are meant to stimulate students' understanding of concepts and ideas. PBL is an approach to the curriculum as well as a teaching methodology. It can foster lifelong learning, critical thinking, problem-solving, and communication skills.

Collaborative Learning

Peer-to-peer instruction and group projects are two examples of collaborative learning practices that have been demonstrated to improve students' comprehension and retention of EET topics (Johnson, Johnson, & Smith, 1998). In the engineering field, collaboration and communication skills are essential, and collaborative learning helps to develop these. Students who collaborate are better able to discuss different viewpoints and find solutions to issues more quickly. According to Salma (2020), collaborative learning is predicated on group projects. Learners can gain from one another as they work in small groups to complete a task and look for understanding. For students, the use of collaborative learning offers a number of benefits. It gradually improves learners' experiences and aids in the growth of social communication. According to Amalia (2018), students need to focus on communication and teamwork in order to be ready for the increasingly complicated work and life contexts of the twenty-first century. Students need to have strong collaboration skills in order to equip themselves with the knowledge and abilities needed to collaborate with varied teams in the future. Therefore, collaborative learning (CL) is very important and is thought to help pupils think at a higher level and retain material longer than solitary learning.

Curriculum Development and Industry Collaboration

Industry-Relevant Curriculum

Creating a curriculum that is in line with business requirements is essential to getting pupils ready for the workforce. A 2009 study by Nair, Patil, and Mertova found that cooperation between academic institutions and business partners helps guarantee that the curriculum is current and relevant. Industry professionals in curriculum creation, internships, and co-ops that give students real-world experience can be involved in this partnership. According to Manivannan & Suseendran (2017), the curriculum is more sensitive to the demands of business and equips students with the employability skills and moral principles needed to handle the challenges of a changing global economy. Collaboration between universities and industry has many benefits and is important, especially when it comes to designing and delivering curricula. It turned out to be a useful instrument for bridging the knowledge gap in the field of Manufacturing Engineering education between industry demands and academic institutions. In addition, the methodology can be used in any field of education and is generalizable (Valiente et al. 2022)

Continuous Professional Development for Educators

Teachers need to be up to date on pedagogical approaches and technology developments in order to teach EET effectively. Programs for continuous professional development (CPD) can assist teachers in gaining new abilities and information, enabling them to provide high-quality instruction (Villegas-Reimers, 2003). Workshops, conferences, and seminars centred on the most recent advancements in EET and instructional techniques might be included in CPD. According to Rajendran et al. (2023), active engagement in thoughtfully planned Continuing Professional Development efforts is positively correlated with teacher job satisfaction, enhanced instructional efficacy, and a higher probability of sticking with the profession. To enhance institutional performance and student learning outcomes, educational leaders must prioritize continuous professional development (CPD) (Faizuddin, 2022).

CHALLENGES AND SOLUTIONS

Keeping Up with Technological Developments: Keeping up with the quick rate of technological development is one of the biggest issues facing EET educators. Institutions need to make investments in cutting-edge tools and supplies, and teachers need to keep up with the latest developments in their fields. By forming alliances with businesses, educational institutions can gain access to cutting-edge equipment and expose students to business methods as they exist today.

Engaging varied Learners: Another difficulty is interacting with a varied student body that has differing learning styles and readiness levels. Diverse learning requirements can be satisfied by utilizing a range of instructional strategies, such as lectures, practical laboratories, and internet resources. Furthermore, offering assistance to pupils in the form of mentorship and tutoring can help them achieve.

The following research questions guide the study:

- ✓ Is there any significant change in the performance of students before exposing them to pragmatic strategy and after exposing them to pragmatic strategy?

- ✓ Is there any significant change in the accuracy of students before exposing them to pragmatic strategy and after exposing them to pragmatic strategy?

- ✓ Is there any significant time spent on change before and after intervention?

METHODOLOGY

Practical, student-centred approaches that use contemporary technologies and pedagogical methodologies are the hallmark of the methodology for a pragmatic strategy in the teaching and learning of Electrical and Electronic Technology (EET). This method seeks to give pupils the abilities and information needed to prosper in a technological environment that is changing quickly. To give a thorough grasp of the efficacy of the teaching and learning tactics, the research design uses quantitative approach data. 25 people were sampled for the study. In the course of the EET program, data was gathered in the classroom through classroom observation, which engaged the teacher and students. planned trips to different lectures in order to watch classes and methodically document observations. The creation of problems with real-world applications for students to solve informed the development of teaching and learning methodologies, promoting critical thinking and the application of theoretical knowledge. PBL activities are designed in accordance with industry norms and the latest developments in technology. It took six (6) months to administer the observation and score. Using parametric type analysis, SPSS statistics was used for the analysis.

RESULTS

RQ1: Is there any significant change in the performance of students before exposing them to pragmatic strategy and after exposing them to pragmatic strategy?

Table 1: Paired Samples Statistics for Research Question One

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Performance score before practical	36.3200	25	12.66465	2.53293
	Performance score after practical	87.1200	25	6.77200	1.35440

Table 2: Paired Samples Test for research question one

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Performance score before practical - Performance score after practical	-50.80000	15.22060	3.04412	-57.08275	-44.51725	-16.688	24	.000

A paired-sample t-test was conducted to evaluate the impact of the pragmatic strategy on students' performance in EET. There was a statistically significant increase in the performance before (M=36.3200, SD=12.66465) and in the performance after [M=87.1200, SD=6.77200, t(24)= -16.688, p <0.0001 (see Table 1 and 2)

RQ2: Is there any significant change in the accuracy of students before exposing them to pragmatic strategy and after exposing them to pragmatic strategy?

Table 3: Paired Samples Statistics for Research Question Two

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Accuracy observed before practical	2.7200	25	.93630	.18726
	Accuracy observed after practical	7.6800	25	1.02956	.20591

Table 4: Paired Samples Test for Research Question Two

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Accuracy observed before practical - Accuracy observed after practical	-4.96000	1.64520	.32904	-5.63910	-4.28090	-15.074	24	.000

A paired-sample t-test was conducted to evaluate the impact of the pragmatic strategy on students' accuracy in EET. There was a statistically significant increase in the accuracy before (M=2.7200, SD=.93630) and in the accuracy after [M=7.6800, SD=1.02956, t(24)= -15.074, p <0.0001 (see Table 3 and 4)

RQ3: Is there any significant time spent on change before and after intervention?

Table 5: Paired Samples Statistics for Research Question Three

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Time spent before pragmatic strategy	15.2800	25	5.29560	1.05912
	Time spent after pragmatic strategy	9.6400	25	1.31909	.26382

Table 6: Paired Samples Test for Research Question Three

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Time spent before pragmatic strategy - Time spent after pragmatic strategy	5.64000	5.12250	1.02450	3.52554	7.75446	5.505	24	.000

A paired-sample t-test was conducted to evaluate the impact of the pragmatic strategy on students' time spent in EET. There was a statistically significant decrease in the time spent before the intervention (M=15.2800, SD=5.29560) and in the time spent after intervention [M=9.6400, SD=1.31909, t(24)= 5.505, p <0.0001 (see Table 5 and 6)

DISCUSSION

It is evident that using the pragmatic approach to EET has a significant impact on students' performance. The performance of the students has improved evidently after the intervention, as Tables 1 and 2 demonstrate. This claim is consistent with Rai & Lama's (2020) description of pragmatism as an educational philosophy that teaches students life lessons that are applicable to real-world situations and motivates them to become better individuals. Furthermore, according to Axtelle (1968), pragmatism enhances the teaching of philosophy when it is applied to issues in the subject. It accomplishes this by demystifying and elucidating the nature of its issues and offering methods for comprehending and assessing their impact on educators and learners. Additionally, it was noted that pupils' accuracy had improved as compared to the non-intervention period. According to Limpao & Nabua (2019), pragmatism is a philosophy that teaches students to look for the methods and actions that would best enable them to accomplish their goals. As a result, the method aids in raising students' accuracy. It was observed that after introducing the pupils to pragmatic strategy, the amount of time spent on the tasks decreased. According to Nonaka & Zhu (2012), pragmatic strategy focuses on strategizing in an original, morally sound, and practical way. In conclusion, the study showed that students' performance, accuracy, and amount of time spent doing laboratory tasks would all significantly improve when pragmatic technique was used in EET teaching and learning.

CONCLUSION

The integration of digital resources, the use of blended and collaborative learning methodologies, and the creation of an industry-relevant curriculum are all part of the pragmatic approach to teaching and studying electrical and electronic technology in the twenty-first century. Teachers can equip students for successful employment in EET by tackling the obstacles and seizing the opportunities brought about by technology breakthroughs. To guarantee that EET education is effective and current, strong industry ties and ongoing professional development for educators are crucial.

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PAPER 11 - ETHICAL IMPLICATIONS OF ARTIFICIAL INTELLIGENCE DEPLOYMENT IN NIGERIA: NAVIGATING CHALLENGES AND ENSURING EQUITABLE ACCESS.

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ABSTRACT

This paper examines the ethical implications of artificial intelligence deployment in Nigeria: Navigating Challenges and Ensuring Equitable Access. The paper assessed that artificial intelligence (AI) has emerged as a transformative technology with the potential to revolutionize various industries and significantly impact our daily lives. The paper agreed that artificial intelligence can be used to distribute false information, create false news, and can be used as surveillance to malign someone's reputation during electioneering campaigns. The study hinges on the Capability approach proposed by Amartya Sen and Martha Nussbaum and the Theory of Distributive Justice proposed by John Rawls. Having explored several key ethical considerations in AI development and deployment which include; transparency and explainability, fairness and accountability, privacy and data protection, human control and autonomy, social and economic impacts, and international cooperation and regulation. The study concludes that ultimately, ensuring ethical considerations in AI is an ongoing and evolving process. It requires continuous evaluation, adaptation, and refinement as technology advances, societal needs evolve, and new challenges emerge. By embracing these ethical considerations, we can shape AI technologies to serve the best interests of humanity and contribute to a more equitable and sustainable future. however, the study recommends that the government formulate national AI policies that provide clear guidelines and regulations to govern AI development and deployment this will help to establish ethical standards and guidelines to ensure AI applications respect human rights, privacy, and fairness. And further strengthen data protection laws to secure personal data and ensure citizens' privacy.

KEYWORDS: Artificial Intelligence, Implications, Deployment, Transformative Technology.

INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative technology with the potential to revolutionize various industries and significantly impact our daily lives. From autonomous vehicles and healthcare diagnostics to personalized recommendations and social media algorithms, AI systems are becoming increasingly pervasive (Akinadewo et al., 2023). However, as AI advances and becomes more integrated into society, it is crucial to address the ethical considerations associated with its development and deployment. AI systems are designed to learn, adapt, and make decisions based on vast amounts of data, often surpassing human capabilities in speed and accuracy (Dagunduro et al., 2023). While this offers tremendous opportunities for innovation and efficiency, it also raises profound ethical questions. The immense power and potential consequences of AI systems necessitate thoughtful reflection on the values, principles, and implications underlying their design and use. However, according to Grupta (2018), AI refers to the development of machines or systems that possess the ability to understand, learn, and apply knowledge across a wide range of tasks and domains, mimicking the cognitive abilities of human beings. Unlike narrow AI systems designed for specific tasks, Artificial general intelligence (AGI) aims to achieve a level of intelligence that is comparable to or exceeds that of humans, allowing for flexible and autonomous problem-solving (Obaid 2023).

Emerging as a transformational technology, AI can radically alter many different sectors and greatly affect our daily lives. AI systems are finding more and more uses in a wide variety of fields, including healthcare diagnostics, autonomous vehicles, personalized recommendations, and algorithms utilized by social media platforms (Ivy et al., 2020). In light of AI's ongoing evolution and growing social integration, we must resolve the ethical concerns associated with its research and implementation.

LITERATURE REVIEW

Artificial Intelligence (AI)

AI refers to the development of computer systems or software that can perform tasks that typically require human intelligence. These tasks include learning from experience, adapting to new information, understanding natural language, recognizing patterns, solving problems, and making decisions Dagunduro et al., (2023). AI systems are designed to simulate cognitive functions, enabling machines to execute complex tasks and exhibit behaviours traditionally associated with human intelligence. AI encompasses various subfields, such as machine learning, natural language processing, computer vision, and robotics, contributing to the creation of systems capable of perceiving, reasoning, and learning from data (Akinadewo, 2021; Akinadewo et al., 2023). In the context of the deployment of AI and emanating challenges, AI refers to the application of advanced computational technologies that simulate human-like intelligence to enhance various aspects of human activities. AI technologies aim to streamline processes, reduce manual efforts, and enhance the ability to uncover insights from complex datasets, ultimately improving quality and thoroughness. When faced with large amounts of data, AI systems can often learn and adapt more quickly and correctly than people Konidena et al., 2024 However, as AI becomes deeply embedded in organizational workflows, the ethical implications of its deployment come to the forefront, prompting the need for a thoughtful examination of responsible AI practices and corporate responsibility, that impact individuals and societies (Aithal, 2023). Recognizing and addressing biases is essential to prevent discriminatory outcomes, particularly in areas like hiring, lending, and law enforcement where AI is increasingly applied. Socio-economic impact is another ethical facet that cannot be overlooked. AI is a complex configurable package of technologies, featuring machine learning, constituting a new general-purpose technology characterized by unforeseen and non-linear development and unintended outcomes (Kinder et al., 2023).

Nevertheless, the world is entering a stage of innovative transformation, and we will be surprised at the scale of technological development. One of the surprising developments is what artificial intelligence intelligent machines can offer. But we should note that with the breakthrough development, comes new responsibilities and problems one should take cautious steps to make the right decisions that are not injurious or an infringement on people's rights (Aithal, 2023). Hence, harnessing and controlling technological developments so that they can fulfill their primary purpose instead of going overboard and causing harm. This is one of the important pieces of information that humans forget to have at the back of their minds. According to Dagunduro (2023), by far, the greatest danger of artificial intelligence is that people conclude too early that they understand it. One of the fundamental problems of artificial intelligence is the human inability to harness the potentialities of artificial intelligence. However, despite the negative impacts of artificial intelligence, it has a myriad of positive implications for human betterment Ivy, et al., (2020).

Theoretical Framework

The theories used in the research include the capability approach and distributive justice Theory; each of these ideas offers support and a detailed understanding of the concepts.

Capability Approach

The capability approach was developed by Amartya Sen and Martha Nussbaum, they focused on the expansion of human capabilities and the freedom to achieve valuable functioning. The capacity approach is a framework that focuses on enhancing the capabilities and freedoms of individuals and communities to lead the kind of lives they have reason to value. In the context of AI deployment in Nigeria, the capacity approach can be particularly relevant in ensuring equitable access and addressing ethical concerns.

One key aspect of the capacity approach is the emphasis on expanding people's real freedoms and opportunities, rather than just focusing on economic growth or other narrow metrics. When it comes to AI deployment, this means considering how the technology can enhance the capabilities of all members of society, rather than just benefiting a privileged few.

For example, the deployment of AI-powered healthcare solutions in Nigeria could significantly improve access to medical care, especially in underserved rural areas. However, it is essential to ensure that the deployment of such technologies does not exacerbate existing disparities in healthcare access. The capacity approach would encourage policymakers and stakeholders to consider how to empower and enable all Nigerians, regardless of their socioeconomic status or geographic location, to fully benefit from these technologies.

Similarly, the capacity approach highlights the importance of addressing ethical concerns, such as algorithmic bias, privacy, and the potential displacement of jobs. By focusing on expanding people's real freedoms and opportunities, the capacity approach would encourage a holistic consideration of the societal implications of AI deployment, rather than just the potential economic benefits.

Social Justice and Fairness Framework

Social Justice and Fairness theory also known as the theory of distributive justice was proposed by American political philosopher John Rawls in 1971 through a seminar work titled “A Theory of Justice”.

Social justice and Fairness theory emphasize the importance of ensuring equitable access and distribution of resources, opportunities, and rights within a society. The ethical implications of AI deployment in Nigeria must be considered through this lens, as AI has the potential to both exacerbate and mitigate existing social and economic disparities.

One key aspect of social justice is the fair and equitable distribution of the benefits and burdens of technological advancements. In the context of AI deployment in Nigeria, it's important to ensure that the benefits of AI-powered solutions, such as improved healthcare, education, or financial services, are accessible to all segments of the population, regardless of their socioeconomic status, geographic location, or other demographic factors.

Fairness theory also emphasizes the importance of procedural justice, which requires that decision-making processes and the implementation of policies and interventions are transparent, inclusive, and accountable. In the case of AI deployment, this means that the development, deployment, and governance of AI systems should involve diverse stakeholders, including marginalized communities, to ensure that their needs and concerns are adequately addressed.

The ethical implications of AI deployment in Nigeria must be grounded in the principles of social justice and fairness, ensuring that the benefits and risks of this technology are equitably distributed and that the deployment process is transparent, inclusive, and accountable. This will be crucial in navigating the challenges and ensuring equitable access to the transformative potential of AI in the Nigerian context.

Frameworks for Responsible AI Development and Deployment

Implementing safety measures is essential to mitigate risks and ensure the safe operation of AI systems. This includes developing robust testing and validation protocols, incorporating fail-safe mechanisms and emergency shutdown procedures, and establishing safeguards against unintended consequences and adversarial attacks. Promoting transparency in AI development and deployment is essential for fostering trust, accountability, and responsible AI practices. This involves disclosing information about data sources, model architectures, and decision-making processes to enable stakeholders to understand and scrutinize the behavior of AI systems. Transparent reporting and documentation practices facilitate ethical auditing, algorithmic accountability, and public oversight of AGI technologies, helping to address concerns related to bias, fairness, and discrimination (Busuioc, 2021).

Ethical governance frameworks are crucial for guiding the design, implementation, and use of AGI systems by ethical principles and societal values (Baker-Brunnbauer, 2021).

AI And Ethical Considerations

Equitable Access and Bias

Fairness and the mitigation of bias are critical ethical considerations in the development and deployment of artificial intelligence (AI) systems. AI algorithms learn from vast amounts of data, and if that data contains biases or reflects existing social inequalities, the AI system may inadvertently perpetuate or amplify those biases, resulting in unfair or discriminatory outcomes (Rivis-Tipei, 2023). Ensuring fairness in AI systems involves treating individuals equitably, regardless of their race, gender, age, or other protected characteristics. It requires addressing biases that may arise at various stages of AI development, including data collection, algorithm design, and deployment Karimian, et al (2021). One key aspect of promoting fairness is to address biases in training data. AI algorithms learn patterns from historical data, and if that data is biased, the system may reproduce and reinforce those biases. For example, if a hiring algorithm is trained on historical data that reflects gender or racial biases in hiring decisions, it may perpetuate those biases when making new hiring recommendations. To mitigate this, developers must carefully curate and preprocess training data, ensuring it is diverse, representative, and free from discriminatory biases (Adams et al., 2023). Algorithmic fairness also requires evaluating and mitigating biases during the design and development of AI systems. This involves assessing the potential disparate impact of AI algorithms on different groups and taking proactive measures to minimize such disparities. Techniques such as fairness-aware learning, bias detection, and fairness constraints can help identify and mitigate biases in AI models. Regular auditing and testing of AI systems can uncover any unintended biases that may emerge during deployment (Herington & McCradden, 2023).

International Cooperation and Regulation: International cooperation and regulation are essential ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI technologies transcend national boundaries and have global implications, it is crucial to foster collaboration and establish frameworks that promote responsible and ethical AI practices on an international scale.

Social and Economic Impacts of AI Deployment

Social and economic impacts are significant ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI technologies continue to advance, they have the potential to profoundly affect various aspects of society, including employment, inequality, privacy, and access to services. Ensuring that the development and deployment of AI systems lead to positive social and economic outcomes is crucial.

Employment: AI technologies have the potential to automate tasks traditionally performed by humans, which could lead to job displacement and changes in the labour market. It is important to consider the potential impacts on employment and develop strategies to mitigate negative consequences. This may involve reskilling and upskilling programs to help individuals transition to new roles and industries, promoting lifelong learning, and fostering collaboration between humans and AI systems to enhance productivity and job satisfaction.

Adoption and Use of AI in Nigeria

AI is being increasingly adopted across various sectors in Nigeria, leveraging its potential to address unique challenges and enhance efficiency. Here are some examples of how AI is being utilized in different sectors:

In the healthcare sector, AI-powered systems are used to assist doctors in diagnosing diseases from medical images like X-rays and MRIs. For instance, LifeBank, a Nigerian startup, uses AI to optimize the delivery of blood and oxygen supplies to hospitals, improving emergency response times. Platforms like Kangpe use AI chatbots to provide medical consultations and advice, especially in remote areas with limited access to healthcare professionals. AI-driven tools are helping farmers to monitor crop health, predict weather patterns, and optimize the use of resources like water and fertilizers. For example, Nigeria's Thrive Agric uses AI to provide farmers with data-driven insights, enhancing productivity and sustainability. Companies like FarmCrowdy employ AI to manage agricultural supply chains, connecting farmers with markets and optimizing the logistics of farm produce delivery.

Financial institutions are using AI to detect fraudulent activities by analyzing transaction patterns. Systems can flag unusual transactions and reduce the risk of fraud. Interswitch, a major fintech company in Nigeria, uses AI for these purposes. AI algorithms help assess the creditworthiness of individuals who lack traditional credit histories, facilitating access to loans for small businesses and individuals. Startups like Lydia are implementing such AI solutions. Education Technology platforms are utilizing AI to offer personalized learning experiences to students. Companies like Ulesson provide tailored educational content and interactive lessons based on students' learning paces and needs. AI tools help educational institutions in administrative tasks such as scheduling, grading, and managing student records, thereby reducing the burden on teachers and administrators.

AI is used in the energy sector for predictive maintenance of equipment, helping to prevent failures and reduce downtime. Nigeria's energy companies are adopting AI to monitor infrastructure and improve operational efficiency. AI algorithms assist in managing electricity grids by balancing supply and demand, predicting peak usage times, and optimizing energy distribution. This is particularly crucial in Nigeria, where energy supply can be erratic. AI is employed in surveillance systems to enhance security. Facial recognition and predictive analytics help in identifying potential threats and preventing crimes. The Nigerian police and private security firms are increasingly using these technologies. AI tools are crucial in identifying and mitigating cyber threats. They help in real-time monitoring of network traffic and detecting unusual patterns that could indicate cyber-attacks. Many Nigerian businesses are using AI-powered chatbots to improve customer service. These chatbots can handle a wide range of customer inquiries, providing quick and accurate responses. Examples include Kudi.ai, which offers financial services via a chatbot. AI helps logistics companies optimize delivery routes, reducing travel time and costs. Companies like Kobo360 use AI to streamline their logistics operations, ensuring efficient cargo delivery. AI is integral to the operation of ride-hailing apps like Bolt and Uber, which use algorithms to match drivers with passengers, predict demand, and set dynamic pricing.

AI is used by telecom companies to manage network traffic, predict outages, and optimize service delivery. MTN Nigeria, for example, uses AI for network management and customer support. AI analytics help telecom companies understand customer behaviour and preferences, allowing for more targeted marketing and improved customer experiences. AI is proving to be a transformative force across various sectors in Nigeria, addressing local challenges and fostering innovation. As AI technologies continue to evolve, their impact on Nigeria's economic and social landscape is expected to grow significantly.

Navigating the Challenges of Equitable AI Access.

Transparency: One of the primary ethical considerations is transparency and explainability. AI algorithms can be complex and opaque, making it challenging to comprehend how they arrive at specific decisions or predictions. This lack of transparency raises concerns about accountability, trust, and the potential for biases or discriminatory outcomes (Kaledio & Lucas, 2024). Addressing these issues requires developing AI systems that can provide clear explanations for their outputs, enabling users to understand and evaluate the reasoning behind their decisions. Transparency and explainability are fundamental ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI algorithms become more complex and sophisticated, it becomes

increasingly challenging to understand how these systems arrive at their decisions or predictions (Bankins & Formosa, 2023). This lack of transparency not only hampers trust in AI but also raises concerns about accountability, fairness, and potential biases.

Privacy and Data Protection

Privacy and data protection are significant ethical considerations in the development and deployment of artificial intelligence (AI) systems. AI often relies on vast amounts of personal data to train models, make predictions, and drive decision-making processes. Safeguarding user privacy and ensuring robust data protection measures are essential to maintain public trust, respect individual rights, and mitigate potential risks associated with the use of AI technologies (Karimian et al., 2021). Respecting privacy entails protecting individuals' personal information and ensuring that it is collected, stored, and processed securely and confidentially. AI systems must adhere to legal and ethical principles such as informed consent, purpose limitation, data minimization, and data retention limitations. These principles ensure that personal data is collected only for specific, legitimate purposes and is not used or retained beyond what is necessary (Rivis-Tipei, 2023). Data protection is closely intertwined with privacy and involves implementing technical and organizational measures to safeguard personal data from unauthorized access, disclosure, alteration, or destruction. Encryption, access controls, secure storage, and data anonymization are examples of measures that can be employed to protect personal data in AI systems. Privacy-by-design and privacy-enhancing technologies are approaches that aim to embed privacy considerations throughout the AI system's lifecycle. By integrating privacy features and safeguards from the early stages of development, organizations can proactively address privacy concerns and minimize the potential for data breaches or misuse (Adams et al.,.2023).

Accountability and Liability

Accountability and liability are crucial ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI technologies become more autonomous and make decisions that impact individuals and society, it is essential to establish mechanisms to attribute responsibility and address potential harm or negative consequences (Kinder et al., 2023; Karimian et al., 2021). Accountability refers to the ability to assign responsibility for AI system behaviour and outcomes. It involves identifying the individuals, organizations, or behaviours that are responsible for the development, deployment, and operation of AI systems. Clear lines of accountability ensure that there are designated parties who can be held responsible for the actions and decisions of AI systems. In the context of AI, accountability can be distributed among various stakeholders, including developers, data providers, system operators, and users (Akinpelu & Akintola, 2023). Developers are responsible for ensuring that AI systems are designed with ethical considerations in mind and that appropriate safeguards are in place. Data providers must ensure the quality, accuracy, and legality of the data used to train AI models. System operators are accountable for the proper deployment, monitoring, and maintenance of AI systems. Users also have a responsibility to understand the limitations and potential biases of AI systems and appropriately use them (Bankins & Formosa, 2023).

Safety and Security

Safety and security are paramount ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI technologies become more complex and autonomous, ensuring the safety of AI systems, and safeguarding them against potential security vulnerabilities is essential to protect individuals, organizations, and society as a whole (Kaledio & Lucas, 2024). Safety in AI systems refers to the prevention of harm or adverse consequences resulting from the operation or behaviour of AI technologies. It involves identifying and mitigating risks associated with AI systems to ensure that they operate reliably and do not pose threats to human well-being or the environment (Bankins & Formosa, 2023). To promote safety, AI developers should employ rigorous testing and validation procedures throughout the development process. This includes conducting thorough risk assessments, testing for possible failure modes, and implementing appropriate safeguards and fail-safe mechanisms. Furthermore, developers should strive for transparency in AI system behaviour, ensuring that system outputs and decision-making processes are understandable and explainable (Obaid, 2023).

Human Control and Autonomy

Human control and autonomy are critical ethical considerations in the development and deployment of artificial intelligence (AI) systems. As AI technologies advance and become more autonomous, it is important to strike a balance between the capabilities of AI systems and the need for human oversight and decision-making. Human control refers to the ability of humans to maintain authority over AI systems, ensuring that they operate within ethical and legal boundaries. It recognizes that ultimate responsibility and accountability for AI system behaviour should rest with human beings. Human control involves the ability to supervise, intervene, and override AI system decisions when necessary. Maintaining human control over AI systems is crucial for several reasons. First, it helps prevent potential biases, discrimination, or unfair outcomes that may arise from algorithmic decision-making. Human oversight allows for the identification and correction of algorithmic biases and ensures that AI systems respect fundamental human rights and values.

Inclusive Data Practices: To mitigate bias, it is crucial to use diverse and representative datasets for training AI systems. This involves actively seeking out and including data from underrepresented groups. Additionally, continuous monitoring and updating of datasets can help address emerging biases (Kaledio & Lucas, 2024).

Robust Privacy Protections: Implementing stringent data privacy laws and regulations can protect individuals from misuse of their data. Techniques like differential privacy and federated learning can enhance privacy while still enabling AI development. Organizations must prioritize ethical data practices and ensure transparency in how data is used.

Transparency and Explainability: Developing AI systems with built-in explain-ability features can help demystify their decision-making processes. Efforts such as the European Union's General Data Protection Regulation (GDPR) promote the right to explanation, enabling individuals to understand and challenge AI-driven decisions. Encouraging open-source AI development can also foster transparency.

Education and Reskilling Programs: Governments and organizations should invest in education and training programs focused on AI and digital skills. Initiatives such as coding boot camps, online courses, and vocational training can help workers adapt to the changing job market. Partnerships between educational institutions and industry can ensure that curricula align with market needs (Kaledio & Lucas, 2024).

Equitable Resource Allocation: International cooperation and public-private partnerships can help distribute AI resources more equitably. Supporting AI research and development in resource-limited regions can bridge the gap between advanced and developing economies. Funding mechanisms, grants, and subsidies can empower small enterprises and startups to innovate with AI (Camilleri, 2023).

Ethical Frameworks and Policies: Establishing ethical guidelines and regulatory frameworks for AI can ensure its responsible use. These frameworks should address issues like bias, accountability, and societal impact. Multistakeholder approaches, involving governments, industry, academia, and civil society, can create balanced and inclusive AI policies (Kaledio & Lucas, 2024).

Artificial Intelligence holds the promise of transformative benefits across various domains. However, realizing this potential equitably requires addressing significant challenges related to bias, privacy, transparency, skill gaps, and resource disparities. By adopting inclusive data practices, ensuring robust privacy protections, fostering transparency, investing in education, promoting equitable resource allocation, and establishing ethical frameworks, we can work towards a future where AI benefits all of humanity. Achieving equitable access to AI is not only a moral imperative but also essential for fostering a just and inclusive society.

FINDINGS AND CONCLUSION

In conclusion, ethical considerations play a crucial role in the development and deployment of artificial intelligence (AI) systems. As AI technologies continue to advance and become more pervasive, it is essential to address these ethical considerations to ensure that AI benefits society while minimizing potential risks and harms. Throughout this study, we have explored several key ethical considerations in AI development and deployment. These considerations include transparency and explainability, fairness and accountability, privacy and data protection, human control and

autonomy, social and economic impacts, and international cooperation and regulation. Transparency and explainability in AI systems are vital for understanding how decisions are made and detecting potential biases or errors. Fairness and accountability ensure that AI systems do not perpetuate discrimination or harm individuals. Privacy and data protection safeguards individuals' rights and promotes responsible data handling practices. Human control and autonomy strike a balance between human oversight and AI system independence, ensuring that humans remain accountable for AI system behaviour. Social and economic impacts address issues such as employment, inequality, access to services, and economic disruptions, aiming to ensure that AI technologies contribute to societal well-being.

Ultimately, ensuring ethical considerations in AI is an ongoing and evolving process. It requires continuous evaluation, adaptation, and refinement as technology advances, societal needs evolve, and new challenges emerge. By embracing these ethical considerations, we can shape AI technologies to serve the best interests of humanity and contribute to a more equitable and sustainable future.

RECOMMENDATION

Based on the study's findings, the following recommendations are proposed, The Nigerian government, State government, AI Experts, NGOs and Private organizations should:

i. Formulate national AI policies that provide clear guidelines and regulations to govern AI development and deployment this will help to establish ethical standards and guidelines to ensure AI applications respect human rights, privacy, and fairness. And further strengthen data protection laws to secure personal data and ensure citizens' privacy.
ii. Improve internet connectivity and digital infrastructure, especially in rural areas, to support AI technologies by promoting the adoption of cloud computing services to provide scalable and affordable AI resources.
iii. Integrate AI and data science courses into the educational curriculum at all levels. Promote STEM education to build a foundation for AI literacy as well as offer continuous learning opportunities and training programs for professionals to update their skills in AI technologies.
iv. Invest in AI research and development by funding universities, research institutions, and startups. Encourage collaboration between academia and industry, and further establish innovation hubs and incubators to foster AI startups and provide them with resources and mentorship.
v. Encourage partnerships between the government, private sector, and academia to work on AI projects that address national challenges

CONTRIBUTIONS TO KNOWLEDGE

This study contributes to the knowledge by providing insights into the nuanced of ethical implications of the deployment of different AI components in Nigeria. The findings contribute to a more nuanced understanding of the challenges and opportunities associated with AI integration in Nigeria and provide valuable guidance for practitioners and researchers in the field.

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PAPER 12 - DELIVERING THE CCMAS VIA OPEN DISTANCE LEARNING (ODL) AND HYBRID MODES

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ABSTRACT

The new Core Curriculum and Maximum Academic Standards (CCMAS) for education and training on undergraduate programmes evolved from the Benchmark Minimum Academic Standards (BMAS) With Seventeen disciplines CCMAS made provision for curriculum and course design with 70% in common knowledge in all the National Universities System while 30% variation reflects the collateral cultural values of peculiar universities and their socio-ecological mileu. Universities are categorized based on mode of instructional delivery while 170 Universities in Nigeria deliver through physical classroom (with face-to-face) contact, Five (5) Universities have been licensed as Open Universities in Nigeria and Twenty (20) are licensed as Distance Learning Universities . Adaptations on contact interface precipitates varieties of delivery modalities as face-to-face contact, Open and Distance Learning (ODL) System, Remote Learning System and Hybrid Learning System. Delivering CCMAS for ODL and Hybrid Learning mode involves providing essential educational content in relevant discipline with appropriate academic benchmarks using key approaches that are flexible, remote, blended and versatile. Hybrid learning offers combination of online instructional path with periodic face to face. The CCMAS is evolving along revolutions in educational content and delivery with framework that integrates linear hierarchical and non-linear lateral curriculum via modalities of both physical classroom and virtual learning.

KEYWORDS: CCMAS, BMAS, ODL, Face-to-Face, Hybrid Modes

BACKGROUND

The Core Curriculum and Minimum Academic Standard (CCMAS) are designed to provide education and training of undergraduate students wishing to obtain first degree in different areas of study in the Nigerian University System. The National University Commission (NUC) CCMAS has Seventeen (17) disciplines which is an expansion from the Twelve (12) discipline contained in Benchmark Minimum Academic Standard (BMAS).

The provisions in CCMAS documents are structured to guide University undergraduate programmes in curricular and course design while incorporating necessary innovation into the content and delivery of their programmes so as to achieve the overall goals of education and training nationwide (Okebukola, 2023).

NUC has provided seventy percent 70% of core content for each programme in all the disciplines, then gave 30% to cognate department in each university as additional content to complement and conceptualize their overall product. Students from different universities offering the same course will therefore have 70% in common knowledge while 30% variation will reflect the collateral cultural values of their peculiar university for that programme. The thirty percent will still go through a validation process to ensure conformity in terms of standard and curriculum structure. It should not be duplication of any part of the NUC 70%. A body of reviewers called CCMAS reviewers who are

experts from Nigerian Universities in each knowledge area have been trained to examine and recommend approval of the 30%. Upon approval, the university can then proceed to produce a handbook from the 70 + 30 percent for each programme. The handbook becomes the operating manual for that programme in its university. This will also be submitted for upload to the CCMAS website for public consumption. So, prospective candidates seeking admission can download the handbook of different universities for preference/programme of choice, check through the similarities and differences and make informed decision.

Education for All (EFA) is the most popular intervention trademark in the world today while in Nigeria, the Universal Basic Education (UBE) offers the modus of free and compulsory education. Both chronicle free and compulsory education that means every citizen must be captured, the challenge is that some of this target persons are in the slum, some in the creeks, while some are in the desert, some are sedentrists (those who cannot leave their location not to talk of going to school or appearing in classroom), some are roaming around, they cannot be tied down in a physical classroom or space, some are physically challenged while some are gifted (Akinola and Kosoko-Oyedeko, 2024). To achieve the educational goals of EFA and UBE with these variations, the physical classroom education has to be supported by educational program that is capable of delivering content and instruction to anybody at anytime at anywhere they are. Thus open distance learning and it hybrid delivery cohort becomes apparent.

Academics and research will eventually grow a huge data as research compliment as they study, explore and rationalize the strength, impact and beneficiary potentials of various courses across the same or relevant fields. Design and Development of course content and their mode of delivery in the post-covid-19 era has made distance and online education a greater force in the portfolio of products offered by Colleges and Universities (Graham, 2015). Practices and tools in Online and Open and Distance Learning delivery have become complements of Curriculum Development and Curriculum Review.

UNIVERSITY ACADEMIC PROGRAMMES AND DELIVERY MODES

The conventional method of instructional delivery has been the physical classroom (with face-to-face teacher-learner contact). Prior to COVID-19 period there have been various adventures on on-line learning, remote learning, open and distance learning in various pouch of educational delivery, but more pronounced at the tertiary level of education. The COVID-19 restrictions however busted all levels of education, primary secondary and tertiary into alternative education to the physical classroom/school contact (Akinola and Kosoko-Oyedeko, 2024). While remote and online learning became virile in many parts of the world, the weakness or complete absence of internet in the various communities, regions and some part of the globe generated a blend of physical and virtual learning thus, complimenting the lack of outreach in "one-off" insufficient choice. Since then till now there has not only been proliferation of resources in remote and on-line learning, the magnus of operations has been soaring. List of notable universities offering programs on various platforms are shown below:

Licensed Open Universities in Nigeria *(www.legit.ng/education/1549184-nuc-releases)*

1. National Open University (NOUN)
2. Miwa Open University, Abuja FCT
3. Iconic Open University, Sokoto, Sokoto state
4. West Midland Open University, Ibadan, Oyo State
5. Al-Muhibbah Open University, Abuja, FCT

Licensed Distance Learning Universities in Nigeria

1. Distance Learning Centre, University of Ibadan

2. University of Lagos, Distance Learning Institute
3. University of Abuja, Centre for Distance Learning and Continuing Education
4. University of Maiduguri, Centre for Distance Learning
5. Obafemi Awolowo University, Ile-Ife, Centre for Distance Learning
6. Modibo Adama University of Technology, Yola, Center for Distance Learning
7. Ladoke Akintola University of Technology Open and Distance Learning Centre.
8. Distance Learning Center, Ahmadu Bello University, Zaria
9. Lagos state University Open and Distance Learning and Research Institute
10. Joseph Ayo Babalola University Centre for Distance Learning
11. University of Nigeria, Nsukka Center for Distance and e-Learning
12. Federal University of Technology Minna, Center for Open Distance and e-learning
13. Babcock University Ilisan-Remo, Center for Open and Distance e-Learning
14. University of Ilorin, Center for Open and Distance Learning
15. Afe Babalola University, Ado-Ekiti – Open and Distance Learning Center
16. Olabisi Onabanjo University, Ago-Iwoye, Open Distance Learning Center
17. Ignatius Ajuru University of Education, Portharcourt, Institute of Distance Education
18. Usmanu Danfadio University Center for Distance and Open Education (CODE), Sokoto
19. Enugu State University of Science and Technology Open and Distance Learning Center, Agbani
20. University of Benin Center for Distance Learning, Edo state.

The total number of universities in Nigeria that conduct teaching-learning through physical contacts amount to one hundred and seventy (170)

Conceptual Meaning of Educational Delivery Modalities.

Educational delivery modalities are the means by which content is communicated to learners. It usually involve certain resources (technologies and facilities) to deliver intended learning experience and meet specific goals.

The following are synoptic description of various platform for instructional delivery;

Face-to-Face: face-to-face (F2F) teaching is an instructional method, where course contents and learning materials are taught in person to a group of students. This permits the teacher and learners to engage in physical interactions. F2F is characterized by the benefits of being intensive, rendering certain topic or skill within specified time frame, with human torch.

Open and distance learning (ODL) system is a teaching-learning concept in which the teacher and learners need not necessarily be present either at the same place, or same time during the teaching learning contact. It is flexible in respect of timing and modalities of teaching and learning.

Remote Learning occurs when educators students or information resources are not physically present in a traditional classroom and information is replayed through technology or other physical means. This can be synchronous, where real time interactions actually exist and asynchronous where self-paced learning activities that takes place independently of the teacher. With remote learning, students are free to learn at their own pace, access their course work and learning materials from anywhere with an internet connection when it suits them. This flexibility and convenience are the most outstanding characteristics of remote and online learning. Remote learning is also scalable as it permit materials to be used over and over again yet offering the same information.

Hybrid learning is a mix of diverse learning components, learning processes and learning spaces.

A mix of collective learning and individual learning, A mix of synchronous and asynchronous learning, A mix of self-paced learning and group paced learning and A mix of formal and informal learning.

Hybrid learning can further be summarized as integration of work and learning, mixing learning and practicing activities, integrating online and offline resources.

Hybrid learning is captured as an educational model in which some students attend class in person while others attend the class virtually or while each student undertakes a mix of in-person and off-line (UNESCO, 2020). Educators view this in four dimensions, learning environment, learning management, learning experience and learning content.

CCMAS for ODL and Hybrid Learning Modes: The Concept

Delivering core curriculum and minimum academic standards CCMAS through open and distance learning (ODL) and hybrid modes involve providing essential educational content in relevant discipline with appropriate academic benchmarks using key approaches that are; Flexible, remote, blended and versatile.

In this paper, ODL, Remote and Hybrid learning are taken as similar delivery modes;

Hybrid Learning: Hybrid Learning offers combination of online instructional path with periodic face-to-face sessions. Research in e-methodology according to Klisowska, Sen and Grawdowski (2021) showed that distance and remote learning secured the advantage of professional development of teachers and fortifies intergenerational experience exchange particularly when abintio, they parade poor or no experience of remote learning (Buchner Majchrzak and Wierzbicka (2020).

Remote learning expose learners to large quality of teaching materials and makes them learn at their own pace. While development and expansion of IT infrastructure is an added advantage to the system. remote and Distance learning however takes a lot of time from the teacher and students on the Computer Systems, it poses difficulty in development assimilation of new materials, low didactic effects and social exclusion, also disadvantaged to students is the lack of direct contact with the teacher and no physical activities cost of installation and maintenance of computer can be very high.

Accessibility is a principal characteristics in hybrid learning, programme contents and delivery mode must be structured to provide access to all students (including those with special needs). Alternative formats for materials as well as assistive technology platform must be readily available.

Curriculum Adaptation: ODL and hybrid learning offer flexibility and accessibility. The curriculum should be adopted to suit the characteristics features of expanded access and flexibility with enhanced links. ODL and hybrid learning options should be leveraged to allow students learn according to their needs and ability. High opportunities must be provided for personalization and self directed learning.

The provider is required to build a robust learning management system on dedicated portal (preferably as an API on the university portal) that will permit registered students to access course materials, content, engage in structured interactions with the lecturer, colleagues, form tutorial groups, obtain and submit assignments and track learners progress. The platform should embrace synchronous and asynchronous learners. Teachers and lecturers of designated courses shall source for various digital and on-line materials like application (apps), software, websites, interactive modules, e-books, video lectures, podcasts, and other multimedia materials/learning objects (they can be based on electronic text, pictorials, graphics and animated movie). Teacher shall engage in the development of designed packages for dissemination to students through the digital media platform. Various communication and feedback channels should be setup for students to reach their teacher and support staff to follow-up, provide updates, foster sense of community, suggest improvements in the delivery. The findings and reports should be channeled properly for continuous improvement and enhancement. Intermittent, continuous and end of course assessment for

remote or hybrid learning include drill and practice, online quizzes, group tutorial, peer evaluation, portfolio display, project presentation installed on LMS that incorporates both physical assessment and online assessment, with feedback embedded installation should also accommodate On-call technical support to teachers (adapt appropriate on-line apps & software) and enabling stable online system or internet needs.

Assessment should be more holistic, criteria for assessment need to capture the core ideas in the disciplines. Assessment in hybrid curriculum needs technical support in the form of a Learning Management System. It also needs more hands-on assistance to teachers.

Support services: Personnel should be in 2 major areas, the technical assistance who shall constantly look into various escalation from the media dispensary and content manager who shall dwell more on the programming junkets on content upload.

Arrangements should be made to have designated support officers on ground. Both students and staff should be supported to obtain necessary guide and support in creating and engaging digital content facilitating and partaking in online discussions, conducting online chats, tutorials reports and records.

Technical and content management training should be arranged to induct all users (staff and students) in their respect-route of engagement while follow-up (routine) training should be carried out regularly at least twice in a semester to reverberate the operational Skills and evolving models and practices.

Resource Allocation and Quality Assurance: Resources including finance, technology and personnel, should be allocated in good and pragmatic faith to the CCMAS ODL and Hybrid modes project.

The quality assurance framework must ensure that the CCMAS delivery through hybrid and ODL modes are of the same standard with the traditional in-person education. The monitoring and evaluation process should involve analytics and feedback from students for improvement sake. It should be constant and continuous.

Pedagogical Change in Hybrid learning: Hybrid Learning characteristics lies in flexibility and versatility. Flexibility is in two respects (i) Contents with cross grade learning objectives and cross content learning objectives while (ii) on pedagogy, hybrid learning expresses flexibility through various teaching-learning methodologies and process based curriculum design.

Teaching learning process tilt from stand-alone subjects with clear cut boundary between disciplinary area to reality of everyday life. Educational courses are characterized by cross cutting disciplines, spirit of interdisciplinarity and transformation in skill acquisition, job and career pursuit. This curriculum pattern is referred to as non-linear lateral curriculum as against the traditional linear hybrid learning restructures teaching resources to cause great improvement in the quality of teaching activities. Cognizance should be taken not to dichotomize learning but integrate physical classroom and virtual learning to make students learn as effective as possible.

Personalizing (neuroscience and brain research) ->Logic or Personalizing learning. Good for equity and accountability towards each child. (not one-size-self all approaches to school knowledge).

Personalizing involves matching teaching to the individual learner, it demands a radical approach to school and class organization based around student individual progress (OECD, 2006). It requires learners to be actively engaged in setting own targets, devising their own learning plans and goals. choosing from among a range of various ways to learn. Hybrid learning creates opportunities for personalizing learning.

Students Competencies in ODL and Hybrid Learning.

Online learning and its hybrid takes place in a completely new or modified environment and how students feel about the environment can affect their learning (Nooney and Videl, 2002). In Hybrid learning, students are the owners of learning. Research studies by Michelska (2020) showed that students exhibit poor attendance and irregular involvement in remote learning offers, this require teachers to scale up supervision of lesson contacts and access. Teachers provision and guide are based on two factors, the designated curriculum and the need of the students with two main sectors which are Learning how to learn and developing discipline in learning which include being systematic, persistent, inquisitive and responsive. Eventually, these qualities equip students with self-discipline, self-motivation, autonomy and ability to source for resources.

Structure and contents of Hybrid Learning curriculum framework for schools (HLCFS).

In today's world, Education For All (EFA) prevails, knowledge is therefore no longer confined to the rich and elite. Educating the child is not just the responsibility of the teachers and schools but of family and community (Opertti, 2021). Modalities of learning now changes with technological advances. Hybrid learning is not just a consequence of lockdown, it is a recommendation for future good of education.

HLCFS needs to be structured in a broad perspective involving the institution (LASUED for example), families, societies, and normal agencies with synergy through four dimensions of learning which are learning environment, learning management, learning experiences and learning content.

Table 1: Structure and Content of HLCFS Adapted from developing Hybrid Learning Curriculum Framework for Schools. (IBE: UNESCO International Bureau of Education).

Dimension	**Suggested Content**
Learning Environment	(I) The Overall framework of learning in Hybrid learning, including the possibility of mixing the following: • Synchronous and asynchronous learning and/or • Collective learning and individual learning and/or • Formal and non-formal learning (II) A Hybrid learning environment framework consisting of the three core elements of cognitive presence, social presence and teaching presence, based on community of inquiry and transactional distance theory.
Learning Management	(I) A formula or broad principles set to guide distribution of time, space and resources, allocated as follows: • Synchronous face-to-face learning in physical classroom and/or • Synchronous face-to-face learning in virtual classroom and/or • Asynchronous Learning using online environment and/or • Asynchronous Learning using other remote learning resources. (II) Policy provision and broad principles guiding and facilitating teachers to be 'curriculum-makers' formulating the class 'based curriculum' based on the broad national curriculum guidelines (III) Policy provision and infrastructure as well as resources support for both virtual learning and face-to-face learning.
Learning Experiences	(I) Pedagogical approach from the perspective of teachers and students: - Integrating online and offline resources - Combining relevant learning objectives

	- Mixing learning and practicing activities - Integration of work and learning (II) Suitable and relevant pedagogies, such as project-method and problem-solving approach, where 'learning' and 'practicing' are mixed and integration of learning objectives, as well of online and offline resources, is possible. (III) Policy provision and systemic support for integration of assessment into learning.
Learning Content (Curriculum content)	(I) Principles or procedures in identifying, prioritizing and sequencing curricular contents to develop a curriculum package to facilitate HL: • Sequencing and packaging curriculum content through hierarchical linear learning and lateral learning; • Determining and organizing adequate knowledge through subject-based curriculum, interdisciplinary or whole-school curriculum. (II) Principles in organizing curriculum content: • Coherence, • Flexibility, • Integration, • Contextualisation and personalization of learning. (III) Principles in allowing flexibility in learning modalities of face-to-face and remote learning: - Flexibility in organization of learning objectives in school curriculum; - Possibility of allowing cross-grade learning objectives; - Possibility of cross-subject learning objectives. (IV) Suggestion of principles in promoting integration of learning: - Project-based learning; - Competence-based learning. (V) Principles in contextualising and personalizing learning: - Self-paced learning; - Liberalizing learning, expanding learning beyond the given curriculum.

CONCLUSION

The curriculum for University degree program in Nigeria is Core Curriculum and Minimum Academic Standard (CCMAS) is emerging at this time when educational content and delivery is undergoing revolution with framework that integrates linear hierarchical and nonlinear lateral curriculum via modalities of both physical classroom and virtual learning. The competencies of teachers and students are brought under perspective of skill to search for information and the right attitude to learning. Studies have shown that with appropriate resources, quality assurance, communication and feedback prompts, CCMAS through hybrid learning and ODL is proposed to facilitate systemic and sustainable change.

RECOMMENDATION

The COVID-19 pandemic era, opened a wide vista of opportunities for people to access education and this has formed a new trajectory in advancing Education For All (EFA). Nationals, Proprietors of education and teachers should maintain the continuity of teaching by moving education to the digital world and exploring new technologies

with simpler, easier and faster delivery of the teaching-learning content. Provision for Skillful technical personnel and content manager in each academic department.

With on-line opportunities, teachers should accelerate interactions and Fan-peddling across the globe on content building, content sharing and content presentation.

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PAPER 13 - ICT LITERACY SKILLS AND PERCEIVED ENTREPRENEURIAL SUCCESS OF LIS STUDENTS IN TERTIARY INSTITUTIONS IN KWARA STATE, NIGERIA

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ABSTRACT
The study explores the ICT literacy skills and perceived entrepreneurial success of Library and Information Science (LIS) students in tertiary institutions in Kwara State, Nigeria. The study adopted the descriptive survey design. The study population comprised all the LIS final-year students in tertiary institutions in Kwara State, Nigeria, which was 706 students. This study adopted stratified sampling technique to determine the sample size. Therefore, the sample size was four hundred and twenty-three, representing 60% of the population. The questionnaire was used as the instrument for data collection. Of the 423 copies of the questionnaire administered, only 394 copies, representing 93.1% response rate, were found valid for analysis. The findings revealed that the level of ICT literacy skills of LIS students in tertiary institutions in Kwara State, Nigeria, is high. There is positive correlations between ICT literacy skills (r=.417), and perceived entrepreneurial success among LIS students. The study concludes that LIS students in tertiary institutions in Kwara State exhibit a strong perception of entrepreneurial success, characterised by high proficiency in ICT literacy skills. These findings underscore the students' readiness and competence as information professionals well-equipped for success in the digital age. It was recommended that institutions should focus on equipping LIS students with entrepreneurial skills and enhancing their ICT literacy, particularly in information retrieval and database management. Regular assessment and program updates should be prioritised to meet the changing needs of LIS students in the entrepreneurial landscape, fostering innovation and cultural sensitivity, among others.

KEYWORDS: ICT skills, Entrepreneurship education, entrepreneurship success, LIS students, Tertiary institutions

INTRODUCTION

Entrepreneurship involves recognizing opportunities and developing innovative actions, contributing to employment generation, poverty reduction, universal education, and gender parity, as stated by Nuhu (2021). In library and information science (LIS), Francis and Oghenevwogaga (2015) note that entrepreneurship is about developing profit-oriented attitudes and behaviors in students, graduates, and practitioners. Success in entrepreneurship can be subjective, often associated with innovation, profit-making, client satisfaction, and peer recognition (Al-Issa, 2021). Therefore, entrepreneurship involves creating, diversifying, and intervening in existing organisational processes. Entrepreneurs (LIS students) can feel successful in many other ways, such as pursuing innovation, depending on their imagination, making profits, accepting client input, and winning praise from other entrepreneurs and business partners (Owolabi, 2022). Success is subjective and cannot have a universally valid quantitative definition; however, success can be described as the good feeling of achievement an enterprise feels when achieving its goals (Al-Issa, 2021). Therefore, as plans differ from person to person, so does the definition of success. From an entrepreneurial perspective, every business-minded individual must have the required Information and Communication Technology (ICT) literacy skills, and abilities to succeed in his business, thus leading to entrepreneurial success.

Entrepreneurial success is individual satisfaction derived from set goals. Paige and Littrell (2002) defined entrepreneurial success as both intrinsic criteria (including freedom and independence, controlling a person's future, and being one's boss) and extrinsic outcomes (including increased financial returns, personal income, and wealth). It is also commonly described in economic or financial measures, including return on assets, sales, profits, employees, and survival rates, and nonpecuniary measures, such as customer satisfaction, personal development, and personal achievement. Entrepreneurial success is often associated with the entrepreneurs' (LIS students) personality traits, social networks, and prior knowledge in business. Glosenberg et al. (2022) described that entrepreneurial success is a complex phenomenon, covering both financial and non-financial criteria. Initially, entrepreneurial success is often equated to financial/economic indicators. The financial indicators include business efficiency, growth rate, profitability, personal satisfaction, market share, and staff growth rate (Welsh et al., 2023). The non-financial measures are the entrepreneur's view of goal achievement, self-good image, satisfied customers, continued business operation, personal development, independence/autonomy, satisfaction with the enterprise's overall performance, and provision of secured jobs.

ICT literacy skills are crucial for entrepreneurial success, especially for undergraduate LIS students who must navigate today's ICT-driven industry. ICT tools, including telephones, fax machines, computers, social media, and the internet, are essential for modern enterprises. Wogboroma and Wogboroma (2022) emphasize the indispensable role of technology in various human endeavors, noting that access to ICT resources significantly impacts business success.

ICT skills encompass the ability to solve information-related problems using digital technologies and communication platforms, essential for participation in an information-driven society. These skills include operating personal computers, using software for tasks, navigating the internet, accessing information from the web, engaging with e-learning platforms, and conducting computer-based analyses (Wogboroma and Wogboroma, 2022). Acquiring these skills prepares LIS students for self-sustainability and business success. Okoye (2017) stresses that LIS undergraduates must acquire ICT skills to succeed as entrepreneurs in Nigeria's evolving economy. The Nigerian federal government mandates entrepreneurship education in higher institutions to equip students with managerial and ICT skills, enabling them to manage businesses and become self-reliant after graduation.

Omotayo and Umoru (2015) lists essential ICT skills for LIS students, including proficiency in word processing, spreadsheets, databases, electronic presentations, email management, digital cameras, file management, video conferencing, software installation, scanner operation, and familiarity with storage devices. They highlight the transformative potential of ICT in enhancing student engagement, economic viability, and teaching methods.

ICT literacy, defined by Anyim (2018), involves effectively using digital technology, communication tools, and networks to manage and communicate information within ethical and legal standards. The literature on entrepreneurial success in Nigeria is limited, as noted by Oyeku, Oduyoye, and Elemo (2020), who call for more research to support SME development. LIS students can become successful entrepreneurs by acquiring relevant ICT literacy skills, potentially creating alternative wealth sources beyond salaries (Usuka et al., 2019). This study investigates the ICT literacy skills of LIS students in tertiary institutions in Kwara State, Nigeria.

Statement of the Problem

Entrepreneurship education in Nigeria aims to equip students in tertiary institutions with the necessary knowledge, skills, and motivation to improve their prospects for success across diverse enterprises. It is a lifelong process essential for the knowledge economy to be competitive. Based on this, the Federal Government of Nigeria, through the Federal Ministry of Education, made entrepreneurship education a compulsory course for all students in higher institutions. This aims to teach the spirit of success among students of higher institutions nationwide. Investigation showed that LIS students offer entrepreneurship education as a general course, yet, the majority cannot create jobs for themselves after graduation, and those who manage to create jobs are not very successful at most, achieving low entrepreneurial success. This may be attributed to the student’s lack of ICT literacy skills.

The goal of entrepreneurs Is to dr”ve t’eir business operations, thus gaining entrepreneurial success. Nonetheless, ICT literacy skills strategically improve the enterprise’s performance to achieve the entrepreneur’s

objective. Against this backdrop, this study examined the influence of ICT literacy skills on the perceived entrepreneurial success of library and information science (LIS) students in tertiary institutions in Kwara State, Nigeria.

Objectives of the study

The broad objective of the study was to investigate the ICT literacy skills and perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State of Nigeria.

Specifically, the study was set to:

i. examine the level of perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria;
ii. find out the level of ICT literacy skills of LIS students in tertiary institutions in Kwara State, Nigeria;
iii. determine the relationship between ICT literacy skills and perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria;

Research questions

The following research questions guided the study:

1. What is the level of perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria?
2. What is the level of ICT literacy skills of LIS students in tertiary institutions in Kwara State, Nigeria?

Hypotheses

The following null hypothesis were tested at a 0.05 level of significance:

1. There is no significant relationship between ICT literacy skills and perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria.

LITERATURE REVIEW

The literature stream on entrepreneurial psychology has extensively discussed the topic of entrepreneurial success; however, its conceptualisation is still unclear. Although, according to Khan, Salamzadeh, Shah, and Hussain (2021), there are many ways that entrepreneurial success can appear (such as financial performance and business growth), individual-level analysis is generally absent from the research that has already been done. Personal aspirations are the primary driving force behind entrepreneurs' decisions to launch new businesses and risk leaving stable employment to earn an uncertain living. Usually, achieving both material (economic) and intangible rewards is the focus of these life objectives (self-actualisation and self-esteem).

The ability of the student entrepreneurs to maintain the business is viewed in this study as a measure of entrepreneurial success. Different academics have defined success in different ways. In most Nigerian studies, a company's ability to survive its first two or three years of operation was considered its measure of success (Owoseni and Oluwadamilola, 2022). A successful entrepreneur founded a company, built it up in areas where none had been before, and saw it through to its current profit-making structure over a minimum of five years. Success can also be described more in terms of money, connecting the traits entrepreneurs share most frequently to metrics such as annual profit, increase in sales and profit, or the owner/personal manager's income. Success is generally defined as achieving one's aims and objectives in any area of one's life.

A firm is considered successful if it can accomplish its declared goal. As a result, it is the company's accomplishment of its objectives. It is setting and attaining objectives. Moreover, Maina and Nyambura (2020) asserted that market share, leverage, efficiency, growth, profit, scale, liquidity, success, and failure are frequently shown by a company's level of success. It provides data on the company's expansion, successes and failures, and profitability.

Wach, Stephan and Georgievski (2016) classified the conditions for entrepreneurial success as perceived by firm owners by thoroughly reviewing the literature on psychology, management, business, and entrepreneurship. In addition to conventional economic metrics like profitability and growth (e.g., rise in headcount or sales), the authors considered less evident metrics like innovation (e.g., launch of new goods or processes), business survival/continuity, and giving back to the community (e.g., socially conscious and sustainable production methods). This classification also included more arbitrary standards of entrepreneurial success, such as personal fulfilment and work-life balance, which had to do with making time for friends, family, and leisure activities.

Information and communication technology (ICT) has become essential in modern society, on par with traditional academic subjects like reading, writing, and mathematics. ICT includes many tools for retrieving, storing, creating, distributing, and managing information. Since the mid-20th century, its rapid evolution and widespread adoption have significantly driven globalization and economic growth. ICT plays a transformative role in economies and entrepreneurship. Suleiman and Bakin-zuwo (2020) highlight ICT's importance in information management, while Awobamise (2018) emphasizes its role in fostering innovation and the rise of new enterprises. Various studies have explored ICT literacy and its impacts in educational and professional contexts. Nwosu et al. (2018) found that 80% of undergraduate students in Ogun State possess basic ICT skills, which enhance their academic performance. Tuoyo et al. (2020) revealed a strong correlation between ICT usage and increased innovation and entrepreneurial sustainability in Nigeria. Similarly, Onyebinama (2021) identified business centers and cybercafés as key sources of ICT skills for students in Imo State, though challenges such as inadequate funding and facilities persist. Agbo et al. (2020) demonstrated significant ICT literacy among academic librarians in southeast, Nigeria, although funding constraints hindered optimal usage. Judah et al., (2022) found that librarians in Ekiti State are proficient in basic and intermediate ICT skills but face challenges with infrastructure. Izevbekhai and Egharevba (2020) revealed that while library users in private universities in Edo State are proficient in basic ICT, they struggle with advanced e-resources platforms.

Okehie et al. (2022) showed a significant correlation between ICT proficiency and job performance among librarians, recommending ongoing training and hiring based on ICT skills. Munawar et al. (2021) and Manzoor and Hamid (2021) stressed the importance of ICT competencies for library professionals and female entrepreneurs, advocating for continuous training. These studies collectively underscore the crucial role of ICT in enhancing educational outcomes, professional development, and entrepreneurial success. They also highlight persistent challenges related to infrastructure, funding, and access to advanced technologies. Strategic investments and policy interventions are necessary to leverage the potential of ICT fully.

In their study, Bajpai and Madhusudhan (2019) examined the ICT proficiency of LIS professionals employed by the University of Delhi-affiliated college libraries, concluding the libraries' improvement. The current study used the survey approach to obtain data from the respondents via a structured questionnaire. Through in-person meetings and online distribution, the surveys were completed by sixty LIS experts from different college libraries connected to the University of Delhi, and 100% of them responded. The study has shed light on how users can adapt to the changing needs of the digital age by developing their ICT skills and competencies. Overall, the findings highlight how important ICT proficiency is to providing library services effectively and enhancing the library. To improve the efficiency with which library services are delivered and the overall well-being of the library, the current study also gave LIS professionals a platform to identify areas of focus for learning and updating their ICT skills in a digital environment.

The ICT self-efficiency skills of library workers at a few public universities in southwest Nigeria were examined by Moruwawon and Kumar (2022). The study aims to determine the degree of ICT self-efficiency abilities library employees possess while providing library services. The results showed that while some library employees were self-sufficient and adept in using ICT to manage services, others were itching to. Compared to library workers at state universities, the majority of federal university library staff members had greater ICT self-efficiency skills. The library staff's ICT self-efficiency abilities for administering ICT-based library services and skills for handling electronic resources were often lower than their ICT basic skills.

The study by Yusuf et al. (2018) examined undergraduate students at the University of Lagos in Nigeria about their ICT literacy and how it relates to their use of information. It was discovered that University of Lagos undergraduate students possessed a comparatively high ICT literacy. Most University of Lagos students stated that they primarily learned ICT literacy abilities through guided self-study, formal instruction, trial and error, and peer support. The undergraduate students' information utilisation and ICT literacy levels did not significantly correlate. Similarly, there was no discernible correlation between the undergraduate students' usage of information and their development of ICT literacy abilities. Okon and Njoku (2016) concentrated on developing students' skills for starting small businesses in South-East Nigeria. Two research questions and two null hypotheses were developed to serve as the study's guiding principles. A few literary reviews were done. The study employed a simple random sampling technique to choose 86 participants from a sample of 195. The study's conclusions showed that entrepreneurial and ICT skills impacted the creation of small businesses.

The extent and link between ICT literacy and ICT skills in the use of e-resources among postgraduate students at Federal University Dutsin-Ma, Nigeria, were investigated in this study by Ahmad and Enna (2022). With a focus on the entire population of the 2100 postgraduate students at the university, the study used a survey research design. The intended sample was chosen through the use of a multistage sampling procedure. The results showed a favourable link between ICT skills and the usage of e-resources and a significant level of ICT literacy and ICT skills on the use of e-resources. As a result, it meant that ICT literacy and abilities greatly impacted how people used e-resources. Thus, the study concluded that postgraduate students at the Federal University of Dutsin-Ma, Nigeria, who possess adequate access to and knowledge of information and communication technology, are more likely to utilise e-resources.

Mamun et al. (2016) investigated the impact of entrepreneurial competencies on students' inclination to pursue entrepreneurship. The study involved 333 students from Universiti Malaysia Kelantan, focusing on business-related disciplines, using a cross-sectional design and quantitative methodology. Results indicated that students' abilities to identify income-generating opportunities, along with their entrepreneurial training, expertise, innovativeness, and information-seeking skills significantly influenced their intention to pursue entrepreneurship.

METHODOLOGY

The study adopted a descriptive survey design to assess the ICT literacy skills of final-year library and information science (LIS) students in tertiary institutions in Kwara State, Nigeria. The institutions included in the study were the University of Ilorin, Kwara State University, Al-Hikmah University, and Federal Polytechnic Offa. According to investigations conducted by the researchers, there were 706 final-year LIS students (HND II and 400 level) across these four institutions during the 2023/2024 academic session.

A stratified sampling technique was employed to determine the sample size, with 60% of the population selected for the study, resulting in a sample size of 423 students. Data were collected using a questionnaire and analyzed using descriptive and inferential statistics with Statistical Product and Service Solutions (SPSS) version 22. A total of 423 copies of the questionnaires were administered to the students across the selected tertiary institutions in Kwara State. Of the 423 copies administered, 394 copies of questionnaires, representing 93.1%, were returned and found usable and valid for analysis.

Table 1: Population and sample size

S/N	Institutions	Population (N)	Sample size (60% of N)
1	University of Ilorin, Ilorin	117	70
2	Kwara State University, Malete	411	247
3	Federal Polytechnic, Offa	147	88
4	Al-Hikmah University, Ilorin	31	18
	Total	**706**	**423**

Results

Table 2: Demographic Information of the respondents

Gender	Frequency	Percentage (%)
Female	204	51.8
Male	190	48.2
Age Range		
20-25 years	273	69.3
26-30 years	83	21.1
31-35 years	28	7.1
36 years and above	10	2.5
Marital status		
Single	338	85.8
Married	56	14.2
Total	**394**	**100.0**

Table 2 reveals the demographic composition of the study's respondents. Out of the 423 participants, 204 (51.8%) were female, and 169 (48.2%) were male, indicating a slight predominance of female participants. Regarding age distribution, the majority of respondents, 273 (69.3%), were aged between 20 and 25 years. This is followed by 83 (21.1%) in the 26 to 30 years range, 28 (7.1%) aged between 31 and 35, and 10 (2.5%) aged 36 and above. This indicates a youthful sample population, with a large number of respondents in the 20 to 25 age range, reflecting the perspectives and experiences of young adults within the LIS student community in Kwara State. Marital status distribution shows that 338 (85.8%) of the respondents were single, while 56 (14.2%) were married. This demographic detail suggests that most of the study participants had not entered into formal marital commitments at the time of the survey, offering insights into the personal lives and social dynamics of LIS students in tertiary institutions in Kwara State, Nigeria.

Table 3 Level of perceived entrepreneurial success of LIS students in tertiary institution

S/N	Statement	VH	H	L	VL	Mean	Std. Dev
1	I believe I can make a profit when I establish my business.	290	96	8	0	3.7157	.49466
		73.6%	24.4%	2.0%	0%		
2	I have the required entrepreneurial skills to make a profit in business.	213	173	8	0	3.5203	.53938
		54.1%	43.9%	2.0%	0%		
3	With the right entrepreneurial orientation, I can profit from my business.	258	125	6	4	3.7208	.06466
		65.5%	31.7%	1.5%	1.0%		
4	I'm determined to create a firm in the future and expand it when necessary.	229	147	14	4	3.5254	.61831
		58.1%	37.3%	3.6%	1.0%		
5	I plan to start, earn profit and expand my business.	253	126	10	5	3.5914	.60786
		64.2%	32.0%	2.5%5	1.3%		
6	My professional goal is to become a satisfied entrepreneur.	253	131	6	4	3.6066	.57519
		64.2%	33.2%	1.5%	1.0%		
7	I have good customer relations that can guarantee my success.	249	124	20	1	3.5761	.60156
		63.2%	31.5%	5.1%	0.3%		
8	When a customer talks harshly, I swallow my pride and still attend to them politely.	208	163	15	8	3.4492	.66823
		52.8%	41.4%	3.8%	2.0%		
9	I can attend to a customer when I am not happy.	210	120	51	13	3.3376	.82595
		53.3%	30.5%	12.9%	3.3%		

The result on the level of perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria is presented in Table 3. The result revealed that the majority of the respondents believed that they could make a profit when they established their business ($\bar{x}$ = 3.71) and if they have required entrepreneurial skills ($\bar{x}$ = 3.52), and right entrepreneurial orientation ($\bar{x}$ = 3.72). This implies that LIS students in tertiary institutions in Kwara state, Nigeria, can profit when they establish their business if they have the required entrepreneurial skills and ICT literacy skills.

The result revealed that the majority of the respondents affirmed that they are determined to create a firm in the future and expand when necessary ($\bar{x}$ = 3.52), plan to start, earn profit and expand my business ($\bar{x}$ = 3.59), the professional goal can make them become a satisfied entrepreneur ($\bar{x}$ = 3.60). The result implies that LIS students are determined to create and expand their businesses afterwards. Also revealed was that due to the country's present economic situation, their professional goal is to become a satisfied entrepreneur who can earn profit and expand the business, having acquired the necessary business skills and access to funds.

Most respondents affirmed that they have good customer relations that can guarantee success ($\bar{x}$ = 3.57), when a customer talks harshly, they swallow their pride and still attend to them politely ($\bar{x}$ = 3.44), and even when they are not happy, they can attend to the customer ($\bar{x}$ = 3.33). This implies that LIS students in tertiary institutions

in Kwara state, Nigeria, have good customer relations to keep their customers, can give out incentives, and are polite. It could thus be deduced from the table that the level of perceived entrepreneurial success of LIS students in tertiary institutions in Kwara State, Nigeria, is high.

There is a high level of perceived entrepreneurial success among LIS students in Kwara State. This aligns with the findings of previous studies (Owoseni & Oluwadamilola, 2022) that considered the ability to survive the initial years as a measure of success. The aggregate weighted mean reinforces the assertion that LIS students perceive a high level of entrepreneurial success, aligning with the multifaceted understanding of success discussed by Maina and Nyambura (2020).

Table 4: Level ICT literacy skills of LIS students in tertiary institutions

S/N	Statement	VT	T	ST	NT	Mean	Std.Dev.
	Information retrieval/access skills						
1	I can access relevant materials from any source for my information needs.	257	123	14	0	3.6168	.55517
		65.2%	31.2%	3.6%	0%		
2	I can use a local website to access Information of interest.	207	165	10	12	3.4391	.69355
		52.5%	41.9%	2.5%	3.0%		
3	I can use different information sources and resources to achieve my desired goals.	253	111	21	9	3.8782	.12348
		64.2%	28.2%	5.3%	2.3%		
	Database management skills						
4	I have knowledge of different databases.	195	154	28	17	3.5406	.78849
		49.5%	39.1%	7.1%	4.3%		
5	I can identify useful databases.	203	144	23	24	3.3350	.84072
		51.5%	36.5%	5.8%	6.1%		
6	I can save documents in a database.	202	140	34	18	3.3350	.81926
		51.3%	35.5%	8.6%	4.6%		
	Information capturing skills						
7	I can enter data efficiently.	220	131	23	20	3.4492	.96172
		55.8%	33.2%	5.8%	5.1%		
8	I am very good at typing.	249	122	15	8	3.5533	.66803
		63.2%	31.0%	3.8%	2.0%		
9	I can process typed Information	225	126	31	12	3.4315	.76609

	very well.	57.1%	32.0%	7.9%	3.0%		
	Information storage skills						
10	I can store typed documents on any storage media.	236	136	9	13	3.5102	.70343
		59.9%	34.5%	2.3%	3.3%		
11	I can create a password for my document.	269	98	10	17	3.5711	.74566
		68.3%	24.9%	2.5%	4.3%		
12	I can save a document in a specific location.	246	124	17	7	3.5457	.66478
		62.4%	31.5%	4.3%	1.8%		
	Information dissemination skills						
13	I know how to share Information on social media.	245	114	18	17	3.4898	.77568
		68.2%	28.9%	4.6%	4.3%		
14	I can publish my article in a journal.	185	144	37	28	3.2335	.89175
		47.0%	36.5%	9.4%	7.1%		
15	I can present my findings at a conference.	155	162	46	31	3.2284	.24540
		39.3%	41.1%	11.7%	7.9%		
	Software application skills						
16	I can install software packages.	194	139	39	22	3.2817	.85862
		49.2%	35.3%	9.9%	5.6%		
17	I can uninstall the application software.	189	158	26	21	3.3071	.81625
		48.0%	40.1%	6.6%	5.3%		
18	I can troubleshoot problems in software.	182	133	48	31	3.1827	.93128
		46.2%	33.8%	12.2%	7.9%		
	Aggregate Weighted Mean = 3.44						
	Criterion Mean = 2.50						

NB.: VT= Very True; T= True; ST= Somewhat True and NT= Not True

Table 4 shows the ICT literacy skills of LIS students in Kwara State tertiary institutions. The result revealed an aggregate weighted mean score of 3.44 is higher than the criterion mean score of 2.50, implying a high level of ICT literacy skills of LIS students in Kwara State, Nigeria. The table further showed that all the indicators of the ICT literacy skills of LIS students in Kwara State tertiary institutions showed a high level of ICT literacy

skills. Accordingly, the respective weighted means of information retrieval/access skills, Information capturing skills, information storage skills, information use skills (3.45), information dissemination skills (3.38), software application skills (3.29) and database management skills (3.28), also implies that the level of ICT literacy skills of LIS students in tertiary institutions in Kwara State, Nigeria is high, as all the weighted mean scores of the indicators of ICT literacy skills are individually and collectively higher than the criterion mean score of 2.50.

The result indicates that LIS students in Kwara State are well-equipped with the necessary ICT skills to navigate the evolving information landscape. It also revealed the relevance of specific ICT skills, such as information retrieval and database management, for effective information management. The high scores in these specific skills suggest that students have acquired practical skills that are essential for their future roles in the field.

The study found that Library and Information Science (LIS) students in Kwara State, Nigeria, possess high levels of ICT literacy skills. This is significant for their educational and professional preparedness, resonating with Munawar et al. (2021) on the importance of ICT in libraries. Key skills highlighted include information retrieval/access, capturing, storage, and dissemination, aligning with Bajpai and Madhusudhan (2019) and Yusuf et al. (2018) on the necessity of these competencies. The emphasis on software application skills matches findings by Wogboroma and Wogboroma (2022) on the need for such skills among postgraduate business education students. This proficiency reflects the demands of the digital age, demonstrating that LIS students are well-equipped to meet contemporary professional challenges.

Table 5: Relationship between ICT literacy skills and perceived entrepreneurial success

Variables	N	Mean	St.Dev	r	P	Remark
ICT literacy skills	394	3.44	.519	.417	.000	Sig.
Perceived Entrepreneurial Success	394	3.52	.385			

* Sig at 0.05 level

The result of hypothesis one as presented in Table 5 showed that the correlation coefficient (r=.417) indicating a positive correlation between ICT literacy skills and perceived entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria was significant at moderate level (r=.417; P=000; <0.05). Thus, ICT literacy skills had a significant relationship on perceived entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria. Hence, hypothesis one was rejected, which meant the alternative hypothesis was accepted. This implies that ICT literacy skills significantly influenced LIS students' perceived entrepreneurial success; there would be a corresponding improvement on the entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria.

SUMMARY OF THE FINDINGS

The study investigated ICT literacy skills and perceived entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria. Consequently, the following are a summary of the major findings.

1. The result of the finding revealed that LIS students in tertiary institutions in Kwara state, Nigeria, can profit when they establish their business if they have the required entrepreneurial skills, and the right entrepreneurial orientation and ICT skills. Due to the country's present economic situation, the professional goal of LIS students is to become satisfied entrepreneurs who can make a profit and expand their businesses, having acquired the necessary business skills and access to funds. Hence, the study's findings on the perceived entrepreneurial success of Library and Information Science (LIS) students in tertiary institutions in Kwara State, Nigeria, present a positive outlook across three key indicators: profit, growth, and customer satisfaction.
2. The result indicated that LIS students in tertiary institutions in Kwara State are well-equipped with the necessary ICT skills to navigate the evolving information landscape. It also revealed the relevance of specific ICT skills, such as information retrieval and database management, for effective information

management. The high scores in these specific skills suggest that students have acquired practical skills essential for their future roles in the field.

3. ICT literacy skills have a significant relationship on perceived entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria. Hence, the ICT literacy skills had a significant influence on perceived entrepreneurial success of LIS students. This implies that there would be a corresponding improvement on perceived entrepreneurial success of LIS students in tertiary institutions in Kwara state, Nigeria.

CONCLUSION

In conclusion, the findings suggest a robust perception of entrepreneurial success among LIS students in tertiary institutions in Kwara State, Nigeria. The comprehensive analysis indicates that the level of ICT literacy skills among LIS students in Kwara State affirms their high proficiency in various aspects of Information and communication technology. The findings underscore the importance of ICT literacy in LIS students' education and future professional endeavours, positioning them as competent and well-prepared information professionals in the digital age.

RECOMMENDATIONS

Based on the findings, the researcher, therefore, recommends the following:

1. Institutions should focus on equipping LIS students with the necessary entrepreneurial skills. Developing programs and courses that enhance entrepreneurial skills will better prepare students for establishing and managing profitable businesses.
2. Institutions should also continue prioritising and enhancing ICT literacy skills among LIS students. This includes focusing on information retrieval and database management, ensuring that LIS students are well-prepared for their roles in the evolving information landscape.
3. Institutions should continuously assess and update their programs based on the evolving needs of LIS students in the entrepreneurial landscape. Staying responsive to changing trends and demands will contribute to sustained success for LIS students in their entrepreneurial endeavours.
4. Encourage and foster a culture of innovation among LIS students. Implementing initiatives that support idea generation, exploring new markets, and designing unique products and services can contribute to the LIS students' overall entrepreneurial success.
5. Continuous updates in the LIS curriculum to incorporate emerging technologies and information management tools will be crucial to ensure that students remain at the forefront of technological advancements.
6. In the context of the LIS profession, students' high ICT literacy skills are particularly relevant. Information professionals are increasingly expected to leverage technology for effective information services, and the findings suggest that these students are well-prepared for the evolving demands of the field.

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PAPER 14 - A FUZZIFIED SERVICE RATES' MANAGEMENT SYSTEM FOR SINGLE-SERVER QUEUES WITH VACATIONS

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ABSTRACT

The study examines a fuzzified service rates control for M/M/1 queues with possible server vacations. The server's optimal control system is a threshold type in which all arriving jobs finding *K* jobs awaiting service turns and / or service are denied admission into the buffer. In this model, system cost has a direct relationship with queue length. The aim of the policy is to choose the rate of queue service such that it is flexible for the optimal functioning of the system is concerned so that average cost is minimized. These problems are addressed in this study by proposing a fuzzified system of management. The simulation of the proposed system started at a state where each of *k*, *s* and *c* equals to zero, while adopting the fuzzified management policy at each stage of decision-making. In the simulation, the varying values of both *k* and *s* for the first 1500 units of time indicates that an idle server is not switched on as soon as a job arrives, i.e. as the value of *s* increases from zero to *1* but rather after waiting for a minimum arrival of two jobs. The hysteretic property of the system which indicates that the number of times the server is switched on has a direct relationship with the value of *s* during a period of 15000 time units. This indicates that the optimal policy of the system is a function of the hysteretic property of *s*, consequently making the proposed approach efficient and promising.

KEYWORDS: Hysteretic property; Threshold; Service rate, Average cost; Steady-state probability; State transitions.

1. INTRODUCTION

Queues are part of everyday's life. This is because we do experience waiting in banks, supermarkets, hotels, cinemas, airports, hospitals, etc. More importantly, there are other types of queues which are invisible such as those of voice or packets in telecommunication networks. Generally, queues are often undesired because it is associated with corresponding costs of time and other valuable resources. However, it is necessary to observe that queues exist because service providers are insufficient to meet demand. In other words, if there were adequate service providers, there might be no need for queue of any kind. In cases where there are insufficient service providers in queue networks, it implies that servers might not available to provide required service as a result of attendant cost limitations, or the system is unable cannot produce required services at such a rate necessary to avert unwarranted waiting resulting in avoidable costs.

A queueing system is a stochastic and dynamic system involving the arrival and waiting of jobs until they are served and consequent departures. The evolution of a queueing system is analyzed by a careful observation of the properties of its servers, including service and servers' characteristics as well as the volume of jobs in the queue network over time. A queueing system with variable rate is one in which the average rate of job's service rate could be selected from a set of unlimited rates of service such that: $\{\mu_k \mid k \in K\}$. In this case, *K* is a pre-programmed set

of service types. In this system, the time required to service a job is stochastic in nature which has no relationship with the patterns of arrivals as well as the preceding service times.

The task of ascertaining when to switch servers on or off is multi-faceted. In order to ensure optimality in servers' usage, it is essential to ascertain the savings from turning servers off and comparing this with the cost of serving customers awaiting service turns. Similarly, it is possible to adopt a flexible control of the service rate by applying a timeless service pattern while servers are on in order to ensure optimality in the management of network resources [1].

A stationary policy is said to be of the N-type provided it instigates the switching on of the server provided there are *N* jobs in the queue system while it turns off the server provided there are no jobs in the system. More often, policies of the N-type guarantees optimality for single - server queues with costs associated with startup as well as a single service rate [2]. It is shown in [3] that for singe server queues with flexible service rate control, optimality of the service rate structure is guaranteed with the number of jobs awaiting service turns.

To the best of our knowledge, not much work had been done in modeling a fuzzified management system for the control of service rates with the aim of increasing systems' efficiency and reducing wastages of servers' time. This in turn will provide optimal usage of available servers while also minimizing customers' wait time. In this study, a fuzzy-based management system was modeled to dynamically manage service rates in an *M/M/1* queues. In other words, we modeled the proposed system from a managerial perspective such that it is instrumental in modeling more sophisticated controls for the management of servers in *M/M/1* queue systems.

2. RELATED WORKS

Works on queueing systems with removable servers include [4] which described an *M/G/*1 queue network being implemented with *N*-policies, consequently describing the quantitative relationships among various parameters of the queue system. In a similar study, [5] evaluated the optimal performance of *N*-policies as applicable to *M/G/*1 queues considering the associated warm up costs and reward criteria, respectively. These performance metrics were considered vis-à-vis relative costs of server's warm-up and reward systems.

A study of *M/M/*1 queues under *N*-policies involving startup costs and exponentially distributed warm up times was done by [6]. In essence, the study sought to establish a point of relationship as far as start-up costs and the corresponding effect on the performance of the queue system is concerned. However, it is pertinent to note that the study did not consider the control of service rate applicable in the system. An extension of this work included parameters for warm up times, steady-state probabilities, wait time and as well as the volume of customers in queue was investigated by [7], thereby setting the pace of queue system optimality for server's performance.

An analysis of *M/G/*1 queue involving known service time upon arrival was investigated by [8] involving a pre-determined behavioural pattern of the server as well as arriving customers. Similar studies included network queues with server breakdowns as well as warm up times [9], queues with server vacations [10] and batch arrivals [11], among others. The first study involving modeling of queue system involving varying service rates using Markov Decision Processes was [12]. The study aimed at a variation of arrival patterns in order to see the corresponding effects on overall network performance. An investigation on the optimal policy for *M/M/*1 queue networks involving dynamic service rate control proving the monotonicity of the optimal service rate was carried out by [3]. In this study, the service rates and capacity of the servers were re-negotiated as arrival patterns vary considering the need for optimality and cost reduction on the overall queue network.

A queue system in which service rates in the queue system are chosen from a closed subset of $[0, \infty]$ was designed by [13]. In this case, there was a wide range of service capabilities to cater for the varying needs of arrivals. A one-server system with dynamic service rate management and Markov modulated arrivals was designed by [14] which involved modeling of the arrivals vis-à-vis server's capabilities. Similarly, an investigation of the

value of dynamic service rate control in combination with admission control in *M/M/1* queues was done by [15]. The model was designed such that the server had varying service range to cater for all categories of arrivals.

The use of sleep-state control involving varied policies in *M/G/*1 queues was studied by [16]. Related to this, [17] examined an *M/G/*1 queue system with warm up times and multiple sleep states for a specific cost function involving the product of the mean power usage and mean response time in steady state. Other related studies considered multiple server systems including [18, 19, 20].

In a study of a one-server vacation queue by [21], a relationship between significant abandonments and Bernoulli's feedbacks was established. Similar to this, [23] investigated the state characteristics of Markovian queue with finite capacity, working breakdowns as well as server vacations. An *M/M/1* queuing model with second optional service, in which the server is subject to working breakdowns was studied by [24]. Related to this, [25] studied an *M/M/1/N* queueing system with a working breakdown and dual-phase services.

In real life queueing systems, it is often considered that a server ceases service during its breakdown period. However, it is desirable that the server provides service at a slower rate rather than entirely ceasing service during its breakdown period. This scenario of server breakdowns is called working breakdowns and was first introduced by [26] in which a study of the steady-state analysis of an *M/M/1* queue with working breakdowns was done.

A single server disaster queueing model with a working breakdown was investigated by [27] in which the service times follow a general distribution. Consequently, [28] adopted the matrix-geometric method to evaluate a finite capacity Markovian queue with an unreliable server subject to working breakdowns involving impatient customers. An analysis of the steady-state behaviour of M/M/1/N queue with working breakdowns and Bernoulli feedbacks was studied by [29]. An investigation of the modeling and derivation of real-time application relating to Markov-based admission management system and startup was carried out by [30].

The application of fuzzy set theory is robust innovation applicable in resolving classical and non-classical problems in a more convenient way than crisp systems. As a result of the potentials of the fuzzy set theory, modern innovations in the control of queues had adopted it as a way to managing imprecise and uncertain situations as far as modeling and process control in queue systems is concerned. Fuzzy control of queueing systems is the use of fuzzy logic theory to the management of network queues. This is done by applying a fuzzy logic controller to provide decision mechanisms that determines the parameters, patterns and policies of the queueing system dynamically. Consequently, a fuzzy queueing control system involves the application of artificial intelligence, operations research and optimal control policies to ensure optimality in queue systems.

3. MATERIAL AND METHODS

This section is discussed under the following sub-sections: analysis of the steady state for *M/M/*1 queues, problem definition, fuzzy Markov chain, design of the fuzzified control system as well as simulation of the Markov queueing system.

3.1. Steady state analysis of *M/M/*1 queues

If *N(t)* is the number of arrivals in the system at time *t*, the bi-variate function $\{(C(t),\ N(t)),\ t \geq 0\}$ is a Markov chain of the continuous-time version [30]. Consequently, let:

$$P_i,\ n(t) = \text{Prob}\{C(t) = i,\ N(t) = n\},\ \text{where}\ i = 1, 2, 3, 4\ \text{while}\ n \geq 0$$

The steady-state probability equations as provided by [21] are as follows:

$$\mu p P_{1,1} + \mu_1 P_{2,1} = \lambda P_{1,0};$$

$$\lambda P_{1,n-1}+\gamma P_{3,n}+\mu p P_{1,n+1}+\mu_1 P_{2,n+1}=(\lambda+\beta+\mu)P_{1,n}, 1\le n\le N-1;\ \lambda P_{1,n-1}+\gamma P_{3,n}=(\beta+\mu)P_{1,n},\ n=N;$$

$$\mu q P_{1,1}+\xi P_{4,1}=(\mu_1+\alpha+\lambda)P_{2,1}\ \lambda P_{2,n-1}+\mu q P_{1,n}+\xi P_{4,n}=(\mu_1+\alpha$$

$$+\lambda)P_{2,n}+2\le n\le N;$$

$$\lambda P_{2,n-1}+\mu q P_{1,n}+\xi P_{4,n}=(\mu_1+\alpha)P_{2,n}, n=N;$$

$$\mu_b p P_{3,1}+\mu_{b1}P_{4,1}=\lambda P_{3,0};$$

$$\mu_1 p P_{3,n+1}+\lambda P_{3,n-1}+\beta P_{1,n}+\mu_{b1}P_{4,n+1}=(\gamma+\lambda+\mu_1)P_{3,n}, 1\le n\le N-1;$$

$$\lambda P_{3,n-1}+\beta P_{1,n}=(\gamma+\mu_1)P_{3,n},\ n=N;$$

$$\alpha P_{2,1}+\mu_1 q P_{3,1}=(\xi+\lambda+\mu_{b1})P_{4,1};$$

$$\alpha P_{2,N}+\mu_1 q P_{3,N}+\lambda P_{4,N-1}=(\xi+\lambda+\mu_{b1})P_{4,n}, 2\le n\le N;$$

$$\alpha P_{2,n}+\mu_1 q P_{3,n}+\lambda P_{4,n-1}=(\xi+\mu_{b1})P_{4,n}, n=N.$$

From the normalizing condition,

$$P_{1,0}+P_{1,e}+P_{2,0}+P_{2,e}+P_{3,0}+P_{3,e}+P_{4,0}+P_{4,e}=1$$

where ***e*** is the unit column vector of dimension *N*, resulting in:

$$P_{1,0}=1/\psi$$

where

$$\Psi=1-A_{12}A_{22}^{-1}e+\Theta_7 A_{62}A_{22}^{-1}e+\Theta_8 e+\Theta_7 e+\Theta_5\Theta_6^{-1}e$$

A Markov chain of the continuous-time version: $X_t,\ t\in(-\infty,\infty)$ according to [31] is a stochastic process involving a countable set of states $\{S_1,\ S_2,...\}$ and satisfies the Markov chain:

$$P(X_{tn},|\ X_{tn-1},X_{tn-2},...,X_{t()})=P(X_{tn},|\ X_{tn-1})$$

for all choices of $-\alpha<t_0<t_1<...<t_n<\alpha$

3.2. Problem definition

A queuing system in which it is possible to switch off the server is a system with vacations. This is described in figure 1.

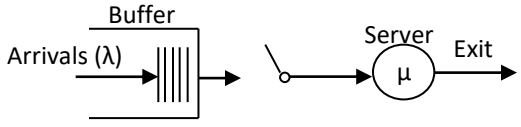

Figure 1: A single server system with vacations

Customers arrive the system are according to a Poisson process, λ. The buffer, in this case has an infinite capacity. The system has a single server with service rate μ, where $\mu > \lambda$. In this queue network, it is possible to adjust the service rate to zero at certain intervals of time depending on varying system characteristics. This queue network has three distinctive costs:

a. The power-on cost *R*: This cost is incurred whenever the server is switched on and it is expressed as: R_k, k = 0, 1, per unit time. The corresponding values of $k = 1$ and $k = 0$ when it is turned on and off respectively;
b. The service cost *r*: This refers to the cost per time unit when the server is switched on and it is expressed as: r_k, *where* k = 0, 1, per unit time when the server is switched on and off with corresponding values of $k = 1$ and $k = 0$ respectively while $r_0 \leq r_1$;
a. The holding cost *h*: This refers to the holding cost per time unit for individual customer in the system, including the one in service (if any).

The goal is to derive an optimal server's control policy, which tells when the server is turned off resulting in the minimization of corresponding average cost rate of the queue network over a period of time. This is a semi-Markov decision process as a result of the use of a controller. Consequently, time intervals between successive service completions is not exponentially distributed. This stochastic process is synonymous with a Markov process at the instants of state transitions.

According to [2], it is optimal to keep the server always on when:

$$\left[\frac{2r(1-\rho)}{h}+1\right]^2 - \frac{8\lambda R(1-\rho)}{h} < 0 \qquad (1)$$

where $\rho = \lambda / \mu$ represents the traffic intensity of the queue network. It is necessary to switch on the server when there are arrivals awaiting service and to power it off when there is none to be served, i.e. while the server is idle. In this case, the least cost is given as:

$$n^* = \sqrt{\frac{2\lambda R(1-\rho)}{h}} \qquad (2)$$

In (2) above, $N = 0$ when (1) is true. In this case, it is optimal to keep the server always on when *R* is significantly larger than the service cost rate *r*.

3.3. Birth and death processes in the proposed method

In the proposed model, service and inter-arrival times of arrivals are independent, exponential random variables with mean values $1/\mu$ and $1/\lambda$ respectively. Consequently, the control of the system is of the optimal threshold type as far as the usage of network resources is concerned. This implies that arrivals finding *K* customers ahead in queue and

service are denied admission into the system for some specified threshold value *K*. The state transitions are shown in figure 2.

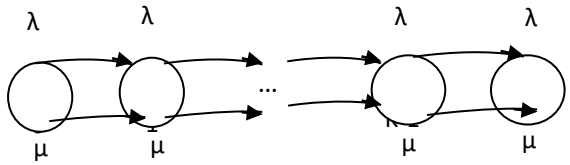

Figure 2: State transitions of the queue model

The rates of transition of each state can be expressed as:

$$\Lambda_{n,n+1} = \begin{cases} \lambda & \text{if } n < K, \\ 0 & \text{if } n = K. \end{cases}$$

$$\Lambda_{n,n-1} = \begin{cases} \mu & \text{if } n > 0, \\ 0 & \text{if } n = 0. \end{cases}$$

$$\Lambda_n = \begin{cases} \lambda & \text{if } n = 0, \\ \lambda + \mu & \text{if } 0 < n < K, \\ \mu & \text{if } n = K. \end{cases}$$

3.4. Fuzzy Markov chain

It is possible to define a fuzzy Markov chain for an *M/M/1* queue system. Let $X = (\tilde{S})$ represent the fuzzy stochastic process which is fuzzy Markovian by an evaluation of the system after the completion of service of a customer and the commencement of service of the next customer in queue. If $\tilde{P}_i$ is the probability of *i* arrival during service time $\tilde{S}$, then $\tilde{P}_i$ is a fuzzy function as there exists a possibility distribution invoked by $\mu_{\tilde{S}}$ on each of its destinations. Since arrival is a Poisson process with λ, defined the fuzzy probability function can be expressed as:

$$\mu_{\tilde{P}_i}(x) = \sup_{t \in R^+} \left\{ \mu_{\tilde{S}}(t) \mid x = \frac{\exp(-\lambda t)(\lambda t)^i}{i!} \right\}$$

Transitions from state *i* to *j* require the arrival of *j* customers for the service interval. Similarly, transition from state *i* to *j* where $j \geq i$, $-1 > 0$ requires that *(j-i+1)* customers arrive during a service interval. Consequently, moving from point *i* to *j* where $j < i - 1$ is not feasible as long as service occurs intermittently.

Given the transition probability matrix of the fuzzy Markov chain: $\tilde{P} = [P_{ij}]$, it is possible to express all $j \geq i-1$, $i > 1$ as follows:

$$\tilde{P} = [P_{ij}] = \begin{bmatrix} \tilde{P}_0, & \tilde{P}_1, & \tilde{P}_2, & \tilde{P}_3, & \ldots \\ \tilde{P}_0, & \tilde{P}_1, & \tilde{P}_2, & \tilde{P}_3, & \ldots \\ 0\ , & \tilde{P}_0, & \tilde{P}_1, & \tilde{P}_2, & \ldots \\ 0\ , & 0, & \tilde{P}_0, & \tilde{P}_1, & \ldots \\ . & . & . & . & \ldots \\ . & . & . & . & \ldots \\ . & . & . & . & \ldots \end{bmatrix}$$

where P_{ij} is defined as:

$$\forall j \geq i-1,\ \ i \geq 1;$$

$$\mu_{\tilde{P}_{ij}}(x_{ij}) = \sup_{t \in \mathrm{R}+} \left\{ \mu_{\bar{s}}(t) \mid x_{ij} = \frac{\exp(-\lambda t)(\lambda t)^{j-i+1}}{(j-i+1)!} \right\}$$

3.5. Design process of the fuzzified controller

The design of the fuzzy-based controller is premised on the assumption that the server is kept active as long as there are customers awaiting service turns and switched off once there are no customers awaiting service turns. It is possible to express the state of the system as: *(x, y)*, where *x = xt* is the server's state at time *t*, with value 0 while the server is powered off and 1 while the server is in the ready state. Similarly, the number of customers in the system awaiting service turns including the one in service (if any) at time *t is*

y = y(t). The value of *y* changes whenever there is a new arrival or a customer exits the system as a result of service completion. The value of *x* changes anytime the server is powered on or off. Consequently, the average cost rate of the queue system for a given period of time can be expressed as:

$$g = \lim_{T \to \alpha} \left[\sum_{t=1}^{T} \frac{hs(t)}{T} + \sum_{t=1}^{T} \frac{rk(t)}{T} + \sum_{t=1}^{T} \frac{Rx1_{\{k(t-1)=0,\ \mathrm{k(t)}=1\}}}{T} \right]$$

where $1\{k(t-1) = 0,\ \mathrm{k(t)} = 1\}$ is a function with value *1* if condition *x* is true and *0*, if otherwise. This implies that $Rx1_{\{k(t-1)=0,\ \mathrm{k(t)}=1\}}$ is the cost of switching on the server at time *t*. Similarly, the cost, *c* is expressed as:

$$c = h \sum_{i=1}^{n} s_i$$

where i is the i^{th} consecutive time of server's state, n is the sum of time the server was idle in the current state k beginning from the last time it was switched to that state while s_i is the number of arrivals in the system at the i^{th} time.

There are three cases when it might be optimal to power on the server. These include:

a. Provided there is no powering on costs, it is cost effective to turn on the server when there is an arrival. This is because switch-on cost might result in a delay to turn on the server even while there are arrivals in the system awaiting service turns. This is to ensure a reduction or avoidance in this cost. In this case, the optimal switching-on time will depend on the relationships that exists between holding cost and the cost of switching on the server. This relationship results in the fact that when the accumulation of holding cost c during the server's idle time is enough to compete with the switching cost, it is optimal to switch on the server.
b. The traffic intensity ρ is defined using the following function:

$$\rho = \lambda / \mu$$

In this case, ρ is the average server's usage over an infinite time 1- ρ. This quantity is the fraction of the time it is possible for the server to be idle. If $\rho \geq 1$, then the number of customers in the system increases infinitely. In this case, if the server is switched off during a fraction of time T, this will save a constant cost rate r while the holding cost rate will grow at an average rate of $h\lambda$. It is optimal to keep the server active during this time. However, $\rho=0$ *and* $\lambda=0$, it is optimal to serve all customers in the system after which the server is switched off permanently. In order to prevent this, it is assumed that $\rho > 0$. If ρ is close to zero, then it is necessary to keep the server idle until the accumulation of holding cost $\boldsymbol{c}$ during the server's idle time. In this case, it is optimal to turn on the server. This can be succinctly stated that the higher the ρ, the easier it becomes to decide to switch on the server.

c. If $h = 0$, keeping the server idle switched off achieves minimal cost $g = 0$. This is so despite the fact the number of customers in the system increases as time T increases. In this case, it is assumed that $h > 0$. Hence, it is obvious that the higher the h, the easier it is to make the decision to switch on the server.

The inputs of the rule base include: c, h and ρ with each input represented by four linguistic values: EM, FP, PO and HP representing 'Empty', 'Fairly Positive', 'Positive' and 'Highly Positive' respectively. The integer weight for each linguistic input value was assigned as 0, 1, 2 and 3 for EM, FP, PO and HP respectively. The output of each rule combination is denoted by *dec.*, indicating the decision as to when to switch the server 'on' or 'off'. This is represented by the linguistic values ON and OFF.

Rule sequence	c	h	ρ	*dec.*
1	EM	EM	EM	OFF
2	FP	EM	EM	OFF
3	PO	EM	EM	OFF
4	HP	EM	EM	ON
5	EM	FP	EM	OFF
6	FP	FP	EM	OFF
7	PO	FP	EM	ON
8	HP	FP	EM	ON

9	EM	PO	EM	OFF
10	FP	PO	EM	ON
11	PO	PO	EM	ON
12	HP	PO	EM	ON
13	EM	HP	EM	ON
14	FP	HP	EM	ON
15	PO	HP	EM	ON
16	HP	HP	EM	ON
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
49	EM	EM	HP	ON
50	FP	EM	HP	ON
51	PO	EM	HP	ON
52	HP	EM	HP	ON
53	EM	FP	HP	ON
54	FP	FP	HP	ON
55	PO	FP	HP	ON
56	HP	FP	HP	ON
57	EM	PO	HP	ON
58	FP	PO	HP	ON
59	PO	PO	HP	ON
60	HP	PO	HP	ON
61	EM	HP	HP	ON
62	FP	HP	HP	ON
63	PO	HP	HP	ON
64	HP	HP	HP	ON

The decision (*dec.)* is OFF if the sum is less than or equal to 2; otherwise it is ON. The mathematical weight of rule 1, for instance is 0 + 0 + 0 = 0. The sum 0 < 2 and therefore the *dec.* is OFF. For rule 13, the mathematical weight

is EM (0) + HP (3) + EM (0) = 3. The sum i.e. 3 >2, therefore the *dec.* is ON. Similarly, for rule 59, the mathematical weight is PO (2) + PO (2) + HP (3) = 7. The sum i.e. 7 > 2, therefore the *dec.* is ON.

The membership function of the input variables is either triangular or trapezoidal. The forms of the membership functions of inputs these values depend on the corresponding inputs. The interval $[0, +\infty)$ depicts the domain of the accumulated cost c. This implies that when $c \geq R$, then c is of the fuzzy set HP with membership grade 1, thereby making it of a trapezoidal membership function. The membership functions of EM, FP and PO for c are triangular in form with peak values distributed between 0 and R. In order to obtain the normalized values of c, observed values were multiplied by the scaling factor $6/R$. Membership functions of the normalized input value c are depicted in figure 2.

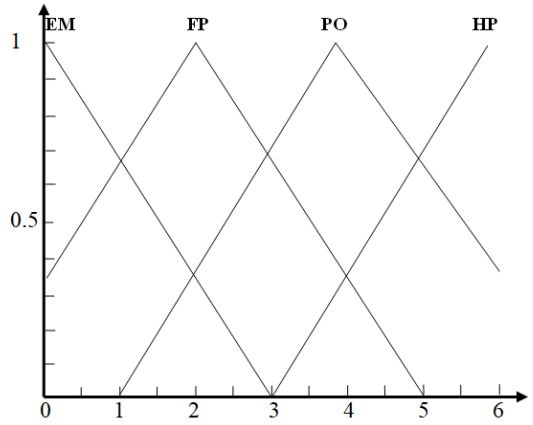

Figure 2: Membership functions for normalized input c.

HP has a membership grade 1 since $h \geq R$. Hence when $h \rightarrow 0$, then h is of the set EM with membership grade 1. Similarly, $\rho \in (0, 1)$ is HP for ρ with membership grade 1 while EM is at 0. Consequently, the scaling factors of h and ρ are $6/R$ and 6 respectively.

If all arrivals had been served and consequently left the system, the server is switched off at this time to prevent unnecessary costs. In this case the server is switched off during n time units, $i = 1, 2, \ldots, n$. The emergence of a new arrival into the queue network corresponds to a time unit where $s_i = s_{i+1} + 1$. The expected arrivals in any interval in the queue network is therefore proportional to ρ. Figure 3 shows the membership functions for normalized input ρ.

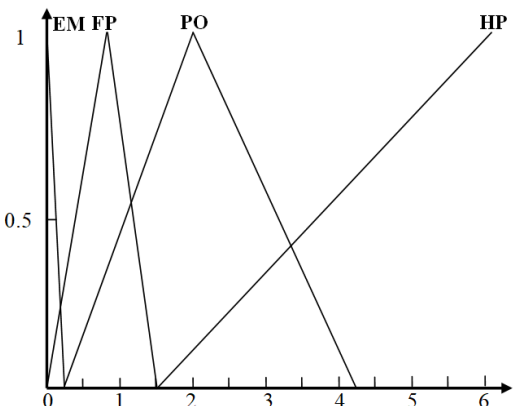

Figure 3: Membership functions for normalized input ρ

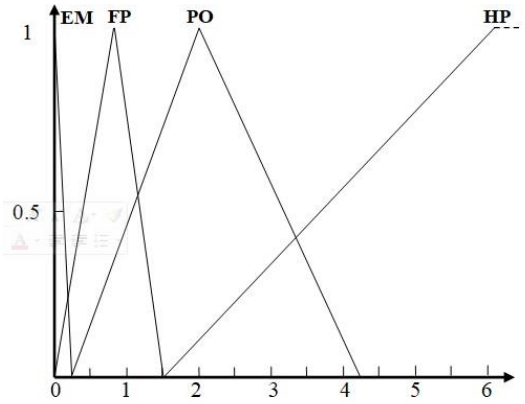

Figure 4: Membership functions for normalized input *h*

The membership functions for *h* are the same for ρ, however the normalized equivalents of *h* are unbounded. Figure 4 shows the membership functions for normalized input *h*.

3.6. Simulation process of the Markov queueing system

Simulation is a technique which involves the use of a computerized process to derive a sample path and evaluate the behaviour of a stochastic entity. Consequently, it is a symbolic representation of the underlying rules that relate a present state to past states. Thus, if given a state at time zero, a simulator derives subsequent states and their corresponding transition epochs as they evolve.

4. RESULTS

The sojourn time in state S_i is of the exponential distribution value λ_i. In addition, the probability of the system moving from S_i to S_j is λ_{ij} / λ_i, which does not depend on the time spent in S_i.. The queueing system has a monotonic state variable which ranges over the set $\{S_1, S_2, ...\}$. If it happens that the system is in state S_i at time zero , then it implies that the system will remain in this condition for a stochastic interval of time with an exponential

distribution function with mean value $1/\lambda_i$. From this state, it proceeds to the next state i.e. S_j having probability function λ_{ij}/λ regarding some time distribution.

The system was simulated beginning from a point where $k = s = c = 0$ while adopting a fuzzified control at each decision-making process. The first 100 time units were considered the warm-up period for the system. The emergence of the values of *k* and *s* for the first 1,500 unit of time is depicted in figure 5.

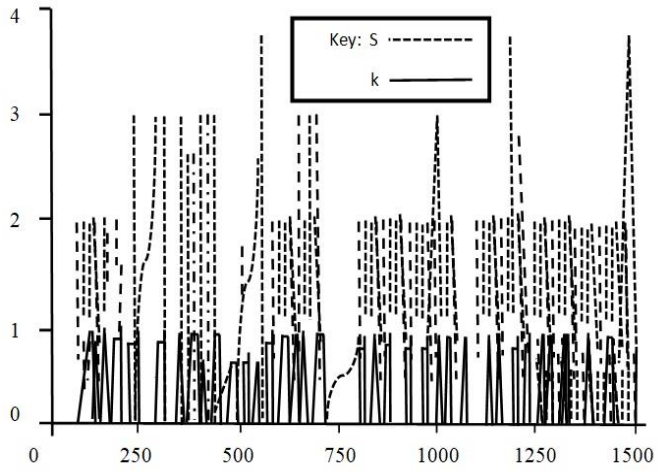

Figure 5: Evolution of *k, s*

An evaluation of figure 5 indicates that it follows an idle server is not immediately switched on to begin service upon the arrival of a customer but rather after multiple arrivals. This is an indication of the hysteretic property of the system

which establishes a direct relationship between the numbers of customers and the number of times the server is turned on. In other words, it shows the frequency of number of times the server is turned on as a function of *s* during a period of 15,000 units of time. It is obvious that the server is most often turned on when there are arrivals in the system.

If the capacity of server is $r \geq 1$ and it takes *r* customers per service, then if at the end of service less than r customers are awaiting service turns, an idle period begins and the server consequently goes on vacation. The server begins service again only when the queue size is equal to *r*. In this system, service of arrivals is started and turns off when it crosses *r*. This is common in transportation problems. Queueing systems in which the server capacity could be a random variable subsequent to a vacation period is feasible in distributed systems as well as assignment problems.

The input process is a systematic Poisson process of $\{r_n; n \in N\}$ having intensity $\lambda > 0$. While r_n is the arrival rate of the N^{th} customer, *N(t)* is the associated incremental process. Similarly, if σ_n denotes the service time of N^{th} category of arrivals, it is assumed that $\{\sigma_n; n \in N\}$ and $\{r_n; n \in N\}$ have no relationship. If $T_n (T_0 = 0)$ is

the time of the N[th] service completion and the queue size is greater than r, then $T_{n+1} - T_n = \sigma_n$. However if the queue size is less than *r*, $T_{n+1} - T_n = (\text{time for the queue to reach N}) + \sigma_n$. Similarly, if V_n is the number of arrivals in the queue during the N^{th} service σ_n and *Q(t)* represent the queue size at any time *t*, then the server takes a batch of exactly *r* customers. The service time σ_n is exponentially distributed based on a probability distribution function with a finite moment *b*. If the number of arrivals awaiting service turns at time T_n is less than *r*, then an idle period begins. In figure 5, the idle period is more of the values which are lesser than 1. Idle period starts every time the queue drops to *r*. Once there are $N \geq r$ arrivals in the queue, service is started.

5. CONCLUSIONS

The proposed method had proven to be efficient in the management of admission of arrivals in an M/M/1 queue system involving server vacations. Consequently it is suitable in the control of admission in traffic and communications control systems since the control of admission is of the threshold type.

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PAPER 15 - BIG DATA: AN ASSESSMENT OF PUBLIC LIBRARIES IN NIGERIA

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ABSTRACT

This study examines librarians' perception on the ease of use and perceived usefulness of big data in public libraries in Kwara State, Nigeria. It adopted a descriptive survey design and purposive sampling technique was used. A total of 16 professional librarians filled the questionnaires and responded to the interview questions. The data collected were analyzed and revealed that librarians expressed different degrees of optimism, lack of perception on the use of big data in their various libraries and that big data has not been applied in their libraries. One of the findings is that the Public libraries in Kwara State have no dedicated section or department for big data. This study recommends that Public library authorities and professional organizations should develop educational programs and training sessions to enhance librarians' knowledge of big data concepts and applications. It further recommends that librarians should engage in collaboration and networking among librarians within and across libraries to facilitate knowledge sharing, best practices, and the exploration of big data implementation strategies.

KEYWORDS: **B**ig data, Perception, Librarians, Public Library, Perceived Usefulness.

INTRODUCTION

The fourth industrial revolution, which is currently in its early phases and will see new advances as a result of advancements in sectors like robotics, artificial intelligence (AI), quantum computing, 3D printing, the internet of things (IoT), and Big data is already underway. This research focuses on Librarians' Perception on the Ease of Use and Perceived Usefulness of Big Data in Public Libraries in Kwara State**.**

Li, Tao, Cheng & Zhao (2015) both found that the emergence of big data was the result of an information explosion. The amount of knowledge generated in just the year 2006 is equivalent to the information contained in all books ever written. The development of information technology, such as information gathering, storing, and processing, has fueled the growth of big data (Bryant, Katz, and Lazowska, 2008; Li et al 2015; Moise, 2016; Xu et al 2015). New opportunities and demands for people and organizations are brought about by the proliferation of information and the development of information technologies.

In addition, library collections that are developed based on regionally-produced clinical data create demanding conditions that force librarians to strengthen the educational networks of their users. Therefore, effective development systems need to be developed at these libraries (Newton, Miller, & Bracke, 2010). Big Data technology makes it easier to work with big datasets, hyperlink unique datasets, locate styles in real-time, predict results, undertake dynamic risk scoring, and test hypotheses. In contrast, both libraries and librarians are uniquely

ideal for operating with large statistics. According to Muhammed and Garba (2018), traditional library services such as serial services, circulation services, loan services, children services and reference services are the majority of the services offered by public libraries in Northern Nigeria. Big data has come to stay and now librarians must learn how to use this technology in their day-to-day activities, this has coerced public librarians to begin obtaining an understanding of big data, its effect on their discipline and how it may be used effectively for various purposes in the library.

Utilizing big data in libraries

Affelt (2015) and Kaladhar, Naicka and Rao (2018) noted some issues which are common to both library data and big data as listed below:

Lack of Data Analysts: The fundamental problem is that data analysts require not only statistical and computer science skills but also domain expertise and teamwork abilities. Therefore, managing the information in big data is one of the issues facing librarians. It also appears that short-course training may be ineffective.

Lack of Requisite Facilities: Big data recommender system deployment in libraries depends on the availability of necessary resources such as ICTs, internet and network services, software and steady power supply which are typically unavailable in some libraries in Nigeria, especially public libraries.

Budget Issues: Even though more and more individuals are becoming aware of the many advantages of adopting big data, IT investments like analytical servers and highspeed computing servers are still required. Due to financial cuts, it appears that most library administrations have not yet considered using big data. The difficulty of managing human resources results in less attention being given to research data controlled by projects. In addition, a lot of research data from ten years ago is still in analogue form. Digitizing these resources is a difficult operation that takes a lot of time and resources.

Big data and librarians

The ability to enable data recovery and retrieval, maintain data quality through cataloguing, indexing, archiving management, preservation, and representation, and make big data sets more useful, visible, and accessible through the creation of taxonomies are all skills that librarians can use to get involved in big data.

Affelt (2015) created an intriguing phrase to describe what librarians might develop into as the necessity to manage Big data becomes more and more necessary. Although the connection between libraries and big data may initially seem strange, there are possibilities first, as Bertot et al (2014) noted, the required infrastructure must be developed to support the type of labor that proper data collection, analysis, and utilization game. Given their familiarity with personal assistance as part of big data, Public librarians with experience in creating community information are especially well suited to contribute to the creation and management of networked community information services.

Application of big data in public libraries

Big data is not a new concept in the public sector, but its implementation is not uniformly applied across all public sectors (Fredriksson et al, 2017). The public library which is essential for promoting the use of technologies created since the advent of big data has received relatively little research attention(Ylipulli and Luusua, 2019)To foster lifelong learning, peace, cultural development, and social welfare, public libraries must disseminate knowledge to its patrons(Abumandour, 2020) Hence, public libraries should organize data, information, and knowledge to fulfil these obligations, as a result managing and acquiring knowledge from big data is inevitable in public libraries.

However, before implementing big data in public libraries, Libraries must take into consideration a very important factor which is the ease of use, Ease of use can be defined as how easily users can use a technology (Big data). Many librarians, according to (Zhan and Widen, 2018) are unfamiliar with the idea of big data-related services. The use of big data software to analyze library data, however, offers a breakthrough in terms of analysis and offers a new way for quickly and effectively evaluating library services, according to research by Kim and Cooke (2017) on

public libraries in London and Seoul. Several librarians do not understand the concept of big data-related services, therefore big data may not be easy to use by this group of people.

Perceived usefulness of big data in public libraries

An individual's perception of how technology or a specific technology is designed to enhance their work or roles in terms of efficiency and effectiveness is known as perceived usefulness. The general perception of opinions about this advancement in librarianship was studied by Zhan and Widen (2018) through a survey and one of the findings was that the interviewees considered big data to be an effective approach for understanding the requirements of library patrons. Furthermore, tools could be developed with big data to support decision-making processes.

Big data's potential for assisting libraries has been proven in professional communities. Despite this, there is another factor to be considered, which is the actual behavior intention and actual usage of this strategy, even though the perception may appear to be favorable (Islam et al, 2021). Big data has been highlighted as a way for librarians to increase their work capacity as well as for librarians to increase their work capacity as well as for librarians to increase their work capacity as well as for libraries to advance to the next level of efficiency.

(Stejskal and Hajek, 2015) assert that public libraries must remember their role in the formation and building of new communities that describe one of the essences of libraries owing to their experience in the department, although acknowledging the obsession with the use of big data.

By gathering, preserving, organizing, and analyzing a vast amount of data, big data also seeks to develop already existing technologies. Through the transformation of outdated learning methods, the age of data abundance has expedited technological growth and led to greater inquiry in science and technology.

Objectives of the study

The broad objective of this study is to examine the Librarians' Perception on the ease of use and perceived usefulness of big data in public libraries in Kwara state Nigeria.

1. Examine the Librarians' perception on the ease of using big data in public libraries in Kwara State Nigeria.
3. Determine the perception of the relevance of big data in public libraries by librarians in public libraries in Kwara state Nigeria.
4. Investigate the perceived usefulness of big data by librarians in public libraries in Kwara State, Nigeria.
5. Identify the challenges militating against the use of big data perceived by librarians in public libraries in Kwara State Nigeria.

Research Questions

Based on the objectives some research questions are;

1. What is the perception of librarians in public libraries on the ease of using big data in public libraries in Kwara state Nigeria?
2. What are the perceptions of the relevance of big data in public libraries by librarians in public libraries in Kwara state Nigeria?
3. What is the perceived usefulness of big data by librarians in public libraries in Kwara state Nigeria?
4. What challenges are militating against use of big data perceived by librarians in public libraries in Kwara state Nigeria?

METHODOLOGY

The research adopted a descriptive survey design and employed in-depth Interview for Data collection. A purposive sampling technique was adopted to select Professional librarians ten (10) from Kwara State Library and six (6) from National Library, Ilorin. A 20-item Likert scale questionnaire was administered. Descriptive statistics was used for the analysis of the data with the aid of version 24-SPSS.

DISCUSSION OF FINDINGS

The demographic characteristics of the respondents set the stages for understanding the study's findings. The fact that majority of the respondents were from the National Library, Ilorin and Kwara State Library suggests that there may be variations in resources and experiences between these two types of libraries. This difference could potentially influence perceptions of big data's usability and relevance. The gender distribution of male and female librarians raises questions about gender disparities in leadership roles within libraries in Kwara State Nigeria. It would be important to explore whether these disparities influence decision-making regarding the adoption of big data technologies and whether there are gender-related variations in perceptions. The departmental distribution shows that the majority of respondents were in the Circulation and Serials departments. This concentration in these departments could affect the adoption and utilization of big data technologies in other areas of library operations. It is worth investigating how different departments within libraries perceive and interact with big data.

Librarians' Perception on the ease of using big data in public libraries in Kwara state.

The findings regarding librarians' perceptions of the ease of using Big Data in public libraries in Kwara State Nigeria reveal a prevailing lack of familiarity with this emerging concept. The survey and interview responses consistently highlight a lack of knowledge and exposure to Big Data among the librarians, with some stating that they have not even encountered the term before. This fundamental lack of awareness regarding Big Data sets the stage for a cautious and hesitant attitude towards its potential application in libraries. This is against the backdrop of the findings of Hamad, Fakhuri and Jabbar, (2020) that there is high level of awareness of Big Data among library staff in Jordanian academic libraries.

Furthermore, the informants express their uncertainty about the possible applications of Big Data in libraries due to their limited understanding of the concept. This lack of knowledge did not only affect their perceptions of ease of use but also inhibits their ability to envision how Big Data could be integrated into library operations. As a result, there is an overarching theme of apprehension and reluctance among librarians regarding the ease of using Big Data in libraries. It is crucial to note that while the responses consistently indicate a lack of awareness and understanding, there is also an openness to learning and exploring the potentials of Big Data in libraries. Librarians recognize the importance of staying informed about emerging technologies, and this awareness may serve as a foundation for future exploration and capacity-building in this area.

Librarians' perception of the relevance of big data in public libraries in Kwara state.

Findings from this study revealed that librarians perceive big data as relevant in certain aspects of library services, such as spotting trends and patterns and optimizing library operations. However, the respondents also show high level of skepticism about whether big data is useful in evaluating the significance and worth of library services more precisely. While the librarians may not have an in-depth understanding of Big Data, they acknowledged its relevance, especially in the context of modernizing library services and operations.

Several informants emphasize the importance of Big Data as an emerging technology that can streamline library operations and provide valuable insights into user behavior and resource utilization. They view it as a means to digitize and organize information resources effectively, making them more accessible to library users. This perception aligns with the broader trend of technology-driven transformations in libraries worldwide. The recognition of the relevance of Big Data in libraries indicates a willingness to explore its potential applications and benefits. It is essential to capitalize on this positive perception and leverage it as a driving force for future initiatives aimed at integrating Big Data into library operations.

Perceived usefulness of big data by librarians in public libraries in Kwara state.

The findings regarding the perceived usefulness of big data indicate that librarians recognize its potential for enhancing efficiency and understanding patrons' needs and preferences. These perceptions align with the broader literature on the benefits of big data in library settings. However, the overall weighed mean suggests that librarians have reservations about its practical implementation. This could be due to concerns about data privacy, resource limitations, or technical challenges. Furthermore, they draw parallels between Big Data and automation, suggesting that its impact could be similar. They see the potential for Big Data to improve resource management and information preservation efforts in the future. The librarians' recognition of the potential usefulness of Big Data demonstrates a forward-looking perspective and a readiness to embrace technological advancements in library services. It suggests that librarians are open to exploring the practical applications of Big Data once they gain a better understanding of its capabilities.

Challenges militating against the use of big data perceived by librarians in public libraries in Kwara State.

Findings from this study revealed that the challenges perceived by librarians regarding the use of big data are significant and multifaceted. Privacy and security are paramount concerns, indicating apprehensions about handling sensitive patron data. Budget issues also pose substantial challenges. These concerns may be related to the costs associated with acquiring and maintaining big data technologies. Additionally, informants emphasized that since they were not currently using Big Data, they cannot identify specific challenges at present. However, they anticipate that challenges related to adoption and the need for technical know-how may arise in the future when considering the implementation of Big Data initiatives. This anticipation of challenges underscores the importance of capacity-building and training programs to equip librarians with the necessary skills to harness the power of Big Data effectively. It also highlights the need for infrastructure improvements to address issues related to power supply and internet connectivity. This agrees with the findings of Hussain and Shahid (2022) in their study on the impact of big data on library services.

Conclusion

This study investigated the Librarians Perception on the ease of use and perceived usefulness of big data in public libraries in Kwara state. The findings revealed the current state of knowledge, attitudes, and expectations among librarians regarding this emerging technology. The demographic analysis revealed that the majority of respondents were from the National Library, Ilorin, indicating a diverse representation of librarians from various backgrounds. Additionally, there was a gender balance among the participants, with slightly more male respondents. Regarding the perception of librarians on the ease of using big data, the study found that a substantial number of respondents were unfamiliar with the concept, indicating a lack of knowledge about big data. This lack of awareness extended to its potential applications in libraries, with many participants unable to envision how big data could be integrated into their work.

RECOMMENDATIONS

Based on these findings, the researcher has made the following recommendations for the librarians in public libraries in Kwara State:

1. Educational Initiatives: Public library authorities and professional organizations should develop educational programs and training sessions to enhance librarians' knowledge of big data concepts and applications. These initiatives should focus on building a foundational understanding of big data and its potential benefits for libraries; and
2. Collaboration and Networking should be encouraged among librarians within and across libraries. This can facilitate knowledge sharing, best practices, and the exploration of big data implementation strategies.

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PAPER 16 - PERCEIVED INFLUENCE OF ARTIFICIAL INTELLIGENCE (AI) ON STUDENTS' LEARNING ENGAGEMENT IN UNIVERSITY

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ABSTRACT

The study examined the perceived influence of Artificial Intelligence (AI) on students' learning engagement in university. Two research questions guided the study. A descriptive survey research design was used. The population comprised 29,548 undergraduates of Tai Solarin University of Education (TASUED), Ijagun, Ogun State, Nigeria. A total of 3500 undergraduates were selected as sample size using the stratified technique. A researcher-designed instrument tagged 'Artificial Intelligence (AI) and Students Learning Engagement Questionnaire (AISLEQ) was used for data collection with 0.93 as the reliability coefficient. Descriptive statistics of mean, standard deviation, and bar chart were used for analyzing research questions. The findings revealed that AI can influence students' learning engagement in university. Limited language options, cultural and religious barriers, biases and lack of accountability, software malfunction, inadequate data infrastructure, high cost of implementation, limited access to high technology, complex algorithms, AI-human interface, and decline of investment were among the challenges confronting Artificial Intelligence (AI) for students learning engagement in university. University management should endeavor to provide the required technological tools for AI operations in each department for lecturers' and students' usage for teaching and learning.

KEYWORDS: Artificial Intelligence, Student, Learning, Engagement, University

INTRODUCTION

Different efforts have been made towards improvement in students learning engagement in university education. One can say that student engagement is the extent to which students show attention, curiosity, optimism and interest in the material that they are being taught. It may refer to students' cognitive investment in their learning, including participating and committing to their studies. In general, students' learning improves when engagement levels are high. Even, student engagement refers to students' willingness to participate in and be successful in their learning process. Student engagement is made up of emotional, behavioural and cognitive engagement. The first shows students' feelings about their instructor, classroom and sense of belonging. The second shows how attentive and invested students are in their classes. The final type of engagement shows how intrinsically motivated students are in their learning process. Also, student engagement is a measure that reflects the quantity and quality of a learner's participation in their courses and every other aspect of their educational program. Also, it echoes a students' interaction and cooperation with co-students and instructors. It is believed that students who effectively engaged in the classroom should translate to better and improved academic outcomes. According to Augustine and Olele (2021), students learning engagement have been affected by several factors, for instance, mobile devices and social media have been sources of distractions for students in today's classroom. Students seem to pay less attention to any classroom learning process whenever they are with their mobile devices in the classroom. Watching online videos

and chatting with friends with their mobile devices seem to be of great importance to students than whatever a teacher is doing in the classroom.

Since today's students attach so much to the Internet, lecturers may need to migrate learning content to the online learning zone. Many universities are now utilizing the opportunities that online education provides to ensure that learners are not lagging in their studies, especially in this epoch of Information and Communication Technology (ICT) (Augustine & Olele, 2021). Pınar and Suleyman (2021) opined that Artificial Intelligence (AI) as one part of ICT is the ability of a computer or a computer-controlled machine to perform tasks related to higher mental processes, such as reasoning, inference, generalization, and learning from past experiences, which are generally assumed to be human-specific qualities. Artificial Intelligence (AI) emerges as a dynamic force capable of reshaping social interactions, particularly in education. AI-driven teaching and learning solutions are undergoing testing to prepare students for an AI-driven future (Bulus, 2024). The adoption of AI technologies in education seeks to enhance knowledge acquisition, leading to a surge in online learning. However, many developing nations, Nigeria included, face challenges in fully harnessing AI benefits due to infrastructural limitations and limited access to the Internet. The escalating demand for education worldwide strains existing institutional infrastructure and human resources. Developing nations grapple with operational and technological challenges, impeding the integration of AI-backed learning despite its recognized advantages. This is exacerbated by financial constraints, hindering the establishment of necessary infrastructure and internet access (Bulus, 2024).

In advanced technologies, Artificial Intelligence (AI) stands at the forefront, widely adopted by well-funded universities. While Nigeria claims reputable academic institutions, the lack of financial support impedes their ability to keep pace with the latest AI advancements (Adesulu, 2018). Analogously, the application of AI in Nigeria is akin to requesting a fish to climb a tree or comparing a small knife to a machete. Despite the availability of online learning resources in numerous institutions, only a handful actively cultivate AI capabilities (Adejo & Misau, 2021; Enang, 2022). Afolabi (2014) noted that, despite the prevalence of online learning, students face computer literacy challenges, hindering their engagement with technology-centric education. This predicament arises from the failure of institutions to innovate teaching and learning methods through AI. Nigeria's educational landscape lags behind in AI integration, despite the pressing need for expansion (Bulus, 2024). The application of technology in research, education, and learning is crucial for growth, yet the impetus for change in the Nigerian teaching and learning sector remains limited (Enang, 2022).

Efforts to introduce AI e-learning models in Nigerian educational institutions primarily revolve around collaborative learning frameworks. The educational goals set by the Seventh National Development Plan and Vision 2020 align with the United Nations' Millennium Development Goals, emphasizing the use of AI technologies in education (Bulus, 2024). Evaluating the suitability of these platforms in fostering a conducive learning environment for technology personnel is imperative. The integration of AI-enabled learning into the university system necessitates the education of teacher educators, demanding professional development and support. However, existing workshops and training have proven inadequate. AI-based learning emerges as a potential solution to the challenge of limited physical space on university campuses (Ndzibah & Ofori, 2017). According to Castaeda and Selwyn (2018), AI is a growing trend, it is time for the precise revolution that we anticipate in the educational sector. Almost all industries have adopted it, including the educational sector, and some of its components are currently being automated. According to a study by Agarry (2022), Nigerian education must transition from analogue to digital, and AI technology is a key component of this process. Students are aware of and prepared to use AI-based learning systems, even at the secondary school level, according to Adelana and Akinyemi's (2021) research. Currently, social media and the internet are used by most Nigerian institutions. According to Adelana and Akinyemi (2021), since students are aware of and willing to accept AI-based learning systems, it is necessary to design, develop, and apply them in university education in Nigeria.

STATEMENT OF THE PROBLEM

Many complains have been raised on the level of University students learning engagement. Personal observations by the researcher revealed that students in university today have low level of learning engagement in classroom. This ugly circumstance might be among the factors causing poor academic performance of University students. Government and other stakeholders have taken some steps to address the issue, such as employment of qualify teachers, training and retraining of teachers among others. Despite that, university students learning engagement seems not to have improved. This study was an attempt to examine the perceived influence of Artificial Intelligence (AI) on students learning engagement in university.

OBJECTIVES OF THE STUDY

The main objective of the study was to examine the perceived influence of Artificial Intelligence (AI) on students learning engagement in university. Specifically, the study sought to:

1. Find out the extent to which AI could influence students learning engagement in university.
2. Identify the likely challenges confronting Artificial Intelligence (AI) for students learning engagement in university.

RESEARCH QUESTIONS

The following research questions were analyzed in this study:

1. To what extent does AI could influence students learning engagement in university?
2. What are the likely challenges confronting Artificial Intelligence (AI) for students learning engagement in university?

METHODOLOGY

A descriptive survey research design was used for the study. The population of this study comprised 29,548 undergraduates of Tai Solarin University of Education (TASUED), Ijagun, Ogun State, Nigeria for the academic session 2023/2024. Using purposive and stratified sampling techniques, a total of 3500 undergraduates were selected as sample size representing 11.8% of the population. The stratification was based on gender sensitivity. A researcher-designed instrument tagged 'Artificial Intelligence (AI) and Students Learning Engagement Questionnaire (AISLEQ) was used for data collection. AISLEQ was used for the collection of data on the extent AI influence students learning engagement in university and the likely challenges confronting Artificial Intelligence (AI) for students learning engagement in university. This questionnaire was administered to undergraduates in TASUED. The questionnaire requested responses on a four (4) – point scale format which was a modification of 5-point Likert scale. The responses rating scales are as follows: Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). To ensure the face and content validity of the instrument, copy of the instrument was given to three experts in the Departments of Educational Technology in Tai Solarin University of Education, Ijagun, Ogun State for content correction After all the identified corrections were done, the final draft was used to gather the required data for the study. Reliability test of the instrument was done using Cronbach Alpha. In this case, copies of the instruments were administered on twenty-five undergraduates of Lagos State University of Education (LASUED), Lagos State, Nigeria. The collected data from the administration of the instrument were computed using Cronbach Alpha. The respective reliability estimate was reported as 0.93. This implied that the instrument was reliable and can help the researcher to elicit required data for the study. Primary method of data collection was adopted in this study. Questionnaire was the basic instrument used for data collection. The exercise was done within two months with the help of three trained research assistants. Descriptive statistics of mean, standard deviation and bar-chart were used for analyzing research questions. Any mean score of 2.5 and above was regarded as agreed while any one below 2.5 regarded as disagreed.

RESULTS

Research Question 1: To what extent does AI could influence students learning engagement in university?

Table 1: Descriptive statistics on the extent does AI influence students learning engagement in university

Items	Mean	SD	Remarks
Artificial intelligence (AI) rendered learning more engaging.	2.74	.636	Agreed
AI provides deeper insights into student learning.	2.56	.698	Agreed
AI facilitating individualized learning processes.	2.81	.782	Agreed
AI motivates student learning.	2.93	.792	Agreed
AI interactive engaged student learning.	2.78	.845	Agreed
AI provides immersive experiences for student.	2.71	.893	Agreed
Through adaptive content of AI, student learning engagement is enhanced.	2.59	.901	Agreed
Gamification and instant feedback of AI helps student learning engagement.	2.67	.832	Agreed
AI-powered virtual assistants and chat bots provide real-time personalized for student learning.	2.69	.799	Agreed
Average Mean	2.72		

Source: Field Survey, 2024

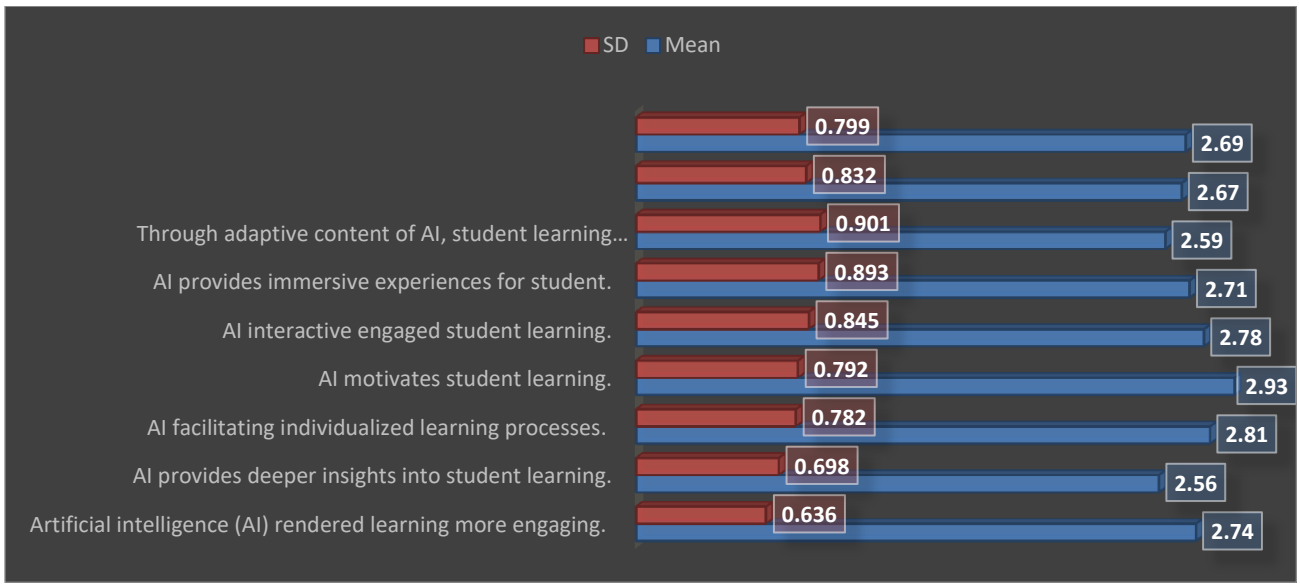

Figure 1: Bar-chart showing how AI influence students learning engagement in university

Table 1 revealed that average mean was 2.72 and bench mark mean value was 2.50 based on four scales responses. Since, 2.72 > 2.50; the implication of these results was that AI could influence students learning engagement in university.

Research Question 2: What are the likely challenges confronting Artificial Intelligence (AI) for students learning engagement in university?

Table 2: Descriptive statistics on the challenges confronting Artificial Intelligence (AI) for students learning engagement in university

Items	Mean	SD	Remarks
Limited language options	2.88	.609	Agreed
Cultural and religious barriers	3.01	.572	Agreed
Biases and lack of accountability	2.77	.800	Agreed
Software malfunction	3.16	.593	Agreed
Inadequate data infrastructure	3.15	.601	Agreed
High cost of implementation	2.55	.888	Agreed
Limited access to high technology	2.57	.784	Agreed
Complex algorithms	3.06	.603	Agreed
AI human interface	3.15	.582	Agreed
Decline of investment	2.99	.704	Agreed
Average Mean	2.93		

Source: Field Survey, 2024

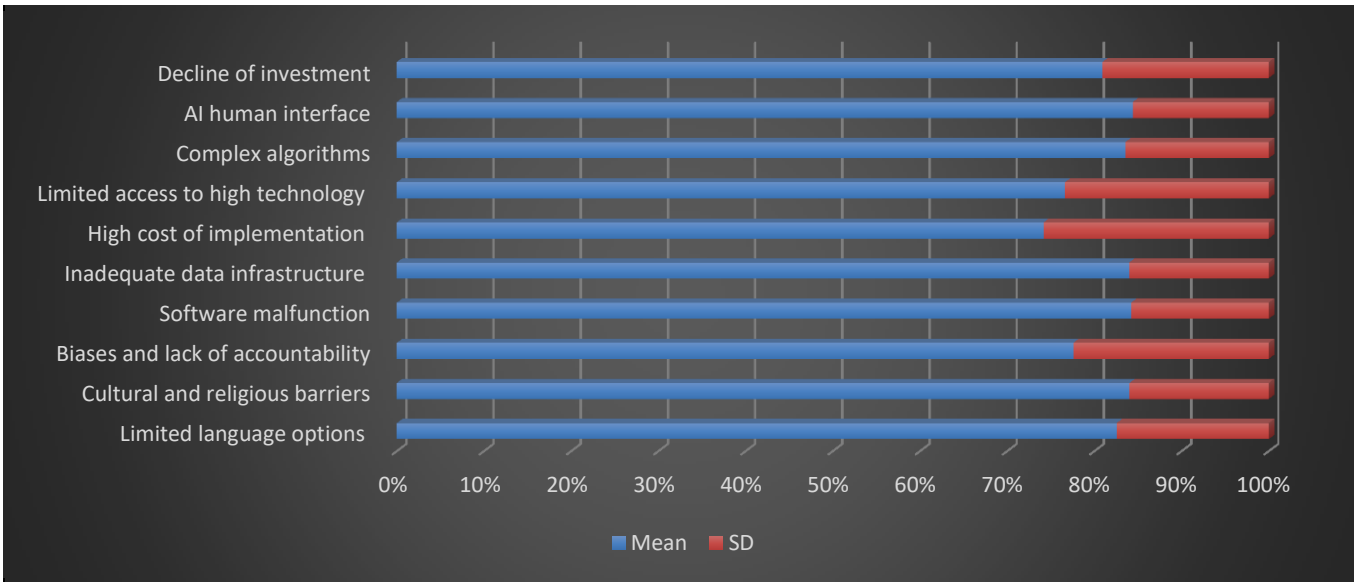

Figure 2: Bar-chart showing challenges confronting Artificial Intelligence (AI) for students learning engagement in university.

Table 2 indicated that average mean was 2.93 and the bench mark mean value of 2.50. Since, 2.93 > 2.50, this implied that limited language options, cultural and religious barriers, biases and lack of accountability, software

malfunction, inadequate data infrastructure, high cost of implementation, limited access to high technology, complex algorithms, AI-human interface and decline of investment were among the challenges confronting Artificial Intelligence (AI) for students learning engagement in university.

DISCUSSION OF FINDINGS

The findings of the study revealed that AI can influence students learning engagement in university. These findings Bulus (2024) who found that AI has capacity to enhanced and improved student learning engagement in school through intelligent tutoring systems, learnable robots or agents, web-based educational systems, and learning management systems explored extensively. It was also found that limited language options, cultural and religious barriers, biases and lack of accountability, software malfunction, inadequate data infrastructure, high cost of implementation, limited access to high technology, complex algorithms, AI-human interface and decline of investment were among the challenges confronting Artificial Intelligence (AI) for students learning engagement in university. These findings corroborate with Robinson (2018) who have examined the importance, challenges and applications of Artificial Intelligence in education in Nigeria and he found that problems relating to software malfunction, decline of investment, human factors and inadequate financial resources were among challenges facing AI adoption for students learning engagement in Nigerian tertiary institutions.

CONCLUSION

Having examined the perceived influence of Artificial Intelligence (AI) on students learning engagement in university, it was concluded based on the findings that Artificial intelligence (AI) rendered learning more engaging, provides deeper insights into student learning, facilitating individualized learning processes, and motivates student learning.

RECOMMENDATIONS

The following recommendations are raised based on the findings that:

1. University management should endeavour to provide required technological tools for AI operations in each department for lecturers and students usage for teaching and learning.
2. Government should provide more fund for investment in Artificial intelligence in school.
3. More training and retraining programmes should be sponsor and organize by the university for its academic staff on how best to used AI in instruction delivery.
4. International organization such as IMF, World Bank, UNESCO should come to the aid of university by supplying and installing AI machines and software for students learning.

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PAPER 17 - NA(T)IVENESS OF DIGITAL SPACE: THE CONSEQUENTIALITY OF MEDIA LITERACY AND PSYCHOLINGUISTIC APPROACH FOR NIGERIAN UNIVERSITY UNDERGRADUATE STUDENTS

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ABSTRACT

This paper explores the transformative role of media literacy and psycholinguistic education approach in the use of social media among university undergraduates in Nigeria. The article examines whether or not the deployment of media literacy and psycholinguistic education in the use of social media addresses academic challenges, moral deficits, and attitudinal bottlenecks of university undergraduate social media users, promoting academic excellence and enhancing life skills. Adopting a conceptual review method, involving a methodical examination of existing literature, and relevant information in the communication, linguistics and education fields, the study discovers that media literacy and psycholinguistic education approach shapes university undergraduates in aptly deploying educational software tools to access information and education-related materials, collaborate with and engage teachers, fostering academic excellence. Furthermore, it is found that media literacy and psycholinguistic education approach promotes responsible digital citizenship, and cultivate a more informed and engaged citizenry in the digital age. Finally, the paper reveals that media literacy and psycholinguistic education strategies are instrumental in refining university undergraduates' interaction with social media content and usage patterns, impacting their attitudes, behaviours, and perceptions. Thus, the study recommends that universities should incorporate media literacy, blended with psycholinguistic education into the university curriculum to hone students' research skills; organise workshops focused on digital skills to help students avoid distractions; establish media literacy and psycholinguistic education programmes to sharpen students' critical thinking skills; establish peer mentorship programmes to allow students to be groomed by more experienced students; and run awareness campaigns to promote healthy usage habits among undergraduates.

KEYWORDS: Nativeness of Digital Space, Naiveness of Digital Space, Social media, Media Literacy Education, Linguistic Education.

INTRODUCTION

In Nigeria, like many other climes in the globe, the digital space has been crowded by youth. In the context of social media, which is the focus of this discourse, a huge population of Nigerian university undergraduates is very active on social media. This is not surprising as it is widely believed that digital space belongs to youth, with the digital natives being active, and the passive participants being naive of the technology.

Active users of social media among Nigerian university undergraduates are characterised by their frequent engagement with various platforms such as Facebook, Twitter, Instagram, and TikTok. They post regularly, share content, and interact with peers and influencers, often using social media as a primary communication tool (Ogunyemi, 2022); utilise social media for academic purposes, seeking information on research topics, accessing

educational resources, and participating in academic discussions (Akinola et al., 2021); often build networks that extend beyond their immediate academic environment, connecting with professionals and organisations that can aid their career development (Ojo, 2023); and engage in content creation, producing videos, blogs, or podcasts that reflect their academic interests or personal experiences (Ibrahim & Adedayo, 2022).

In contrast, a significant number of university undergraduates has a naive view of technology, either unable to use the devices, or not skilled in the use of the devices to enhance academic achievements. These passive users exhibit a more limited engagement with social media. They often browse social media without actively participating, rarely posting or commenting on content (Okoro & Eze, 2023); struggle with the technical aspects of using social media platforms effectively, hindering their ability to access valuable academic information (Adebayo, 2023); feel overwhelmed by the vast amount of information available online, leading to confusion and difficulty in discerning credible sources (Ogunyemi, 2022); and avoid interaction due to fear of negative feedback or lack of confidence in their digital communication skills (Ibrahim & Adedayo, 2022).

The academic achievement and general life of many of the natives of digital space who live substantial part of their lives on social media and those who are naive of social media are both negatively impacted. Both active and passive users of social media encounter several challenges that impede their academic success, perceptions, attitudes and behaviours. The frequent use of social networking sites by university students underscores the possibility of addiction of the students to social media, with the attendant negative impact on their academic performance, perceptions, attitudes and behaviours (Ononogbu & Chiroma, 2018). The outcome of the over-dependence and misuse of the social media on the youths includes taking youths' time off their academic work, immoral behaviours and unsavory lifestyles (Chukwuebuka, 2013).

On the other hand, the passive undergraduate student users of social media are worst hit, with negative impact in academic achievement and life generally (Nkordeh, Olowononi & Ibinabo Bob-Manuel, 2017). Furthermore, O'Keeffe and Kathleen (2021) outlined the negative impacts of social media on students to include accessing inappropriate content, online harassment, and cyber bullying, and internet addiction. Social media platforms increase students' tendency to engage in non-instructive, unscrupulous and inappropriate activities. Students oftentimes utilise social media in a way that disengages them from real academic engagement. Other negative impact of social media on youth include cyber bullying (Tokunaga, 2020); Writing and spelling skills deficiency (Hashem, & ElBadawy, 2015); misinformation (Okoro & Eze, 2023); digital Divide (Adebayo, 2023), and mental health issues (Ojo, 2023).

The challenges faced by those active and passive undergraduate users of social media, though significant, are not insurmountable. It appears that understanding the characteristics of active and passive undergraduate social media users and addressing their unique challenges through media literacy and psycholinguistic education can take care of the negative impact of social media, enhance their academic achievement and equip them with essential life skills. The belief that the level of media literacy and psycholinguistic education among young adults influences their social media content consumption and usage, which in turn impact their attitudes, behaviours, and perceptions, underscores the interconnected relationship between media literacy, psycholinguistic education and social media engagement (Folaranmi, 2023; Owusu-Acheaw & Larson, 2015; Boyd & Ellison, 2007). It is against this backdrop that this paper endeavours to investigate the impact of media literacy and psycholinguistic education approach on the active and passive university undergraduate users of social media. This study is premised on technological determinism theory.

CONCEPT OF TECHNOLOGICAL DETERMINISM THEORY

Technological determinism is a theory that posits technology as the primary driver of societal changes. The theory emerged prominently in the early 20th century, gaining traction through the works of thinkers like Thorstein Veblen and later, Marshall McLuhan. Technological determinism theory, which has been a significant topic of debate and

analysis, argues that technology shapes society's structure, values, and history. The theory suggests that technological development follows a predictable path, inevitably influencing social change, fostering economic, social, and cultural transformations (Veblen, 1921, cited in Chukwuebuka, 2013).

TYPES OF TECHNOLOGICAL DETERMINISM THEORY

Technological determinism can be categorised into two main types: hard determinism and soft determinism. Protagonists of hard determinism asserted that technology is the primary force shaping society, and that technological development follows a linear, autonomous path. According to this view, social institutions, cultural values, and human behaviour are all determined by technological imperatives. For instance, the rise of the internet has drastically altered communication, commerce, and information dissemination among the members of the society, including the university undergraduates.

On the other hand, soft determinism, also known as "contextualism," acknowledges the significant role of technology in shaping society but also recognises that social, economic, and cultural factors influence technological development. This perspective allows for a more reciprocal relationship between technology and society. For example, while the internet has influenced many aspects of the society such as social institutions, cultural values, and human behaviour, its adoption and use have been shaped by regulatory frameworks, cultural attitudes, and economic conditions. It is on this perspective that this study is based, beginning with the conceptual review of social media, media literacy education and linguistic education.

CONCEPT OF SOCIAL MEDIA

Social media concept has been viewed by scholars differently, depending on the area of emphasis. Social media is primarily a created platform of internet- and mobile-based tools for sharing and discussing information by users. The concept, social media, according to Junco, Heibergert and Loken (2010), is a group of internet-based applications that builds on the ideological and technological foundations of Web 2.0 and that allows the creation and exchange of user generated content. Onyeka, Sajoh and Bulus (2013) looked at social media as those internet-based tools and services that allow users to engage with one another, generate contents, distribute and search for information online.

Merriam-Webster dictionary (2017) defined social media as the use of electronic and internet tools for the purpose of sharing and discussing information and experiences with other human beings in more efficient ways. On the other hand, social media is the use of technology for social interaction, and to create or co-create value. Social media is a form of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (as videos).

Social media refers to the means of interactions among people in which they create, share, and or exchange information and ideas in virtual communities and networks. They are the web-based and mobile-based technologies that involve interactive dialogue among organisations, communities, and individuals. In general, social media are internet-based and forms of electronic communication through which users interact among people, create, freely share, exchange and discuss information, ideas, personal messages, and other content about one another and their lives, using a multimedia mix of personal words, pictures, videos and audio, utilising online platforms (Cox, 2018). These platforms include Facebook, LinkedIn, Twitter (now X), Instagram, etc all of which are internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content (Junco, Heibergert, & Loken, 2010).

The concept of social networking has evolved, much like other innovations, and is becoming increasingly sophisticated with advancements in technology (Oye, Mahamat & Rahim, 2012). Currently, there are hundreds of

Social Network Sites (SNSs) that draw millions of people, with diverse technological affordances. Social network sites are web-based services that enable individuals to construct a semi-profile within a bounded system, articulate a list of other users with whom they share connection with, views and go through their list of connections and those made by others within the system, although the nature and nomenclature of these connections has variation (Boyd and Ellison, 2007).

Since their appearance, social media have changed different aspects of people's lives, and changed the way people around the globe communicate with one another, with a great improvement in the creation and exchange of user generated content (Junco, Heibergert & Loken, 2010). Social media are capable of providing information that give users emotional and social support. Social networking sites are considered as information sources (Chukwuebuka, 2013). Accordingly, Chukwuebuka (2013) noted that: only humans can provide certain types of information such as opinions, advice and recommendations; the information sources are personally known to the user to a greater or lesser extent, and are therefore trusted sources and have cognitive authority; users can provide localised (geographically specific) information, and current or time-sensitive information; information provided by users are customised for the requester; social contacts can perform intermediary functions of researching, synthesis and packaging of information; and users are able to broadcast a question to a known group of people.

In addition, Oye, Mahamat and Rahim (2012) posited that social media involve online resources which people leverage upon to share content including video, photos, images, text, ideas, insight, humour, opinion, gossip and news. Furthermore, social media are seen as platforms where individuals and organisations create profiles, share and exchange information on various activities and interests. Chukwuebuka (2013) argued that social media are activities, practices, and behaviours among communities of people who gather online to share information, knowledge, and opinions using conversational media.

In Nigeria, most social media users access the tools mainly through computers and mobile devices such as personal computers, phones and tablets. Also, politicians in Nigeria are rapidly joining the online community to communicate with their audiences whom they believe are a key demographic that shape and influence perception (Onyeka, Sajoh & Bulus, 2013). Thus, social media, in Nigeria is moving beyond the usual one-to-one conversation toward one-to-many sharing, and it cuts across all ages, with the adoption and use more prominent among the youths, particularly, the country's university undergraduates. As of 2021, over 120 million Nigerians are online while over 80 million of this population are young, between 18 and 35 years (Nigerian Communications Commission, 2022).

CHARACTERISTICS OF ACTIVE AND PASSIVE SOCIAL MEDIA USERS

Active users of social media among Nigerian university undergraduates are characterised by their frequent engagement with various platforms such as Facebook, Twitter, Instagram, and TikTok. These students typically exhibit the following traits:

High Engagement: Active users post regularly, share content, and interact with peers and influencers, often using social media as a primary communication tool (Ogunyemi, 2022).

Information Seekers: They utilise social media for academic purposes, seeking information on research topics, accessing educational resources, and participating in academic discussions (Akinola et al., 2021).

Networking: Active users often build networks that extend beyond their immediate academic environment, connecting with professionals and organisations that can aid their career development (Ojo, 2023).

Content Creation: Many active users engage in content creation, producing videos, blogs, or podcasts that reflect their academic interests or personal experiences (Ibrahim & Adedayo, 2022).

In contrast, passive users exhibit a more limited engagement with social media. Their characteristics include:

Minimal Interaction: Passive users often browse social media without actively participating, rarely posting or commenting on content (Okoro & Eze, 2023).

Limited Skills: This group may struggle with the technical aspects of using social media platforms effectively, hindering their ability to access valuable academic information (Adebayo, 2023).

Information Overload: Passive users may feel overwhelmed by the vast amount of information available online, leading to confusion and difficulty in discerning credible sources (Ogunyemi, 2022).

Fear of Engagement: Some passive users may avoid interaction due to fear of negative feedback or lack of confidence in their digital communication skills (Ibrahim & Adedayo, 2022).

SOCIAL MEDIA AND UNIVERSITY UNDERGRADUATE STUDENTS

In recent years, social networks have experienced a massive growth in membership (Chukwuebuka, 2013), particularly among university students (Lenhart, Duggan, Perrin, Stepler, Rainie & Parker, 2015). Although over 90% of young adults of university age between 18 and 25 years old were reported to have an active profile on a social networking site in the United Kingdom, Lenhart, Purcell, Smith and Zickuhr (2010) argued that about 57% of social network users are between the age of 18 and 29 years and have a personal profile on multiple social media websites. Finally, Nigerian Communications Commission (2022) reported that over 120 million Nigerians are online while over 80 million of this population are young, between 18 and 35 years.

The use of social media is on the rise in higher education classrooms, as a variety of software tools and free web applications are being deployed to enhancing learning, communication, and engagement. Social media usage enhances educational access and interaction and they fill the learning gap informally between students and the instructors (Talaue, Alsaad, AlRushaidan & AlHagail, 2018). Social media use impact students' communication skills (Onyeka, Sajoh & Bulus, 2013), and improve academic success of undergraduate students in general (Boateng & Amankwaa, 2016).

Shabir, Hameed and Safdar et al. (2014) observed that social media tools are attractive to students and thus motivate their participation in the learning process. Education becomes more interesting when the process is made attractive to students, involving students' motivation and participation in the educational process (Nyland & Near, 2007). Social media enrich the learning experience by allowing students and instructors to exchange ideas, foster collaboration and discussion, engage and interact using emerging social platforms (Ogunkola, 2018).

Social media has become one of the prominent communication tools, particularly in the school community. Talaue, Alsaad, AlRushaidan and AlHagail (2018) emphasised that social media platforms help with access to information and educational-related materials. Thus, students and instructors use social media as a teaching and learning tool, using social media platforms, such as Facebook, LinkedIn, Twitter and YouTube to connect with students and make information passage easy (Shabir, Hameed & Safdar et al., 2014).

Also, social media platforms are widely used to connect with current and potential students, and to deliver instructional content (Paul, Baker, & Cochran, 2012). Furthermore, social media sites such as blogs complement formal educational activities and enhance learning outcomes. These technologies also allow instructors to mentor students. They make monitoring of students' academic performance, and supervising of students' behaviours easy. Use of social media in education fosters student mentorship (Umeogu & Ojiakor, 2014).

In addition, compared to traditional learning method that provides few opportunities for learners to develop and maintain their own learning activities, learning platforms on social media offer window for personalised learning (Madge, Meek, Wellens & Hooley, 2019). With this, all students can learn at their space, resulting in improved

academic competence. The efficacy of social medial tools in collaborative learning and social interaction cannot be questioned (Goodwin, 2016). Social media is a means of connecting many students to share common interests, ideology, thoughts and perceptions about issues, and they represent useful tools for communication and education, and provide an opportunity for networking in any disciplines (Ali, Iqbal & Iqbal, 2016). Similarly, Nyland and Near (2007) stated that social-networking sites constitute an integral part of daily communication practices for many university students.

Social media are handy in handling numerous assignments, given to students by instructors. With time constraints and demanding class schedules, social media help students to perform multitasks simultaneously (Ali, Iqbal & Iqbal, 2016). In addition, social media platforms allow students to interact with stakeholders including other students, teachers, management and communities that share in their education and related activities (Pardo, 2013). Students, parents and teachers use social media to connect and communicate inside and outside the classroom. Programmes like Black Board, School loop, Top Hat, and Moodle have created platforms to enhance the learning experience by increasing communication between all parties. These sites are not necessarily social media websites, they may be added communication features such as forums, which create an experience that is similar to that of social media. With this, many universities now maintain profiles and groups on social networking sites such as Facebook, where students and management can interact, share resources and express ideas.

Aside the role social media play in formal learning environments, social platform sites can facilitate skill development preparatory to world of work. Social media enhance skills acquisition and development by supporting peer-to-peer learning of knowledge and skills, collaboration, diverse cultural expression, the development of skills valued in the modern workplace, and a more powered conception of citizenship (Kaya & Bicen, 2016).

Creative content sharing practices through the platforms such as blogs, animations, videos, photos, and digital collages form an integral part of young people's communicative exchange and play a significant role in youths' developing sense of identity for their communities. Creative content production and sharing powers of undergraduates help foster development of literacy and technical skills (Ogunkola, 2018); develop a sense of aspiration, personal achievement and self-worth, incubating creativity and self-expression (Ogunkola, 2018); aid exploration and experimentation with new aspect of identity (Nyland & Near, 2007); and reinforce aspects of identity, such as ethnicity or cultural backgrounds (Kaya & Bicen, 2016).

NEGATIVE IMPACT OF SOCIAL MEDIA ON UNIVERSITY UNDERGRADUATES

The frequent use of social networking sites by students underscores the possibility of addiction of the students to social media, with the attendant negative impact on academic performance. Pempek, Yermolayeva and Calvert (2019) noted that the amount of time spent daily on social network sites by university undergraduate vary greatly. However, an analysis of the data indicated that most student participants spend approximately 30 minutes a day socialising, mostly during the evening hours between 9pm to 12am; that students spend an average of 47 minutes a day on Facebook; and that more than 50% of college students go on a social networking site several times a day (Subrahmanyam & Patricia, 2008).

Despite the benefits of social media on student learning and achievement with respect to knowledge sharing, Rithika and Sara (2013) pointed out that even when social media is used for an educational purpose, students use and adopt the technology in a way that differs from the intentions of the course instructor. There are overwhelming evidences that social media impact students' life negatively. O'Keeffe and Kathleen (2021) outlined the negative impacts of social media on students to include accessing inappropriate content, online harassment, and cyber bullying. The negative influence of social media on students are as follow:

Internet addiction: A few decades ago, the main issue was the addiction to television. Today, it is the issues with Internet addiction and the increased amount of time young people and adults spend on the Internet. The frequent use of social media by students easily make them addicted to the media. Many students spend much time on their laptops, tablets, desktop computers and smart phones to check Tweets and status updates of their friends and families. Addiction to the use of social media platforms can squander students' time that could otherwise be used for profitable tasks and exercises. Addiction to social networks is capable of frustrating students' precious time and life (Christakis & Moreno, 2019).

Distraction: Spending immeasurable hours on social sites can deflect the focus and concentration from a particular task. Thus, excessive use of social media networking takes most of the time of students and redirects it towards non-constructive, sometimes unethical, deceptive and/or improper activities. Due to this addictive behaviour, students use social media even while in the classroom, giving room for distraction and lack of concentration for the user and students around him or her. Inability to carefully follow lectures affects learning outcomes and academic performance of students (Owusu-Acheaw& Larson, 2015).

Anti-Social Behaviour: Actions that exemplify anti-social behaviours, often, do find expression on social networks, making the users vulnerable to picking anti-social attitudes and behaviours. Social network websites grab the attention of students so much so that they unconsciously pick unethical and inappropriate practices, which they are frequently exposed to. Many students, instead of taking advantage of social media for learning purposes, divert their attention to wrong use of the device such as sexting, hacking, fraud and scams. Many students, having picked bad behaviors from the social media, end up posting embarrassing, humiliating, and hurtful content in text, photos, and videos, which harm others. Engaging in these habits may impede students' studies and academic life (Fodeman & Monroe, 2019).

Cyber bullying: Cyber bullying involves any behaviour performed through electronic media by individuals or groups that repeatedly communicate hostile or aggressive messages intended to inflict harm or discomfort on others (Tokunaga, 2020). Cyber bullying uses different forms of writing and posting means online, which include threatening messages, sexual harassment, ridiculous posts aboutthe personality of another person, posting of mis information, disinformation, lies, rumours, or gossips, and encouraging others to share and circulate the posts. Cyber bullying among students is associated with their increased access to social media platforms (Lenhart, Duggan, Perrin, Stepler, Rainie& Parker, 2015).

Writing and spelling skills deficiency: Slangs, abbreviations, terms and coded words are often used for interaction on social media platforms. Given the huge time students spend on the internet, they become so familiar with these improper spellings and use of words that they deploy them in the writing of tests, assignments and examinations. Also, students depend on their smart phones for language structure and spelling check highlights, which eventually undermine students' command of language, language use and creative writing skills (Hashem, & ElBadawy, 2015).

CONCEPT OF MEDIA LITERACY

Media literacy education provides great value from which people of all ages and different categories of users, be it active and passive can benefit. A review of the research on media literacy education and reduction in racial and ethnic stereotypes found that children as young as 12 can be trained to recognise bias in media depictions of race and ethnicity and understand the harm it can cause (Jenkins, Clinton, Purushotma, Robison & Weigel, 2009). Also, media literacy education can help adolescents, active or passive users of social media become sensitive to prejudice and learn to appreciate diversity (Folaranmi, 2023).

In the age of digital media, media literacy has become increasingly important, especially among young adults who are prolific users of social media platforms. The belief that the level of media literacy among young adults influences their social media content consumption and usage, which in turn impacts their attitudes, behaviours, and perceptions, highlights the interconnected relationship between media literacy and social media engagement (Boyd & Ellison, 2007). Media literacy education plays a crucial role in addressing the challenges of the Nigerian undergraduate student users of social media and enhancing their academic achievements.

Media literacy is essential for individuals, especially young adults to navigate the vast amount of information available on social media platforms effectively. It enables them to critically assess the credibility of sources, detect fake news, and understand the potential biases inherent in media content (Folaranmi, 2023). A high level of media literacy empowers young adults to make informed decisions about the content they consume and share on social media, thereby shaping their online interactions and behaviours (Hargittai, 2010).

In media literacy education, there are various educational software tools and free web applications that can be aptly deployed to access information and education-related materials, and enhance learning, communication, and engagement (Nyland & Near, 2007). These education apps can be properly adopted to fill the learning gap informally between students and their instructors (Jenkins, Clinton, Purushotma, Robison & Weigel, 2009), fostering collaboration and discussion between students and teachers (Subrahmanyam & Patricia, 2008), and improving academic success of undergraduate students in general (Goodwin, 2016).

CONCEPT OF PSYCHOLINGUISTIC EDUCATION

Psycholinguistic education provides insights into how individuals process language, which is crucial for interpreting media messages. Psycholinguistic education is a multidisciplinary field that combines elements of psychology and linguistics to understand how language is acquired, processed, and utilised in educational settings. Kroll and Stewart (1994), cited in Gee (2014) defined psycholinguistics as the study of how language is represented and processed in the mind, emphasising the cognitive processes involved in language acquisition and use. Ellis (2008) described psycholinguistics as the intersection of linguistic theory and cognitive psychology, focusing on how learners acquire language skills and how these skills can be effectively taught in educational contexts. He emphasised the role of cognitive processes in language learning and the implications for teaching strategies. Gass and Selinker (2008) defined psycholinguistics in the context of second language acquisition, noting that it encompasses the cognitive processes that underlie language learning and use. They argued that understanding these processes is crucial for developing effective pedagogical approaches in language education.

Combining insights from Ellis, Gass and Selinker, and Gee provides a holistic understanding of psycholinguistics as it pertains to language acquisition and use. Ellis focuses on cognitive processes in learning environments, Gass and Selinker emphasize the interplay between language processing and acquisition, while Gee connects language use with social dynamics. This underscores the significance of psycholinguistics in presenting media literacy education to university undergraduate student social media users. Psycholinguistics can play a significant role in enhancing media literacy education, particularly in mitigating the negative impacts of social media, especially on university undergraduate students. By teaching students about the nuances of language, such as connotation, denotation, and persuasive language techniques; and understanding the cognitive processes involved in language acquisition and use, educators can develop strategies that improve critical thinking, comprehension, and communication skills (McLuhan, 1964, cited in Ellis, 2008). It is against this backdrop that three critical instructional skills in psycholinguistics education (cognitive load theory, promoting metacognitive strategies, and critical discourse analysis) were blended with media literacy skills to address the negative impact of social media on users of social media among Nigerian university undergraduate students, using the following processes:

Cognitive Load Theory: Cognitive load theory, which is rooted in psycholinguistics, can inform how media literacy content is presented. By structuring lessons that consider the cognitive load on students, educators can enhance

comprehension and retention of information related to social media literacy (Sweller, 1988, cited in Gas and Selinker, 2008).

Promoting Metacognitive Strategies: Educators can use psycholinguistic principles to teach metacognitive strategies that help students reflect on their own understanding and biases when consuming media. This self-awareness can reduce the negative impacts of social media by encouraging critical evaluation of information sources (Flavell, 1979, cited in Ellis, 2008)

Critical Discourse Analysis: Psycholinguistics informs critical discourse analysis, which can be used to examine how language shapes social media narratives. Teaching students to analyse the discourse surrounding social media can empower them to recognise biases, stereotypes, and manipulative language (Gee, 2014).

ROLE OF MEDIA LITERACY AND PSYCHOLINGUISTIC APPROACH IN SOCIAL MEDIA USE

By integrating psycholinguistic insights into media literacy education, educators can equip students with the skills necessary to navigate the complexities of social media and reduce its negative impacts. The benefits of the psycholinguistic and media literacy education approach in this regard are numerous and are highlighted below:

Research have shown that individuals with higher levels of psycholinguistic insights and media literacy education are better equipped to critically evaluate media content and identify biases, inaccuracies, and manipulative tactics employed in news articles, advertisements, and social media posts (Folaranmi, 2023; Gas & Selinker, 2008). Therefore, by honing their psycholinguistics and media literacy education, young adults can become more discerning consumers of information, enabling them to make informed decisions, participate in digital discourse, and engage with diverse perspectives effectively. By fostering psycholinguistic and media literacy education among young adults, society can promote responsible digital citizenship, and cultivate a more informed and engaged citizenry in the digital age (Folaranmi, 2023).

Psycholinguistic and media literacy education approach empowers individuals to recognise and counteract the spread of misinformation and disinformation, safeguarding against the proliferation of false narratives and harmful ideologies online. Psycholinguistics and media literacy education approach encompasses a range of competencies, including the ability to critically evaluate the credibility and accuracy of information, recognise bias and propaganda, and understand the ethical implications of media content. For young adults navigating the digital landscape, psycholinguistics and media literacy education serves as a critical tool in discerning between reliable sources and misinformation, enabling them to make informed decisions about the content they engage with and share on social media platforms (Folaranmi, 2023).

Furthermore, psycholinguistic and media literacy education approach content can influence the attitudes and behaviours of young adults by shaping their opinions on social and political issues. The usage of social media content by young adults not only influences their online behaviour but also shapes their attitudes, and behaviours in the digital realm (Gas & Selinker, 2008). With psycholinguistics and media literacy education combined, attitudes, and behaviours of the active and passive users of social media among Nigeria university undergraduate students.

Psycholinguistic insights and media literacy education content exerts a powerful influence on the perceptions of young adults in the digital age. The design and algorithms of social media platforms combined with the metacognitive strategies in psycholinguistics play a significant role in shaping the content that young adults encounter and engage with online. Platforms like Facebook and Instagram use algorithms to curate users' feeds based on their preferences, behaviours, and interactions (Houk & Bogart, 2024). This personalised content delivery can create filter bubbles and echo chambers, where users are exposed primarily to content that aligns with their existing beliefs and interests, reinforcing their perspectives and potentially limiting exposure to diverse viewpoints (Boateng & Amankwaa, 2016).

Educational initiatives and interventions focused on promoting media literacy among young adults have become increasingly important in addressing the challenges posed by the digital media environment. By incorporating media literacy education blended with psycholinguistics into school curricula, promoting fact-checking tools and resources, and fostering critical thinking skills, educators and policymakers can empower young adults to navigate the complexities of the digital world with confidence and discernment (Hobbs, 2018).

Finally, psycholinguistics and media literacy education contributes to the development of critical thinking skills and the ability to analyse complex information effectively. It serves as a foundational skill set for young adults in the digital age, shaping their ability to engage with social media content thoughtfully and responsibly (Onyeka, Sajoh & Bulus, 2013). These skills are essential for navigating the digital landscape and engaging with diverse perspectives in a constructive manner. Encouraging young adults to question and evaluate media content critically could promote intellectual curiosity, information literacy, and the capacity to form well-founded opinions based on evidence and reason (Folaranmi, 2023). With psycholinguistics and media literacy education, young adults are better prepared to navigate the complexities of the digital environment, critically assess information, and participate in digital discourse with confidence and awareness.

CONCLUSION

The digital landscape presents both opportunities and challenges for Nigerian university undergraduates. The misuse of social media by the undergraduate active users and ignorance of the technology by the undergraduate passive users in the Nigerian universities bring a lot of challenges. However, by understanding the characteristics of active and passive social media users and addressing their unique challenges through Psycholinguistics and media literacy education approach, tertiary educational institutions can significantly enhance academic achievement and equip undergraduates with essential life skills. As the digital world continues to evolve, stimulating a generation of digitally literate individuals will be crucial for their success in academia and beyond.

RECOMMENDATIONS

Based on the discovery of the relevance of psycholinguistics and media literacy education in the use of social media by the university undergraduates in Nigeria, the following recommendations are made:

1. Universities should incorporate media literacy blended with psycholinguistic skills into the university curriculum to equip students with critical skills to analyse and evaluate information sources, fostering better research practices.
2. Universities should organise workshops focused on digital skills, helping students learn to use social media effectively for academic purposes while avoiding distractions.
3. Universities should establish psycholinguistic and media literacy education programmes that emphasise critical thinking skills, encouraging students to question the credibility of information and sources encountered online.
4. Universities should initiate peer mentorship programmes to allow more experienced students to guide their peers in navigating social media for academic success, fostering a supportive learning environment.
5. Universities should run awareness campaigns about the potential mental health impacts of social media use, promoting healthy usage habits among students.

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PAPER 18 - TRANSFORMING PEDAGOGICAL PRACTICES IN TECHNOLOGY EDUCATION: LEVERAGING BIG DATA AND ARTIFICIAL INTELLIGENCE FOR ENHANCED LEARNING AND ASSESSMENT OUTCOMES

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ABSTRACT

This study investigates the integration of Big Data and Artificial Intelligence (AI) in Technology Education, utilizing the Assessment of Big Data and AI Integration in Technology Education (ABAIITE) questionnaire. A mixed-methods approach was employed, with quantitative data analyzed using ANOVA to assess perceptions of learning outcomes, assessment accuracy, implementation challenges, and overall efficiency. The sample consisted of 250 respondents, including students, educators, administrators, and technology experts. Findings indicate that the integration of Big Data and AI significantly enhances learning outcomes ($F(3, 242) = 3.39$, $p < 0.05$), with a grand mean of 4.01. AI-driven assessments were found to provide more accurate and personalized feedback than traditional methods ($F(3, 246) = 3.87$, $p < 0.05$), with a grand mean of 4.11. Challenges related to implementation were identified, with a grand mean of 4.06 and $F(3, 246) = 3.44$, highlighting the need for targeted strategies. Additionally, a positive correlation was found between the use of Big Data and AI and the efficiency of teaching processes ($F(3, 246) = 2.78$, $p < 0.05$), with a grand mean of 4.16. The results emphasize the importance of integrating Big Data and AI in Technology Education to improve pedagogical practices and student outcomes.

KEYWORDS: *AI (Artificial Intelligence), Big Data, Education, Learning Outcomes, Technology Integration.*

1. INTRODUCTION

1.1 Background of the Study

Overview of Current Trends in Technology Education:
Technology Education is undergoing a transformative shift, influenced by the rise of digital innovations and the need to equip learners with contemporary skills. As traditional instructional methods give way to interactive, tech-driven approaches, educators are increasingly incorporating online modules, virtual labs, and digital platforms. However, despite these advances, many institutions continue to rely on conventional practices that may not fully harness the potential of modern technology.

The Role of Big Data and AI in Modern Education:
Big Data and Artificial Intelligence (AI) have emerged as pivotal tools in reshaping educational practices. AI enables real-time student performance analysis, adaptive learning pathways, and personalized feedback, while Big Data provides insights into student behaviors, teaching effectiveness, and academic outcomes. Together, these technologies offer the potential to improve learning experiences and streamline educational processes. Despite their advantages, the adoption of AI and Big Data in Technology Education has been limited, underscoring the need for further investigation.

1.2 STATEMENT OF THE PROBLEM

Challenges in Traditional Learning and Assessment Methods

Traditional methods of teaching and assessment in Technology Education are often inadequate for today's diverse learning environment. Standardized testing, manual grading, and rigid instructional models fail to offer the

personalized and adaptive learning opportunities needed in modern education. This leads to inefficiencies in measuring student progress and addressing individual learning needs.

The Gap in Integrating AI and Big Data in Technology Education:
Although Big Data and AI hold immense potential for revolutionizing Technology Education, their integration has been minimal due to infrastructure limitations, lack of educator training, and concerns over data privacy. This study seeks to address this gap, focusing on how these technologies can enhance learning outcomes and modernize assessment methods.

1.3 RESEARCH OBJECTIVES

This study is guided by the following objectives:

- **To explore how Big Data and AI can enhance learning outcomes in Technology Education.** The focus will be on investigating the current use of these technologies in providing adaptive learning solutions.
- **To analyze the impact of AI-driven assessments in Technology Education.** The study will assess how AI can deliver more accurate and timely feedback compared to traditional assessment techniques.
- **To examine the challenges associated with implementing AI and Big Data in Technology Education.** By identifying these challenges, the study will propose strategies for effective integration.
- **To investigate the correlation between Big Data and AI use in Technology Education and the overall efficiency of teaching and assessment processes.** The study will explore how these technologies can streamline operations and improve learning experiences.

1.4. RESEARCH QUESTIONS

1. **RQ1:** How does the integration of Big Data and AI in Technology Education influence learning outcomes compared to traditional teaching methods?
2. **RQ2:** In what ways do AI-driven assessment methods offer more accurate and personalized feedback compared to conventional assessment techniques in Technology Education?
3. **RQ3:** What specific challenges are associated with the implementation of Big Data and AI in Technology Education, and how can these challenges be effectively addressed through targeted strategies and support systems?
4. **RQ4:** What is the relationship between the use of Big Data and AI in Technology Education and the overall efficiency of teaching and assessment processes?

1.5 SIGNIFICANCE OF THE STUDY

Contributions to Educational Theory and Practice:
This research will provide valuable contributions to educational theory by examining how Big Data and AI can enhance Technology Education. It will also offer practical insights into the integration of these technologies in educational practices, aiming to support personalized learning and more effective assessments.

Implications for Educators, Students, and Policymakers:
The findings of this study will have broad implications for educators, students, and policymakers. Educators will gain insights into the effective use of AI and Big Data to enhance teaching and assessment. Students will benefit from more adaptive learning experiences, while policymakers will be equipped to make informed decisions regarding the integration of emerging technologies in education. Ultimately, this study will contribute to closing the gap between traditional teaching methods and technology-driven education.

RESEARCH HYPOTHESES

1. **H_1:** The integration of Big Data and AI in Technology Education significantly enhances learning outcomes compared to traditional teaching methods.
2. **H_2:** AI-driven assessment methods provide more accurate and personalized feedback than conventional assessment techniques in Technology Education.
3. **H_3:** The implementation of Big Data and AI in Technology Education is associated with specific challenges that can be mitigated through targeted strategies and support systems.
4. **H_4:** There is a positive correlation between the use of Big Data and AI in Technology Education and the overall efficiency of teaching and assessment processes.

2. LITERATURE REVIEW

Big Data has become a key area of focus in education, with growing interest from both academics and practitioners. A systematic review by Baig, et.al., (2020) analyzed 40 studies published between 2014 and 2019, revealing an increase in research on Big Data in education. Four key themes emerged: learner behavior and performance, educational data warehouses, system improvements, and curriculum integration. Most research has focused on learner performance, showcasing Big Data's ability to enhance personalized learning. However, challenges like scalability and ethical concerns remain. Future research should address these limitations to fully harness Big Data's potential in education.

Big Data has been applied across various sectors, including education, where its use is expanding rapidly. According to Khan et.al., (2020), Big Data in education is characterized by the four Vs: volume, variety, velocity, and veracity. These dimensions allow for the processing and analysis of vast amounts of both structured and unstructured data at high speeds. The authors emphasize that Big Data can revolutionize education by predicting student performance, identifying trends, and improving the overall learning process through Educational Data Mining (EDM) tools. However, despite the growing interest, the number of studies on Big Data in education has slightly declined since 2016, suggesting the need for more research in this area. The paper highlights how Big Data applications can enhance personalized learning and curriculum development while addressing issues such as data reliability and scalability.

The research conducted by Prahani et al. (2023) highlights the significant growth of Big Data studies in education over the past decade, emphasizing how bibliometric analysis can identify key trends and gaps in the field. Using a literature review and PRISMA method, the study analyzed over 1,000 documents from the Scopus database, revealing that the majority of contributions come from conference papers, with China being the most prolific country in this domain. Interestingly, the study noted a decline in research activity in the last year, which presents both a challenge and an opportunity for future investigations. The authors argue that integrating Big Data with STEM (Science, Technology, Engineering, and Mathematics) education could be a valuable direction for future studies, given that STEM skills are essential for effective Big Data analysis. Furthermore, they recommend expanding future research by utilizing databases beyond Scopus to ensure a more comprehensive dataset. The paper underscores the growing importance of Big Data in educational research and the potential for its application in improving educational outcomes through interdisciplinary approaches like STEM integration.

The significance of Big Data in education has grown, particularly due to the digital transformation accelerated by the pandemic. This shift to digital platforms has led to the collection of extensive data on students' academic

performance, learning styles, and preferences. Such data can enhance educational practices by facilitating personalized learning experiences and improving teaching methodologies. A framework for understanding the functions of Big Data in education is proposed, highlighting its potential to address longstanding challenges within educational systems. By leveraging data from various sources, educational institutions can create more effective learning environments tailored to individual needs, ultimately fostering better educational outcomes Duykuluoğlu et al. (2023).

The growing role of Big Data in education has seen a rapid rise in recent years, significantly impacting educational leadership. The study by Kalim (2021) emphasizes the strategic use of large data sets for decision-making in educational institutions, highlighting the integration of information and communication technologies. This trend is expected to intensify, urging educational leaders to develop effective learning management systems for utilizing Big Data in decision-making processes. Furthermore, Kalim discusses how analyzing Big Data can enhance teaching and learning by improving institutional strategies and interactions between students and educators.

Artificial Intelligence (AI) has the potential to transform education by making learning more personalized, engaging, and efficient, as highlighted by Harry (2023). AI technologies, such as machine learning and natural language processing, enhance the learning experience by analyzing data to personalize education for individual students. Key benefits include improved student outcomes through personalized learning, intelligent tutoring systems, chatbots, and automated grading, which increase efficiency and provide accurate feedback. However, challenges such as privacy concerns, trust issues, costs, and potential biases must be addressed. Ethical considerations regarding accessibility, transparency, and fairness are also crucial in implementing AI in education. Despite these hurdles, the promise of AI in providing better data analysis and enhancing student engagement remains significant.

A bibliometric analysis of artificial intelligence (AI) in education reveals significant insights into its role in enhancing learning processes, as discussed by Rosak-Szyrocka (2024). This analysis, based on 3,365 open-access research articles from 2019 to 2024, highlights how AI utilizes machine learning to assess students' skills and requirements, subsequently offering personalized content that boosts learning retention. AI's effectiveness is further enhanced when integrated with technologies like virtual reality and simulations, providing hands-on learning opportunities. However, the study acknowledges limitations related to the breadth of AI's applications across various fields and the research timeframe, suggesting that future developments in AI may yield different outcomes. The findings serve as a guide for universities to understand student needs in AI and improve educational practices. Ultimately, this work addresses the significant potential of AI to connect learning intelligently, thereby enhancing our understanding of human intelligence and educational methods.

The transformative potential of artificial intelligence (AI) in education is emphasized by Iqbal et.al. (2024), who examine its opportunities and challenges. Their study highlights significant advancements in adaptive learning and school management, showing how AI enhances learning efficacy and personalization. While AI offers practical, hands-on learning experiences, challenges in adoption remain. The authors stress the need for supportive policies and better educator training to fully realize AI's benefits in education, advocating for adaptive curricula that align with industrial advancements.

Recent advancements in machine learning and AI present opportunities to enhance student learning and teacher capabilities. AI applications in education include generating personalized student recommendations, autograding essays, and improving educational resources. These applications can be categorized into three groups: Guidance, Learning, and Teacher. This framework aims to organize and facilitate further development in the field. The potential benefits of AI-powered education are significant, especially in a knowledge-based economy. However, ethical concerns surrounding the use of student data remain a critical issue. By analyzing past AI applications in education, insights can be gained to guide future developments in this evolving landscape (Nguyen, 2023).

The transformative role of AI in education is explored by Göçen and Aydemir (2020), who investigate the implications of AI's arrival for schools and educators. Their phenomenological study shows that while AI can bring significant benefits, such as new tools and improved quality in education, it also raises concerns, particularly from teachers and academics, about the future of teaching roles. Legal professionals focus on the potential legal issues

related to AI in education, while engineers see it as an opportunity to enhance overall quality and effectiveness in the sector.

The potential of artificial intelligence (AI) and big data to enhance educational experiences and outcomes is underscored by Sun, et.al. (2024), who conducted a systematic review of 980 articles in this field. Their literature mapping reveals key research clusters, including multidisciplinary studies, educational technology, and information sciences, focusing on topics such as learning analytics and intelligent tutoring systems. This review serves as a foundational resource for educators, researchers, and policymakers, providing insights into the current state of research and highlighting the need for further exploration in the integration of AI and big data within educational practices. The authors emphasize that as digital transformation continues to reshape learning environments, understanding these technologies will be critical for future educational developments.

The evolving landscape of artificial intelligence (AI) in education is critically analyzed by Gràcia et.al. (2021), who explore the implications of big data and machine learning on educational systems. They discuss how the rapid advancement of AI, driven by algorithms and big data, aims to provide effective learning solutions but raises concerns regarding the understanding of these "black boxes" by educators and policymakers. Their paper emphasizes the need for a deeper examination of the impact of excessive screen time on student development and calls for a research agenda to address the potential negative effects of these technologies in education.

The challenges and future directions of big data and artificial intelligence (AI) in education are comprehensively addressed by Luan et al. (2020). Their study highlights significant advancements in the integration of big data and AI into educational research, policy, and practice. As data collection becomes increasingly embedded in educational technologies, the authors emphasize the shift from proof-of-concept applications to substantial adoption across various educational domains. Key trends identified include assessment, individualized learning, and precision education, with a call for caution in interpreting educational analytics. The authors advocate for supportive government policies for lifelong learning, robust teacher education programs, and enhanced collaboration between academia and industry. Furthermore, they stress the importance of aligning technological advancements with relevant theoretical frameworks and fostering dialogue between technological and humanistic perspectives to maximize the benefits of AI in educational practices.

The transformative potential of integrating artificial intelligence (AI) and big data in educational environments is explored by Sargiotis (2024). The paper discusses how AI-enhanced virtual infrastructures can personalize learning experiences, optimize resources, and create scalable learning ecosystems. By leveraging big data analytics, educators can gain insights into learning patterns, predict outcomes, and make informed decisions. The research highlights both challenges and opportunities associated with deploying these technologies in education, emphasizing their role in fostering efficiency, inclusivity, and adaptability. Sargiotis concludes with practical recommendations for educators, policymakers, and technologists to effectively implement AI and big data, promoting continuous improvement and innovation in educational practices.

The application of artificial intelligence (AI) and big data analytics is transforming personalized learning, as highlighted by Magomadov (2020). The paper begins by defining personalized learning and contrasting it with traditional teaching methods. It emphasizes how AI can enhance the effectiveness of personalized education by tailoring learning experiences to individual needs. Additionally, the role of big data is discussed, particularly in how it can be effectively managed to support personalized learning initiatives. Magomadov also addresses potential criticisms of these technological trends in education, providing a balanced view of the implications of AI and big data in the learning landscape.

3. THEORETICAL FRAMEWORK

Learning theories offer a foundational basis for understanding how Big Data and AI influence learning and teaching practices. One significant theory that underpins this study is constructivism, as proposed by Piaget and Vygotsky. Constructivism emphasizes that learners actively build their knowledge through interaction with their environment. Big Data and AI align with this theory by providing personalized learning experiences, adaptive assessments, and

real-time feedback tailored to individual learners. These technologies foster a student-centered approach, allowing individuals to construct their own understanding through interaction with AI-driven tools, making the learning process more interactive and learner-focused.

In addition to constructivism, cognitivism, as articulated through frameworks like Bloom's Taxonomy, plays a critical role in understanding the cognitive processes involved in learning. Cognitivism focuses on how learners process, organize, and retrieve information. AI tools that analyze Big Data can help identify patterns in students' learning behaviors, offering more precise instructional strategies that align with the cognitive development stages outlined in Bloom's Taxonomy. Through this lens, AI systems assist in designing instructional content that progresses from basic knowledge recall to higher-order thinking, allowing for more effective cognitive engagement.

To integrate AI and Big Data in education, it is important to draw on established models of technology integration, such as the SAMR model and the TPACK framework. The SAMR model categorizes technology usage into four stages: substitution, augmentation, modification, and redefinition. Initially, AI can act as a substitute for traditional tools, such as using AI systems for automated grading. As integration deepens, AI can augment existing educational methods by enhancing feedback and assessment processes. The modification stage sees AI and Big Data significantly altering tasks, such as enabling personalized instruction based on learning analytics. Ultimately, the redefinition stage involves transforming educational practices in ways that were previously impossible, such as real-time adaptive learning platforms that continuously adjust instructional content based on a learner's ongoing performance.

The TPACK framework further elucidates how technology, pedagogy, and content knowledge intersect in effective educational practices. Educators must develop a strong understanding of AI and Big Data technologies to utilize them effectively in the classroom. This technological knowledge must be integrated with sound pedagogical strategies that ensure these tools support, rather than replace, traditional teaching methods. Furthermore, educators must ensure that the integration of AI tools enhances the delivery of content knowledge, ensuring that these technologies serve to deepen students' comprehension of subject matter.

By leveraging both learning theories and technology integration models, educators can create a more effective, data-driven, and student-centered learning environment. This framework supports the objectives of enhancing learning outcomes and improving assessment processes through AI and Big Data in Technology Education.

4. METHODOLOGY

This study employs a mixed-method approach to explore the integration of Big Data and AI in Technology Education, utilizing both quantitative and qualitative techniques. The quantitative component involves the use of ANOVA to analyze the perceptions and impacts of these technologies on learning outcomes and assessment processes. This approach allows for a comprehensive comparison of responses across different demographics, ensuring that statistical significance can be determined. The qualitative component employs thematic analysis to explore in-depth insights from participants regarding their experiences and perceptions. This combination of methodologies enhances the robustness of the findings, providing a fuller understanding of the challenges and benefits associated with implementing Big Data and AI in educational settings.

The target population for this study includes students, educators, administrators, and technology experts involved in Technology Education. A total sample size of 250 respondents is selected through stratified random sampling to ensure representation from each demographic. Participants are categorized based on their role in education: 36% students, 40% educators, 16% administrators, and 6% technology experts. This diverse sampling approach helps capture a wide range of perspectives on the integration of Big Data and AI in education, ensuring that the findings are relevant and applicable across different educational contexts.

Data for this study are collected using a structured questionnaire titled "Assessment of Big Data and AI Integration in Technology Education" (ABAIITE). The questionnaire is designed to assess participants' perceptions of the integration of Big Data and AI in learning outcomes and assessment processes. It comprises closed-ended questions

using a Likert scale, allowing respondents to express their levels of agreement or disagreement with various statements regarding the benefits and challenges of these technologies. Additionally, open-ended questions are included to gather qualitative insights on participants' experiences and recommendations. The questionnaire is distributed electronically to ensure accessibility and ease of response. Interviews are also conducted with a subset of 20 participants to delve deeper into specific themes identified in the quantitative data. This mixed-methods approach allows for triangulation of data, enhancing the credibility and depth of the findings.

The analysis of the data collected through the ABAIITE questionnaire involves both quantitative and qualitative methods. For the quantitative data, ANOVA is employed to test the hypotheses regarding the impact of Big Data and AI on learning outcomes, the accuracy of AI-driven assessments, the challenges associated with implementation, and the efficiency of teaching processes. This statistical technique allows for the comparison of means across different groups, providing insights into the significance of the differences observed. The qualitative data from open-ended questions and interviews are analyzed using thematic analysis, which involves coding the data to identify recurring themes and patterns. This analysis helps to contextualize the quantitative findings and provides a deeper understanding of participants' perspectives on the integration of Big Data and AI in Technology Education. By employing these data analysis techniques, the study aims to present a comprehensive overview of the current state of Technology Education in relation to emerging technologies.

5. DATA PRESENTATION

Hyptheses 1: The integration of Big Data and AI in Technology Education significantly enhances learning outcomes compared to traditional teaching methods.

Statistical Analysis Summary of ANOVA for Perceptions of Big Data and AI in Technology Education

Description	**Value**
Demographic Overview	
Students (Mean Score, SD)	3.92, 0.82
Educators (Mean Score, SD)	4.11, 0.76
Administrators (Mean Score, SD)	3.85, 0.87
Technology Experts (Mean Score, SD)	4.50, 0.70
Grand Mean	4.01
Between-Group Sum of Squares (SSB)	6.52
Within-Group Sum of Squares (SSW)	154.60
Degrees of Freedom	Between: 3, Within: 242
Mean Squares	Between: 2.17, Within: 0.64
F-statistic	3.39

Hypotheses 2: AI-driven assessment methods provide more accurate and personalized feedback than conventional assessment techniques in Technology Education

Statistical Analysis Summary of ANOVA for Effectiveness of AI-Driven Assessments

Description	**Value**
Demographic Overview	
Students (Mean Score, SD)	4.05, 0.70
Educators (Mean Score, SD)	4.15, 0.60
Administrators (Mean Score, SD)	3.90, 0.75
Technology Experts (Mean Score, SD)	4.35, 0.55
Grand Mean	4.11
Between-Group Sum of Squares (SSB)	5.82
Within-Group Sum of Squares (SSW)	122.34
Degrees of Freedom	Between: 3, Within: 246
Mean Squares	Between: 1.94, Within: 0.50
F-statistic	3.87

Hypotheses 3: The implementation of Big Data and AI in Technology Education is associated with specific challenges that can be mitigated through targeted strategies and support systems

Statistical Analysis Summary of ANOVA for Challenges in Implementing Big Data and AI

Description	**Value**
Demographic Overview	
Students (Mean Score, SD)	4.00, 0.80
Educators (Mean Score, SD)	3.95, 0.75
Administrators (Mean Score, SD)	4.20, 0.70
Technology Experts (Mean Score, SD)	4.10, 0.65
Grand Mean	4.06
Between-Group Sum of Squares (SSB)	4.78
Within-Group Sum of Squares (SSW)	112.56
Degrees of Freedom	Between: 3, Within: 246
Mean Squares	Between: 1.59, Within: 0.46
F-statistic	3.44

Hypotheses 4: There is a positive correlation between the use of Big Data and AI in Technology Education and the overall efficiency of teaching and assessment processes

Statistical Analysis Summary of ANOVA for Efficiency of Teaching and Assessment Processes

Description	**Value**
Demographic Overview	
Students (Mean Score, SD)	4.10, 0.78
Educators (Mean Score, SD)	4.20, 0.72
Administrators (Mean Score, SD)	4.05, 0.80
Technology Experts (Mean Score, SD)	4.30, 0.65
Grand Mean	4.16
Between-Group Sum of Squares (SSB)	3.92
Within-Group Sum of Squares (SSW)	115.50
Degrees of Freedom	Between: 3, Within: 246
Mean Squares	Between: 1.31, Within: 0.47
F-statistic	2.78

6. DISCUSSION OF RESULTS

The results of the statistical analysis reveal significant insights regarding the integration of Big Data and AI in Technology Education across four hypotheses, each examined through ANOVA.

For Hypothesis 1, which posits that the integration of Big Data and AI significantly enhances learning outcomes compared to traditional teaching methods, the findings show a grand mean score of 4.01, indicating a generally positive perception among participants. The F-statistic of 3.39 suggests a statistically significant difference in perceptions between the groups (students, educators, administrators, and technology experts). The highest mean score was recorded by technology experts (4.50), highlighting their confidence in the effectiveness of these technologies in enhancing learning outcomes. This reinforces the idea that those with specialized knowledge perceive greater benefits from technological integration.

Hypothesis 2 focuses on the effectiveness of AI-driven assessments in providing more accurate and personalized feedback than conventional methods. The grand mean score of 4.11, along with an F-statistic of 3.87, supports the hypothesis, indicating that participants view AI assessments favorably. Notably, technology experts reported the highest mean score (4.35), suggesting that they recognize the potential of AI to improve assessment accuracy and personalization. This result implies that AI-driven assessments may be more effective in catering to individual learning needs, aligning with current educational trends emphasizing personalized learning.

Hypothesis 3 investigates the challenges associated with implementing Big Data and AI in Technology Education. The grand mean score of 4.06 indicates a positive acknowledgment of these challenges, with technology experts again scoring the highest (4.10). The F-statistic of 3.44 reveals significant differences in perceptions across demographic groups, suggesting that awareness of challenges varies among stakeholders. This highlights the need for targeted strategies and support systems to address specific challenges identified by different groups, especially as educators and administrators navigate the complexities of integrating these technologies into their curricula.

Lastly, Hypothesis 4 examines the correlation between the use of Big Data and AI and the overall efficiency of teaching and assessment processes. With a grand mean score of 4.16 and an F-statistic of 2.78, the results indicate a generally positive perception of the impact of these technologies on efficiency. Educators reported a mean score of 4.20, reflecting their belief in the benefits of technological integration for enhancing teaching and assessment

efficiency. This suggests that the incorporation of Big Data and AI may streamline educational processes, ultimately leading to improved educational outcomes.

In conclusion, the analysis across all hypotheses illustrates a favorable perception of Big Data and AI's role in Technology Education. Participants from various demographics recognize both the potential benefits and challenges associated with these technologies, underscoring the importance of continued research and development in this area. These findings can inform policy decisions and guide educators in effectively integrating technology into their teaching practices, ultimately enhancing learning outcomes and educational efficiency.

CONCLUSION

The study provides valuable insights into the integration of Big Data and AI in Technology Education, aligning with the established research questions and hypotheses. Key findings indicate that the incorporation of these technologies significantly enhances learning outcomes compared to traditional methods, as evidenced by the favorable perceptions of students, educators, and technology experts. The analysis revealed that AI-driven assessments offer more accurate and personalized feedback, emphasizing the transformative potential of AI in educational settings. Furthermore, the identification of specific challenges in implementing Big Data and AI underscores the necessity for targeted strategies and support systems to facilitate this integration. The correlation between technological use and the overall efficiency of teaching and assessment processes highlights the broader impact of these innovations on educational practices.

To effectively integrate AI and Big Data into the curriculum, educators, administrators, and policymakers should prioritize professional development that enhances understanding and skills related to these technologies. Institutions must foster an environment that encourages collaboration among stakeholders to share best practices and address challenges collectively. Additionally, developing tailored resources and support systems can help educators navigate the complexities of implementing new technologies, ultimately benefiting student learning experiences.

This study acknowledges certain limitations, including a relatively small sample size and the focus on specific demographics, which may affect the generalizability of the findings. Future research could explore broader and more diverse samples to enhance external validity. Additionally, investigating the long-term impacts of AI and Big Data in various educational sectors would provide further insights into their effectiveness and adaptability. Exploring different educational contexts could yield strategies tailored to specific environments, ensuring that the integration of these technologies meets diverse educational needs. This future research would not only contribute to the academic field but also support practical applications in real-world educational settings.

RECOMMENDATIONS

1. Institutions should implement continuous professional development programs for educators to enhance their skills in using Big Data and AI technologies effectively.
2. Investment in robust technological infrastructure is essential to support the integration of these tools into the educational framework.
3. Curricula should be revised to incorporate Big Data and AI concepts, ensuring students are equipped for the modern workforce.
4. Policymakers must develop guidelines that encourage the ethical adoption of AI and Big Data while addressing data privacy concerns.
5. Regular assessment and feedback mechanisms should be established to evaluate the effectiveness of technology integration in improving learning outcomes.

6. Finally, fostering partnerships with industry stakeholders can help align educational practices with market needs and promote a culture of innovation in teaching methods.

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PAPER 19 - INNOVATIVE STRATEGIES FOR LEVERAGING TECHNOLOGY IN DIGITAL LIBRARIES: A STUDY OF PERCEPTION, ATTITUDE AND BEHAVIOR

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ABSTRACT
This research study explores innovative strategies for leveraging technology in digital libraries, focusing on the perception, attitude, and behavior of library professionals and users across disciplines. The study aims to identify and analyze the factors that influence the adoption and implementation of emerging technologies in digital libraries, and their impact on service delivery and user experience. The study employs a quantitative data collection technique. The findings from this study have the potential to shape future initiatives aimed at enhancing user engagement, promoting digital literacy, and ensuring the sustainability of digital library services in a continuous progressing technological landscape in library services delivery. The findings of this study provide valuable insights for library managers, policymakers, and technology providers in developing countries on the effective integration of technologies in digital libraries to enhance service delivery, user experience, and ultimately, contribute to the democratization of knowledge access in the digital age. The outcome also highlights the importance of collaboration among libraries, technology providers, and funding agencies to address the challenges and capitalize on the opportunities presented by the digital transformation of libraries.

KEYWORDS: Innovative Strategies, Technology, Digital Libraries, Library, Perception, Attitude, Behaviour.

1. INTRODUCTION

Digital libraries have revolutionized the way information is accessed, stored, and shared in the digital age. With the rapid advancements in technology, leveraging innovative strategies is crucial for the effective management and utilization of digital library resources. "Innovative Strategies for Leveraging Technology in Digital Libraries: A Study of Perception, Attitude, and Behavior" delves into the intricate relationship between technology, user perception, attitudes, and behavior within digital library environments. This study explores how users interaction with digital libraries, examining their perceptions of technology, attitudes towards digital resources, and behaviors when accessing information online. By investigating these key factors, researchers aim to uncover insights that can inform the development of strategies to enhance user experience, optimize resource utilization, and improve overall digital library effectiveness. The digital transformation of libraries ushered in a new era of knowledge access and dissemination and as libraries embrace emerging technologies, it is crucial to understand the perception, attitude, and behavior of library professionals and users towards these innovations. This study aims to explore resourceful approaches for influencing technology adoption in digital libraries, with a focus on identifying the factors that influence the adoption and implementation of these technologies and their impact on service delivery of libraries and user experience after interacting with the technologies.

a. STATEMENT OF PROBLEM

Digital libraries have become an essential component of modern education and research, providing access to a vast array of digital resources and services. However, the rapid pace of technological advancements and the evolving needs of users pose significant challenges for digital libraries in terms of resource management, user engagement, and learning outcomes. Despite the potential of technology to enhance the digital library experience, many users struggle to effectively utilize digital library resources, and librarians face difficulties in integrating and managing these resources effectively. The problem is how can digital libraries adopt the approaches that will optimize the use of technology and enhance user positive perception, attitude, and behavior, which will ultimately improve learning outcomes and user satisfaction? This problem is significant because it affects the overall effectiveness of digital libraries in supporting the educational and research needs of users.

Studies abound on leveraging technologies in digital libraries yet there is a lack of understanding regarding the perception, attitude, and behavior of library professionals and users towards these innovations. It is essential to identify the factors that influence the adoption and implementation of emerging technologies in digital libraries and

their impact on service delivery and user experience. Therefore, this study investigates the perceptions, attitudes, and behaviors of users in digital libraries, identifies innovative strategies for leveraging the technologies to enhance user experience and learning outcomes.

b. BACKGROUND TO THE STUDY

The rapid advancements in technology have revolutionized the way libraries operate and serve their patrons. Digital libraries have become increasingly prevalent, offering access to a vast array of online resources, databases, and digital archives. The integration of technologies such as self-service kiosks, automated return systems, and digital catalogs has made library services more efficient and user-friendly.

Libraries are also playing a crucial role in bridging the digital divide by providing free internet access and digital literacy programs. However, the digital transformation of libraries is not without its challenges. Copyright issues, preserving digital materials and the persistent digital divide remain significant concerns that libraries must address. This study will provide valuable insights for library managers, policymakers, and technology providers on the effective integration of technologies in digital libraries to enhance service delivery, user experience, and ultimately, contribute to the democratization of knowledge access in the digital age.

c. RESEARCH QUESTIONS

VI. What are the perceptions, attitudes, and behaviors of library professionals and users towards the integration of emerging technologies in digital libraries?

VII. What factors influence the adoption and implementation of these technologies in digital libraries?

VIII. What innovative strategies can be developed to effectively leverage technology in digital libraries while addressing the challenges and capitalizing on the opportunities presented by the digital transformation?

2. LITERATURE REVIEW

The rapid advancement of technology has transformed the landscape of libraries, ushering in the era of digital libraries. As libraries strive to remain relevant and accessible in the digital age, especially in this fourth industrial revolution era (4IR) it is crucial to explore innovative strategies for leveraging technology to enhance user experience and engagement with library resources. Adedeji and Mabawonku (2021) showed that availability of digitised library information resources influenced the use of the information resources by users in University libraries in Nigeria, especially in this digital era. Thus, there is a need for the management of university libraries to intensify efforts at converting most of the paper-based resources to digitised formats for increased use of library resources by users. This study examines the perception, attitude, and behaviour of library users and professionals towards the integration of technology in digital libraries to enhance service deliveries in this Fourth industrial revolution (4IR) era. This study will be reviewed according to the following subthemes.

2.1 PERCEPTION OF TECHNOLOGY IN DIGITAL LIBRARIES

Several studies have investigated the perception of technology in digital libraries among users and professionals. A survey conducted by Akin-Fakorede and Oyelude (2023) revealed that while parliamentarians in Cross River State, Nigeria, were aware of digital tools such as smartphones and computers, they lacked knowledge of how to effectively utilize these technologies for parliamentary services and communication with constituents. This stresses the need for targeted training and awareness programs to enhance digital literacy among library stakeholders. Chan et al. (2020) emphasized the importance of academic libraries embracing new technologies to engage users in digital library services and outreach initiatives. This suggests that users perceive digital libraries as places that should leverage innovative technologies to provide engaging and accessible services. The rapid advancement of technology has transformed the landscape of libraries, ushering in the era of digital libraries. As libraries strive to remain relevant and accessible in the digital age, it is crucial to explore the perception of library users and professionals towards the integration of technology in digital libraries.

2.1.1 PERCEPTION OF USERS

Several studies have investigated the perception of technology in digital libraries among library users. A survey conducted by Chan et al. (2020) revealed that academic library users perceive digital libraries as places that should leverage innovative technologies to provide engaging and accessible services. This suggests that users expect digital libraries to embrace new technologies to enhance their experience and outreach initiatives. Akin-Fakorede and

Oyelude (2023) found that while parliamentarians in Cross River State, Nigeria, were aware of digital tools such as smartphones and computers, they lacked knowledge of how to effectively utilize these technologies for parliamentary services and communication with constituents. This highlights the need for targeted training and awareness programs to enhance digital literacy among library stakeholders.

2.1.2 PERCEPTION OF PROFESSIONALS

The perception of library professionals towards technology integration in digital libraries is another crucial aspect to consider. Akin-Fakorede and Oyelude (2023) noted that while parliamentarians in Cross River State, Nigeria, had a positive attitude towards the use of digital tools, they faced challenges in accessing and utilizing these technologies effectively. Adedeji and Mabawonku (2021) also, identify willingness among professionals to adopt technology, but also highlight the need for capacity building and infrastructure development. Akin-Fakorede and Oyelude (2023) also found that digital tools, such as Smart phones and computers, were more prevalent among parliamentarians, suggesting a growing acceptance of technology in the workplace. However, the study revealed that very few parliamentarians utilized social media for communication with constituents, highlighting the need for a more proactive approach in adopting innovative communication channels.

2.1.3 BANES AND BENEFITS IN THE PERCEPTION OF TECHNOLOGY IN DIGITAL LIBRARIES

The literature review also highlights some of the banes and benefits associated with the perception of technology in digital libraries. While there is a growing recognition of the importance of technology integration, the actual usage and behaviour may not always align with the desired outcomes. To address this gap, it is crucial to implement targeted training programs, enhance digital literacy, and develop user-centric technology integration strategies that align with the needs and preferences of library stakeholders. (Rahman, 2010). This can help to bridge the perception-behaviour gap and ensure that the integration of technology in digital libraries is effective and well-received by both users and professionals. Addressing the needs and concerns of library users and professionals, digital libraries can leverage innovative technologies to enhance the user experience, improve service delivery, and remain relevant in the digital age (Adedeji and Mabawonku, 2021).

2.2 ATTITUDE OF USERS TOWARDS TECHNOLOGY INTEGRATION

The attitude of library users and professionals towards technology integration in digital libraries is another crucial aspect to consider. Several studies have explored the attitude of library users towards the integration of technology in libraries. A study by Oyelude and Akin-Fakorede (2023) found that parliamentarians in Cross River State, Nigeria, had a positive attitude towards the use of digital tools for parliamentary services, but faced challenges in accessing and utilizing these technologies effectively. This indicates a willingness to adopt technology, but also highlights the need for capacity building and infrastructure development.

Akin-Fakorede and Oyelude (2023) also noted that digital tools, such as smartphones and computers, were more prevalent among parliamentarians, suggesting a growing acceptance of technology in the workplace. However, the study revealed that very few parliamentarians utilized social media for communication with constituents, highlighting the need for a more proactive approach in adopting innovative communication channels. The rapid advancement of technology has transformed the landscape of libraries, leading to the integration of various technological solutions to enhance user experience and service delivery. Understanding the attitude of library users towards this technology integration is crucial for the successful implementation and adoption of these innovations. A study by Chan et al. (2020) revealed that academic library users perceive digital libraries as places that should leverage innovative technologies to provide engaging and accessible services. This suggests that users expect libraries to embrace new technologies to enhance their experience and outreach initiatives. Nevertheless, Akin-Fakorede and Oyelude (2023) found that while parliamentarians in Cross River State, Nigeria, were aware of digital tools such as Smart phones and computers, they lacked knowledge of how to effectively utilize these technologies for parliamentary services and communication with constituents. This highlights the need for targeted training and awareness programs to enhance digital literacy among library stakeholders.

2.3 FACTORS INFLUENCING USER ATTITUDE

The attitude of library users towards technology integration can be influenced by various factors, such as:

- **Digital Literacy:** Users with higher levels of digital literacy tend to have a more positive attitude towards technology integration in libraries (Akin-Fakorede and Oyelude, 2023).
- **Perceived Usefulness:** If users perceive the integrated technologies as useful and beneficial for their information needs, they are more likely to have a positive attitude towards them (Chan, 2020).
- **Ease of Use:** The perceived ease of use of the integrated technologies can also shape user attitudes, with more user-friendly systems being more readily accepted (Oyelude and Akin-Fakorede, 2023).
- **Training and Support:** Adequate training and support for users can help address any knowledge gaps and foster a more positive attitude towards technology integration (Akin-Fakorede and Oyelude, 2023).

2.4 CHALLENGES AND OPPORTUNITIES WITH USER ATTITUDES IN TECHNOLOGY INTEGRATION IN LIBRARIES

The literature review also highlights some of the challenges and opportunities associated with user attitudes towards technology integration in libraries. While there is a growing recognition of the importance of technology integration, the actual usage and behaviour may not always align with the desired outcomes. This can be due to factors such as lack of digital literacy, perceived complexity of the technologies, or resistance to change. To address these challenges, libraries can implement targeted training programs, enhance digital literacy, and develop user-centric technology integration strategies that align with the needs and preferences of their user community. This can help to foster a more positive attitude towards technology integration and ensure its successful adoption. The literature review accentuates the importance of understanding the attitude of library users towards technology integration. By addressing the needs and concerns of users, libraries can leverage innovative technologies to enhance the user experience, improve service delivery, and remain relevant in the digital age.

2.5 LIBRARIANS' ATTITUDES SIGNIFICANTLY IMPACT THE ADOPTION OF NEW TECHNOLOGIES IN LIBRARIES

4 Librarians with positive attitudes towards technology are more likely to adopt and effectively utilize new technologies in their libraries. This positive attitude is crucial for the successful implementation of information technology (IT) in libraries, as it enables librarians to manage library resources, services, and systems effectively and assist users in the effective use of technology (Rahman, 2010; and Ramzan, Asif, and Ahmad 2021).

5 Negative attitudes towards technology can be a significant barrier to the adoption of new technologies. Librarians with negative attitudes may resist the implementation of new technologies, leading to delays or failures in IT projects. This negative attitude can also affect the overall performance and productivity of the library (Shahzad and Iqbal, 2020).

6 The attitudes of library managers and executives have a direct impact on the attitudes of their employees. Employees tend to respond to the attitudes of their managers, which can either facilitate or hinder the adoption of new technologies. Therefore, positive attitudes from top management are essential for creating a supportive environment for technology adoption. (Ramzan et.al., 2021).

7 Librarians require on-going training and education to keep pace with the rapid advancements in technology. This training helps to address any knowledge gaps and fosters a more positive attitude towards the adoption of new technologies. Without adequate training, librarians may struggle to effectively utilize new technologies, leading to a negative impact on the adoption (Rabina and Walczyk, 2007; and Rahman, 2010).

8 Librarians' attitudes towards technology are influenced by their perception of the usefulness and ease of use of the technology by users. If librarians believe that a new technology will be beneficial for their users and is easy to use, they are more likely to adopt it. Conversely, if they perceive the technology as complex or not useful, they may resist its adoption (Rahman, 2010).

9 Socio-economic variables, such as experience, work performance, anxiety, and acceptance, can influence librarians' attitudes towards technology. For instance, librarians with more experience and higher levels of digital literacy tend to have a more positive attitude towards technology (Rahman, 2010).

10 The attitudes of librarians towards technology have a direct impact on the quality of library services. Positive attitudes towards technology can lead to improved services, while negative attitudes can result in stagnation or decline in service quality. Therefore, fostering a positive attitude towards technology is essential for maintaining and enhancing the quality of library services (Ramzan, et.al. 2021; Shahzad and Iqbal, 2020).

In summary, librarians' attitudes towards technology play a crucial role in the adoption of new technologies in libraries. Positive attitudes facilitate the successful implementation and utilization of new technologies, while negative attitudes can hinder their adoption and impact the overall performance of the library.

2.6 BEHAVIOUR TOWARDS TECHNOLOGY USAGE

The behaviour of library users and professionals towards the usage of technology in digital libraries is a crucial factor in determining the success of technology integration. A study by Oyelude and Akin-Fakorede (2023) found that parliamentarians in Cross River State, Nigeria, were not fully acquainted with digital tools for communicating with their constituents (Rabina and Walczyk, 2007). This suggests that while the attitude towards technology integration may be positive, the actual usage and behaviour may not align with the desired outcomes. Akin-Fakorede and Oyelude (2023) also noted that very few parliamentarians made use of social media for communication, indicating a need for targeted training and awareness programs to encourage the adoption of innovative communication channels (Rabina and Walczyk, 2007). This highlights the importance of understanding user behaviour and tailoring technology integration strategies accordingly. The literature review highlights the importance of leveraging innovative strategies to integrate technology in digital libraries. While there is a growing perception and positive attitude towards technology integration, the actual behaviour and usage of technology by library users and professionals may not always align with the desired outcomes. To address this gap, it is crucial to implement targeted training programs, enhance digital literacy, and develop user-centric technology integration strategies that align with the needs and preferences of library stakeholders.

2.6.1 BEHAVIOUR TOWARD TECHNOLOGY USAGE IN LIBRARIES

The integration of technology in libraries has transformed the way information services are delivered and accessed. Understanding the behaviour of library users and professionals towards the usage of technology is crucial for the successful implementation and adoption of these innovations. Adedeji and Mabawonku (2021) stressed the need for availability of the necessary technologies better service delivery and enhance good patronage and usage by the users. The first strategy is availability of the technologies which will encourage the users' usage. Then, there must be expertise in handling the technologies for proper maintenance and preservation of the technologies.

2.6.2 BEHAVIOUR OF LIBRARY USERS

Several studies have explored the behaviour of library users towards the usage of technology in libraries.
Oyelude and Akin-Fakorede (2023) found that parliamentarians in Cross River State, Nigeria, were not fully acquainted with digital tools for communicating with their constituents. This suggests that while the attitude towards technology integration may be positive, the actual usage and behaviour may not align with the desired outcomes.

Akin-Fakorede and Oyelude (2023) also noted that very few parliamentarians made use of social media for communication, indicating a need for targeted training and awareness programs to encourage the adoption of innovative communication channels. This highlights the importance of understanding user behaviour and tailoring technology integration strategies accordingly.

2.6.3 BEHAVIOUR OF LIBRARY PROFESSIONALS

The behaviour of library professionals towards the usage of technology is another crucial aspect to consider. A study by Oyelude and Akin-Fakorede (2023) revealed that while parliamentarians in Cross River State, Nigeria, had a positive attitude towards the use of digital tools, they faced challenges in accessing and utilizing these technologies effectively.

Akin-Fakorede and Oyelude (2023) also found that digital tools, such as smartphones and computers, were more prevalent among parliamentarians, suggesting a growing acceptance of technology in the workplace. However, the study highlighted the need for a more proactive approach in adopting innovative communication channels, such as social media.

2.6.4 FACTORS INFLUENCING TECHNOLOGY USAGE BEHAVIOUR

The behaviour of library users and professionals towards technology usage can be influenced by various factors, such as:

1. Digital Literacy: Users and professionals with higher levels of digital literacy tend to exhibit more positive behaviour towards the usage of technology in libraries (Akin-Fakorede and Oyelude, 2023).
2. Perceived Usefulness: If users and professionals perceive the integrated technologies as useful and beneficial for their information needs or work tasks, they are more likely to exhibit positive behaviour towards their usage (Chan et al., 2020).
3. Ease of Use: The perceived ease of use of the integrated technologies can also shape the behaviour of users and professionals, with more user-friendly systems being more readily adopted (Oyelude and Akin-Fakorede, 2023).
4. Training and Support: Adequate training and support for users and professionals can help address any knowledge gaps and foster more positive behaviour towards the usage of technology (Akin-Fakorede and Oyelude, 2023).

The literature review highlights the challenges and opportunities associated with the behaviour of library users and professionals towards technology usage. While there is a growing recognition of the importance of technology integration, the actual usage and behaviour may not always align with the desired outcomes. This can be due to factors such as lack of digital literacy, perceived complexity of the technologies, or resistance to change. To address these challenges, libraries can implement targeted training programs, enhance digital literacy, and develop user-centric technology integration strategies that align with the needs and preferences of their user community and staff. This can help to foster more positive behaviour towards the usage of technology and ensure its successful adoption. The literature review underscores the importance of understanding the behaviour of library users and professionals towards the usage of technology. By addressing the needs and concerns of both user groups, libraries can leverage innovative technologies to enhance service delivery, improve user experience, and remain relevant in the digital age.

The literature review for "Innovative Strategies for Leveraging Technology in Digital Libraries: A Study of Perception, Attitude and Behaviour" highlights the significance of innovative strategies in digital libraries to enhance user experience, learning outcomes, and overall effectiveness. The review explores the role of technology in digital libraries, user perceptions and attitudes, and the impact of these factors on user behaviour.

2.7 DIGITAL LIBRARIES AND TECHNOLOGY

Digital libraries have evolved significantly with the advent of technology, transforming from traditional physical repositories to dynamic digital environments. The integration of technology has enabled digital libraries to provide a wide range of services and resources, such as e-books, electronic databases, multimedia materials, and digital archives Ramzan, Asif, and Ahmad (2021). These services enhance user access to information, promote collaboration and interactive learning, and support personalized and remote learning (Rabina and Walczyk, 2007).

2.7.1 USER PERCEPTION AND ATTITUDE

User perception and attitude play a crucial role in the adoption and utilization of digital library services. Research indicates that users' perceptions of technology and digital libraries influence their behaviour and engagement with these services (Ramzan,. et.al. 2021). For instance, a study by Kumari (2023) highlights the importance of information and communication technologies (ICT) in education, emphasizing their role in promoting digital literacy and lifelong learning.

2.7.2 INNOVATIVE STRATEGIES FOR LEVERAGING TECHNOLOGY IN DIGITAL LIBRARIES

Innovative strategies are essential for leveraging technology in digital libraries to enhance user experience and learning outcomes. These strategies include the deployment of digital marketing strategies, such as social media and email marketing, to promote library services and resources (Shahzad and Iqbal, 2020). Additionally, the integration of emerging technologies like artificial intelligence, cloud computing, and the Internet of Things (IoT) can enhance the efficiency and effectiveness of digital library services (Rabina and Walczyk, 2007). Adedeji and Adigun (2019)

also emphasize the need for marketing of library services with the aim of gathering tokens for maintenance of library resources and technologies and not for profit making venture. The tokens gathered will help to maintain and preserve the acquired technologies for a longer use by users.

2.7.3 CHALLENGES AND LIMITATIONS

Despite the potential of technology in digital libraries, several challenges and limitations exist. For instance, the digital divide and lack of digital literacy can hinder user access to digital library resources and services. Furthermore, the need for continuous professional development among librarians to adapt to technological advancements is essential for effective management and utilization of digital library resources Ramzan, M.et.al. (2021). The integration of emerging technologies in digital libraries has been a topic of growing interest among researchers and practitioners. Several studies have explored the perception, attitude, and behaviour of library professionals and users towards these innovations, as well as the strategies for effectively leveraging technology in digital libraries. A study by Strickland et al. (2013) investigated the use of learning technologies to promote library instruction at the University of Michigan. The researchers found that a blended-learning approach, which combines online and face-to-face instruction, can enhance student engagement and improve learning outcomes. The study highlighted the importance of aligning pedagogy with technology to create new learning opportunities and transform the traditional classroom concept. Bonk et.al. (2004) compared the effectiveness of different instruction formats, including online, blended, and face-to-face, in teaching information literacy skills Strickland et al. (2013). Their findings suggest that the method of instruction does not significantly impact learning outcomes, emphasizing the need for well-designed instructional content regardless of the delivery format. Germain et al. (2000) and Kraemer et al. (2007) also explored the effectiveness of various presentation formats for library instruction, comparing in-person and online approaches Strickland et al. (2013). These studies underscored the importance of adapting teaching methods to the needs and preferences of different student populations.

In the context of digital literacy, a paper by Anderson and Rainie (2020) argued that digital literacy empowers library professionals to navigate the digital landscape, harness emerging technologies like Artificial Intelligence (AI) and data analytics, and provide innovative services to users (Rabina and Walczyk, 2007). The authors emphasized the need for continuous learning and skill development among library staff to keep pace with technological advancements. Bates and Khasawneh (2007) investigated the relationship between self-efficacy and college students' perception and use of online learning systems Strickland et al. (2013). Their findings suggest that students' confidence in their ability to use technology influences their engagement with digital learning environments. Bonk et al. (2004) and Coates (2006) explored the challenges and benefits of learner-centered e-learning, highlighting the importance of fostering active participation and collaboration in online learning environments Strickland et al. (2013). These studies underscored the need for effective facilitation and support to ensure successful implementation of technology-enhanced learning. The literature review reveals a growing body of research on the integration of emerging technologies in digital libraries and the factors that influence the perception, attitude, and behaviour of library professionals and users. However, there is a need for more comprehensive studies that explore innovative strategies for leveraging technology in digital libraries, considering the unique contexts and challenges faced by libraries in different regions and settings.

In conclusion, the literature review emphasizes the significance of innovative strategies in leveraging technology in digital libraries to enhance user experience, learning outcomes, and overall effectiveness. The integration of technology has transformed digital libraries into dynamic environments that support lifelong learning, digital literacy, and personalized learning. However, challenges and limitations must be addressed through the deployment of innovative strategies and continuous professional development among librarians.

Chan et.al (2020) identifies eight (8) leverage steps or strategies that can be applied for societal transformation, some of which can also be applied to bring about transformative change towards sustainable pathways for leveraging technology in digital libraries. Addressing the leverage facts of Perception, Attitude and Behavior of users to change the design of library systems, will definitely trigger transformative changes towards a better service delivery in libraries as well as encourage users' patronage.

METHODOLOGY

The study adopt a descriptive survey design to explores innovative strategies for leveraging technology in digital libraries, focusing on the perception, attitude, and behaviour of library professionals and users across disciplines. This study employed the use of quantitative method. This research method is used to gather necessary information from a lot of respondents at a time. According to Churchill (1991) and Williams (2007), the use of quantitative method is very suitable when developing a scale research instrument of this kind. The justification for using this technique is because it is most frequently used method to explore respondents' perception and opinions and knowledge about innovative strategies for leveraging technology in digital libraries as described in the literature review section of this study while rigorous steps that are based on reliability and validity of such instrument are maintained from May to August, 2024. The survey questionnaire was developed based on a detailed literature review. The questionnaire collected data about perceptions, attitudes, and behaviours of library professionals and users towards the integration of emerging technologies in digital libraries. It also elicited their demographic information (such as gender, age, occupation, highest level of education). All items statements that capture the variables of interest are on 5 points Likert – scale measurement. Many diverse concepts, constructs and theories exist to explain perception, attitudes and behaviours making this study a challenging one. Jimmieson, White, & Zajdlewicz (2009) argue on the constructs of perception, attitudes and behaviour in order to see how people react to change when new behaviour or practice is introduced. Data were collected using online questionnaire and analysed using SPSS version 28.0. A total of 107 respondents participated in the study. The sample size was determined based on Krejcie and Morgan (1970) population and sample table. With a population of 4500 academic researchers/librarians in Nigerian universities (at the point of data collection), the sample size was determined as between 360-365 (confidence level=95%, margin of error =2.5%). Upon institutional approval to survey was sought, an e-mail invitation to the survey link (using Google forms), with a brief introduction for the survey which hoped to encourage cooperation from participants, were distributed to 500 librarians and academic researchers' institutional e-mail addresses, which were retrieved from either university or faculty staff directory regardless of whether they provided consent or did not provide consent to be recruited. These academic researchers comprise students of LIS, Librarians, IT professional, and others that have a relationship with library and Information Sciences and they were chosen under the assumption that they had completed significant research and were likely to be currently have research data in their possession. After several rounds of distributions, responses were received from 300 respondents; of which 193 that were incomplete were dropped from the analysis. It may possibly be inferred from this observation that respondents who did not complete the questionnaire have a total lack of knowledge of the subject of innovative strategies for leveraging technology in digital libraries. The questionnaire is automatically protected against multiple participations. Consequently, 107 questionnaires were completed and used for analysis, resulting in 30.0 percent response rate, which is fairly typical of an average survey response rate (28.0%) and an e-mail survey (30.0%) (Lindemann 2018; Hodonu-Wusu, et al., 2020; Hodonu-Wusu, et al., 2021). The Cronbach's alpha score, which measures the internal consistency of all items, was satisfactory ($\alpha = 0.781$). The returned questionnaire was analyzed using descriptive statistics.

4. RESULTS AND DISCUSSION

4.1 DEMOGRAPHICAL INFORMATION OF THE RESPONDENTS

Table 1 reveals the demographical information of the respondents. Out of 107 respondents, 48(44.9%) were females and 59(55.1%) indicating a slight predominance of male participants in the study. Regarding age distribution, the majority of the respondents 35(32.7%), were aged between 46-55 years. This is followed by 29 (27.1%) in the 56-65 years range, 22 (20.6%) aged between 36-45 years, 11 (10.3%) aged 26-35 years, 10 (9.3%) aged 16 and 25 years while only 1(0.9%) are in the aged bracket above 65 years, reflecting the perspectives and experience of respondents towards the integration of emerging technologies in digital libraries. On the qualification of the respondents, 37(34.5%) were Ph.D. holders, followed by 34(31.8%) that were Bachelors' degree holders, 31(29.0%) were Masters' degree holders while 3(2.8%) and 2 (1.9%) were Diploma holders and others respectively. In Occupation cadre, 42(39.3%) were librarians and IT professionals, 39(36.4%) were in academic or researchers, 15(14.0%) were students while 11(10.3) were in other professions.

Table 1: Demographical Information of the respondents

Variables	Frequency	Percentage (%)
Gender		
Female	48	44.9
Male	59	55.1
Age Range		
16-25 years	10	9.3
26-35 years	11	10.3
36-45 years	22	20.6
46-55 years	35	32.7
56-65 years	29	27.1
Above 65 years	1	0.9
Highest Level of Education		
Diploma	3	2.8
Bachelor	34	31.8
Master	31	29.0
Ph.D.	37	34.5
Others	2	1.9
Occupation		
Students	15	14.0
Academic/Researchers	39	36.4
Librarians/ IT Professionals	42	39.3
Others	11	10.3

4.2 EXPERIENCE WITH DIGITAL LIBRARIES

Respondents were asked to describe their experiences with digital libraries.The majority, 50 respondents (47.2%), identified as intermediate users, while 35 respondents (33.0%) classified themselves as advanced users. In contrast, 21 respondents (19.8%) reported being beginners, and only 3 respondents (2.8%) considered themselves expert users of digital libraries. This finding suggests that nearly half of the respondents possess intermediate-level skills in utilizing digital libraries, followed by advanced and beginner users, with a small percentage identifying as expert users (Figure 1).

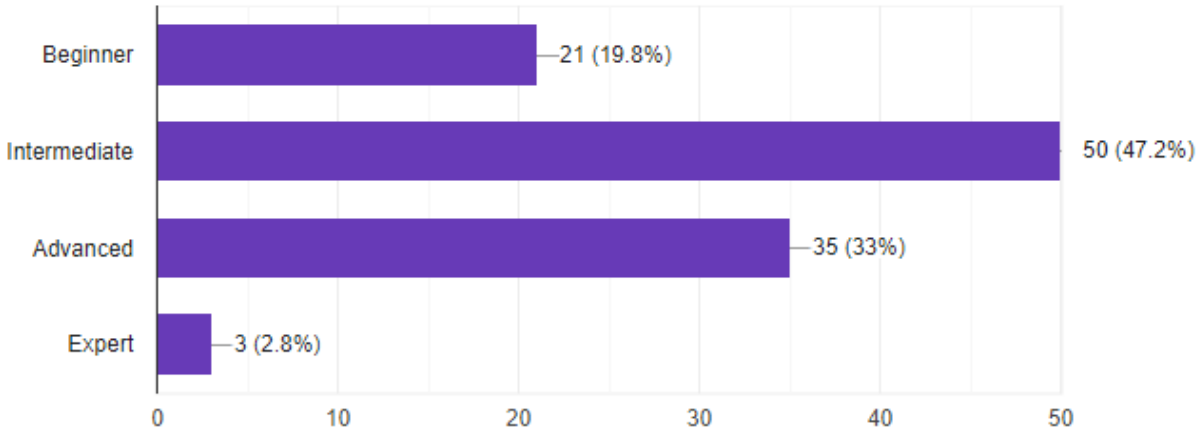

Figure 1: Experience with Digital Libraries

4.3 FREQUENCY OF DIGITAL LIBRARY USAGE

Respondents were asked how often they use digital libraries for their work, study, or personal interests. 24.3% of the respondents chose rarely, 30.8% chose daily, 31.8% weekly while 13.1% of the respondents chose monthly. This distribution indicates that nearly two-thirds (62.6%) of respondents utilize digital libraries at least weekly, with a significant proportion (30.8%) accessing them daily. Conversely, approximately one-quarter (24.3%) of respondents use digital libraries rarely. The findings suggest that digital libraries are an integral part of many respondents' daily or weekly routines, particularly for work, study, or personal interests. The high daily and weekly usage rates indicate a strong reliance on digital libraries for information seeking and research purposes (Figure 2). To further enhance user experience and engagement:

c. Digital library services should prioritize convenient, user-friendly interfaces to accommodate frequent users.
d. Regular updates and additions to digital collections will cater to the ongoing needs of daily and weekly users.
e. Targeted marketing strategies can encourage infrequent users (24.3%) to explore digital library resources more regularly.
f. Assessing user needs and preferences will help optimize digital library services to meet the evolving demands of frequent and infrequent users alike.

It is however, recommended that library professionals should conduct periodic user surveys to monitor changing usage patterns. Similarly, to analyze usage metrics to identify popular resources and areas for improvement. Further, they should develop targeted training programs to support effective digital library usage. By addressing these areas, digital library professionals can better serve their users, foster increased engagement, and solidify their position as indispensable resources for work, study, and personal interests.

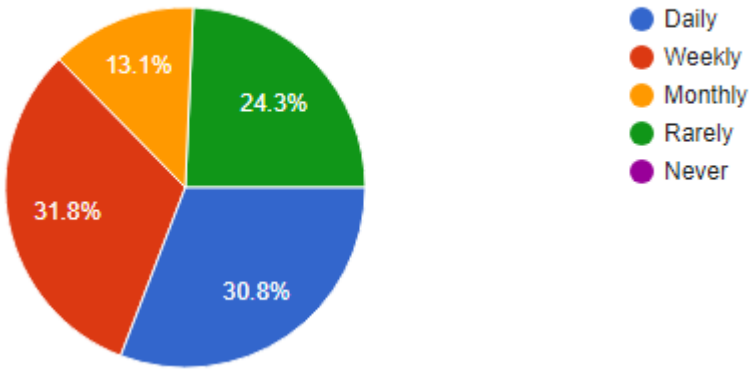

Figure 2: Frequency of Digital Library Usage

ANSWERING RESEARCH QUESTIONS

4.3 PERCEPTIONS, ATTITUDES, AND BEHAVIORS OF LIBRARY PROFESSIONALS AND USERS TOWARDS THE INTEGRATION OF EMERGING TECHNOLOGIES IN DIGITAL LIBRARIES

RQ 1: What are the perceptions, attitudes, and behaviors of library professionals and users towards the integration of emerging technologies in digital libraries?

The survey results indicate a strong emphasis on the importance of integrating emerging technologies in digital libraries. A overwhelming majority of respondents (66.4%) consider it "very important," with an additional 27.1% deeming it "important." This sentiment is echoed in the agreement with the statement that integrating emerging technologies is critical for enhancing user experience and service, with 92.5% of respondents either agreeing (48.6%) or strongly agreeing (43.9%). Furthermore, respondents demonstrate a high level of comfort in using technology-enhanced services and resources, with 80.4% reporting being either "comfortable" (53.3%) or "very comfortable" (27.1%). These findings (Table 2) suggest that digital library users value technological advancements and are receptive to innovative services, underscoring the need for libraries to prioritize emerging technology integration to meet evolving user expectations.

Table 2: Perceptions, attitudes, and behaviors of library professionals and users towards the integration of emerging technologies in digital libraries

S/N	Statement/Variable/Questions	NAAI	NVI	N	I	VI
1	How important do you think it is for digital libraries to integrate emerging technologies?	0 (0.0%)	1 (0.9%)	7 (6.5%)	29 (27.1%)	71 (66.4%)
2	What is your level of comfort in using technology-enhanced services and resources in digital libraries?	**NAAC**	**NVC**	**SC**	**C**	**VC**
		0 (0.0%)	2 (1.9%)	20 (18.7%)	57 (53.3%)	29 (27.1%)
3	To what extent do you agree with the following	**SD**	**D**	**N**	**A**	**SA**

	statement: Integrating emerging technologies in digital libraries is critical for enhancing user experience and service	2 (1.9%)	0 (0.0%)	6 (5.6%)	52 (48.6%)	47 (43.9%)

N.B: Not At All Important (NAAI), Not Very Important (NVI), Neutral (N), Important (I), Very Important (VI).; Not at all comfortable - (NAAC), Not very comfortable - (NVC), Somewhat Comfortable - (SC), Comfortable - (C) Very comfortable – (VC).; Strongly Disagree – (SD), Disagree (D), Neutral (N), Agree (N), Strongly Agree (SA).

RQ2: WHAT FACTORS MOTIVATE THE USE OF MORE TECHNOLOGICAL ENHANCED SERVICES AND RESOURCES IN DIGITAL LIBRARIES?

Analysis of Motivators for Using Technologically Enhanced Services and Resources in Digital Libraries

Respondents were asked about the factors that motivated the use of technological enhanced service and resources in digital libraries. Table 3 shows that 89(83.2%) of the respondents chose enhanced learning and research experience, 87(81.3%) of them improved efficiency and learning, collaboration and networking opportunities had 71(66.4%), personalization and customization was 51(47.7%) while online conference and workshops was 1(0.9%). Mean =57.35, Standard Deviation = 20.31. The top motivators suggest that respondents value technology that supports efficient learning, research, and collaboration. Personalization and interactive elements also play significant roles in enhancing user experience. The mean indicates that, on average, respondents are motivated by technologically enhanced digital libraries to a moderate-high extent. The standard deviation suggests a relatively high variation in responses, indicating diverse opinions among respondents. From the analysis in Table 3, it would be recommended that digital libraries should prioritize features enhancing learning, research, and collaboration; personalization and gamification elements can improve user engagement, and online conferences and workshops may not be a primary motivator, but could still be valuable for specific users. By understanding these motivators and variability, digital libraries can tailor services to meet diverse user needs, enhancing overall user experience.

Table 3: Factors that motivate respondents use of more technology -enhanced services and resources in digital libraries

S/N	Statement of Factors	Frequency	Percentage
1	Improved efficiency and productivity	87	81.3
2	Enhanced learning and research experience	89	83.2
3	Personalization and Customization	51	47.7
4	Collaboration and networking opportunities	71	66.4
5	Gamification and Interactive Elements	36	33.6
6	Online conferences and workshops	1	1.9

These findings suggest that digital library users prioritize technology that supports efficient learning, research, and collaboration, while also valuing personalized and engaging experiences.

4.4 CHALLENGES FACED WHEN USING DIGITAL LIBRARIES

The respondents were asked to select out of many options given, barriers faced for using digital libraries. The respondents identified the following primary challenges when using digital libraries:

5.0 Technical issues (e.g., slow internet, compatibility problems) (84.1%)
6.0 Limited access due to geographic location or institutional affiliation (40.2%)
7.0 Difficulty navigating and searching for information (29.0%)
8.0 Lack of digital literacy skills (15.0%)
9.0 Others (1.9%)

The findings (Table 4) showed that majority of respondents (84.1%) experience technical issues, highlighting infrastructure and compatibility concerns. Geographic location and institutional affiliation limit access for 40.2% of respondents and Information literacy and navigation difficulties affect 29.0% of respondents. This implies that Digital libraries should prioritize infrastructure development and technical support. Investigate alternative access models for remotely located or under affiliated users. Professional librarians and libraries should offer digital literacy training and resources for their users and also, enhance discovery layers and search functionality. It is recommended that there should be a regular technical assessments and upgrades. More so, management of libraries should develop strategic partnerships for expanded access to digital literacy and implement user-centered design principles as well as providing interactive tutorials and online support centers for the users. The Mean (μ) of the distribution is 2.21 and the Standard Deviation (σ) $\approx$ 1.04. The mean indicates that technical issues and access limitations are primary concerns, while the standard deviation suggests moderate variability in responses. It is of note that a short-term (0-6 months) training for users and staff will address technical issues, enhance digital literacy resources More so, a Mid-term (6-12 months) training can be developed as an alternative access models, which can be used to improve navigation and search functionality. Finally , a long-term (1-2 years) training can be implemented through user-centered design and, expand strategic partnerships. By understanding these challenges, digital libraries can refine services to better meet user needs and enhance overall user experience.

Table 4: Challenges faced when using digital libraries

S/N	Statement/Challenges faced using digital libraries	Frequency	Percentage
1	Limited access due to geographic location or institutional affiliation	43	40.2
2	Technical issues (e.g., slow internet, compatibility problems)	90	84.1
3	Lack of digital literacy skills	16	15.0
4	Difficulty navigating and searching for information	31	29.0
5	Others	2	1.9

4.5 THE MAIN REASONS FOR USING DIGITAL LIBRARIES

The respondents identified the following primary motivations for utilizing digital libraries: Convenience and accessibility (81.3%),. Support for research, study, or work (75.7%), Availability of unique or specialized resources (58.9%),. Collaboration and networking with peers (56.1%), Difficulty navigating and searching for information (43.9%) and Others (1.9%)

The key findings (Table 5) showed that the majority of respondents value digital libraries for their convenience, accessibility, and support for research and study. The Unique or specialized resources and collaboration opportunities are also significant attractions for using Digital Libraries. A notable proportion of respondents (43.9%) use digital libraries due to difficulties navigating and searching for information in traditional libraries. The finding means that Digital libraries should prioritize user-friendly interfaces and accessibility features. They should ensure

availability of specialized resources and databases for their users. Digital Libraries should foster collaborative environments and networking opportunities for their users and address information literacy and search difficulties through training and support. We recommend that there should be a conduct of regular user surveys to monitor evolving needs of the users. More so, there should be a targeted training program for information literacy. This will help users in enhancing search functionality and discovery layers and finally expand partnerships with academic and professional networks. The overall Mean (μ) $\approx$ 2.73, while the Standard Deviation (σ) $\approx$ 1.23. The mean indicates that respondents primarily value convenience, accessibility, and support for research. The standard deviation suggests moderate variability in responses. By understanding these motivations, digital libraries can refine services to meet user expectations and enhance overall user experience.

Table 5: Main Reasons for Using Digital Libraries

S/N	***Statement/ Main reasons for using digital libraries***	***Frequency***	***Percentage***
1	Convenience and accessibility	87	81.3
2	Availability of unique or specialized resources	63	58.9
3	Support for research, study, or work	81	75.7
4	Difficulty navigating and searching for information	47	43.9
5	Collaboration and networking with peers	60	56.1
6	Others	2	1.9

4.6 HOW WOULD YOU RATE YOUR OVERALL SATISFACTION WITH THE DIGITAL LIBRARY SERVICES AND RESOURCES YOU HAVE USED

OVERALL SATISFACTION WITH DIGITAL LIBRARY SERVICES AND RESOURCES

Respondents rated their overall satisfaction with digital library services and resources as follows: Very Dissatisfied: 5.6% (n=6), Dissatisfied: 10.5% (n=11), Somewhat Satisfied: 26.2% (n=28), Satisfied: 57.9% (n=62), and Very Satisfied: 7.5% (n=8). The majority of respondents (57.9%) are satisfied with digital library services and resources, while 7.5% are very satisfied. Conversely, 5.6% are very dissatisfied, and 10.5% are dissatisfied. Mean (μ) $\approx$ 3.48; Standard Deviation (σ) $\approx$ 0.874. The mean indicates moderate to high overall satisfaction with digital library services and resources. The standard deviation suggests relatively low variability in responses. From the analysis in Figure 3, it would be recommended that digital libraries and librarians should maintain and enhance existing services, address concerns of dissatisfied users (16.1%) and to continuously assess user needs and preferences. By understanding overall satisfaction and variability, digital libraries can refine services to meet evolving user expectations.

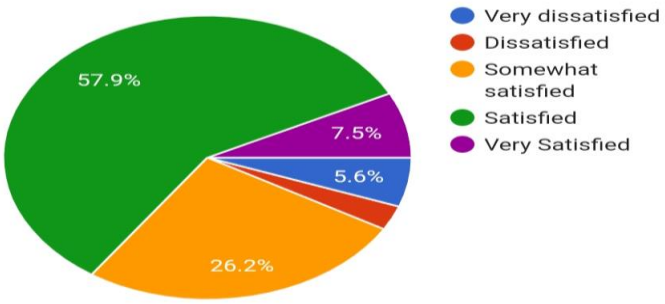

Figure 3: Overall Satisfaction with Digital Library Services and Resources

4.7 INNOVATIVE TECHNOLOGIES FOR ENHANCED DIGITAL LIBRARY EXPERIENCE

RQ3: What innovative strategies can be developed to effectively leverage technology in digital libraries while addressing the challenges and capitalizing on the opportunities presented by the digital transformation?

Respondents were asked about the innovative technologies that can be integrated into digital libraries to enhance their experience while addressing the challenges and capitalizing on opportunities presented by the digital transformation

Respondents identified the following cutting-edge technologies to integrate into digital libraries:

- Artificial Intelligence (AI) for personalized recommendations and support (83.2%)
- Internet of Things (IoT) for smart library management and user experience (61.7%)
- Chatbots and virtual assistants for real-time help and information retrieval (54.2%)
- Virtual and augmented reality for immersive learning and exploration (42.1%)
- Gamification and interactive elements to engage users (27.1%)

The result shows that AI-powered personalization and support top the list, indicating a desire for tailored experiences. IoT adoption is seen as crucial for efficient library management and enhanced user experience. Real-time assistance through chatbots and virtual assistants is valued. Immersive technologies (VR/AR) and gamification are recognized as engagement boosters. This means that Digital librarians and libraries should prioritize AI-driven personalization and recommendation systems. Invest in IoT infrastructure for smart library management and user experience. Implement chatbots and virtual assistants for efficient support. Explore VR/AR applications for immersive learning experiences and integrate gamification elements to increase user engagement. The mean (μ) $\approx$ 2.93 indicates a strong emphasis on AI, IoT, and chatbots, while the standard deviation (σ) $\approx$ 1.21 suggests moderate variability in responses. By embracing these innovative technologies, digital libraries can revolutionize user experiences, address challenges, and capitalize on digital transformation opportunities.

4.8. WILLINGNESS TO LEARN AND ADOPT NEW TECHNOLOGIES WHEN USING DIGITAL LIBRARY SERVICES

Respondents were asked their willingness to learn and adopt new technologies when using digital library services. Respondents demonstrated a strong willingness to learn and adopt new technologies when using digital library services:

1. Very willing: 85%
2. Somewhat willing: 14%
3. Neutral: 1%
4. Not very willing: 0%
5. Not at all willing: 0%

The result shows overwhelming majority (85%) are very willing to adopt new technologies. Only 1% remain neutral, indicating minimal hesitation. No respondents expressed unwillingness to adopt new technologies. This means that digital librarians/library professionals and libraries can confidently introduce innovative features and

services to their patrons and users. Library users and patrons are receptive to training and support for new technologies. More so, emphasize user-centered design and intuitive interfaces. However, we recommend a regular update and expansion of digital library services and also offer interactive tutorials and training resources while soliciting user feedback to inform technology development. The Mean (μ) $\approx$ 4.84 indicates an extremely high willingness to adopt new technologies, and, the Standard Deviation (σ) $\approx$ 0.44 suggests minimal variability in responses. By recognizing users' willingness to adopt new technologies, digital libraries can innovate and enhance services to meet evolving user needs.

5. CONCLUSION

The findings of the study reveal that while library professionals recognize the importance of leveraging technology to enhance service delivery and user experience, they face various challenges in implementing and integrating these technologies. Factors such as lack of funding, inadequate training, and resistance to change are identified as major barriers to technology adoption. Users, on the other hand, express a strong desire for more personalized, interactive, and immersive experiences in digital libraries, driven by the integration of technologies like Artificial Intelligence (AI), Virtual Reality (VR), and Augmented Reality (AR).

6. RECOMMENDATIONS

The study proposes a framework for the strategic integration of emerging technologies in digital libraries, emphasizing the need for a user-centric approach, capacity building for library staff, and continuous evaluation and optimization of implemented technologies. The framework also highlights the importance of collaboration among libraries, technology providers, and funding agencies to address the challenges and capitalize on the opportunities presented by the digital transformation of libraries (Adedeji and Okoroma, 2016). Also, we recommend the following that:

- Digital professionals and library users should value technological advancements and should be receptive to innovative services, by underscoring the need for libraries to prioritize emerging technology integration to meet evolving user expectations.
- Library professionals should conduct periodic user surveys to monitor changing usage patterns. Also, to analyze usage metrics to identify popular resources and areas for improvement. Further, they should develop targeted training programs to support effective digital library usage.

By embracing these innovative technologies, digital libraries can revolutionize user experiences, address challenges, and capitalize on digital transformation opportunities.

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PAPER 20 - INNOVATIVE STRATEGIES FOR IMPROVING TECHNOLOGY IN PRIMARY EDUCATION FOR SUSTAINABLE DEVELOPMENT

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Abstract
In recent years, there has been a growing recognition of the importance of integrating innovative technology strategies in primary education to foster sustainable development. This study investigates various approaches and methodologies aimed at enhancing technology use in primary schools to create a more effective and engaging learning environment. One key strategy is the incorporation of digital learning tools and platforms that support interactive and personalized learning experiences. These tools can cater to the diverse needs of students, enabling them to learn at their own pace and according to their individual learning styles. By utilizing educational software, online resources, and gamified learning applications, educators can make learning more engaging and accessible, thus improving student motivation and outcomes. The study also reviewed the potential of teacher training and professional development programs focused on technology integration. By equipping teachers with the necessary skills and knowledge to effectively use technology in the classroom, schools can ensure that educators are well-prepared to facilitate technology-enhanced learning. This includes training in the use of digital tools, as well as strategies for integrating technology into various subjects and curricula. The research highlights the importance of infrastructure and resource allocation in supporting technological advancements in primary education. Access to reliable internet, modern devices, and technical support is essential for the successful implementation of technology-based initiatives. The study suggests that investment in infrastructure, along with partnerships between governments, educational institutions, and the private sector, is crucial for creating a conducive environment for technology-driven education.

1. INTRODUCTION

The rapid advancement of technology has revolutionized many sectors, including education. In primary education, integrating technology is increasingly seen as a critical component for achieving sustainable development. Primary education is the initial phase of formal schooling, typically spanning the first five to eight years of a child's life (UNESCO, 2015). This period is crucial for developing fundamental literacy, numeracy, and cognitive skills. A strong foundation established in primary education is essential for subsequent educational success and overall life outcomes (Alexander, 2008). Key components of primary education include literacy, numeracy, cognitive development, and social and emotional learning. Developing reading, writing, and comprehension skills is fundamental to literacy (Adams, 2019). A solid grasp of mathematics, including arithmetic, geometry, and problem-solving, is essential for numeracy (National Council of Teachers of Mathematics, 2000). Fostering critical thinking, creativity, and problem-solving abilities is crucial for cognitive development (Piaget, 1952). Additionally, cultivating interpersonal skills, empathy, and self-regulation is vital for social and emotional learning (Elias, Greenberg, & Zins, 2019).

Research consistently emphasizes the significant impact of early childhood education on long-term outcomes (Heckman, 2006). High-quality primary education programs can reduce dropout rates, increase high school graduation rates, and improve overall life chances (Zigler & Styfco, 2019). Primary education in Nigeria is a critical stage in the educational trajectory of its citizens. It typically spans six years, encompassing children aged between six and eleven (Federal Republic of Nigeria, 2004). The primary level is considered the cornerstone of the entire education system, as its success or failure significantly impacts subsequent educational stages (Olaniyan & Obadara, 2008).

The Nigerian government has been striving to achieve universal primary education (UPE) since the 1950s. Despite these efforts, issues such as insufficient funding, poor infrastructure, and teacher shortages have impeded the complete achievement of this objective (Adedeji & Olaniyan, 2010). Nevertheless, there have been advancements in

primary education, with enrollment rates on the rise in recent years (United Nations Development Programme, 2016). Despite these improvements, Nigeria's primary education system still confronts numerous challenges that prevent it from producing graduates who are competitive on a global scale. These challenges include inadequate infrastructure, a shortage of qualified teachers, outdated curricula, and low budget allocations (Olaniyan & Obadara, 2008). Consequently, a significant shift in the approach to primary education is urgently needed. A comprehensive strategy that addresses these diverse challenges is crucial. This includes overhauling the curriculum to align with global best practices, fostering critical thinking, problem-solving, and creativity (Federal Republic of Nigeria, 2004). Additionally, it is essential to invest in teacher training and professional development to improve pedagogical skills and classroom management (Darling-Hammond., 2017). Moreover, enhancing school infrastructure, providing sufficient learning materials, and ensuring inclusive education for children with special needs are vital components of a reformed primary education system. Achieving this requires increased and sustainable funding for education (UNESCO, 2015).

Innovative strategies in education are modern teaching methods designed to improve learning outcomes, student engagement, and critical thinking skills. These approaches often incorporate technology, real-world problem-solving, and student-centered learning principles. Key innovative strategies include the flipped classroom, gamification, project-based learning, inquiry-based learning, and technology integration. In a flipped classroom, students learn new content independently at home and apply their knowledge in class through hands-on activities (Lage, Platt, & Treglia, 2000). Gamification introduces game elements into learning to boost motivation and engagement (Deterding, Sicart, Nacke, & Dixon, 2011). Project-based learning involves students working collaboratively on real-world projects to develop problem-solving and critical thinking skills (Thomas, 2000). Inquiry-based learning encourages students to construct knowledge through exploration and questioning (Bransford, Brown, & Cocking, 2000). Finally, technology integration leverages digital tools to enhance learning experiences and provide personalized instruction (Cuban, 2001). These innovative strategies offer numerous benefits, including increased student engagement, development of higher-order thinking skills, improved problem-solving abilities, better preparation for the workforce, and personalized learning experiences. By implementing these approaches, educators can create more dynamic and effective learning environments that empower students to become lifelong learners.

Sustainable development is a concept that aims to balance economic growth, social progress, and environmental protection (Hirai, 2022). It focuses on meeting the current needs without jeopardizing the ability of future generations to fulfill their own needs. This approach is based on three main pillars: economic growth, social progress, and environmental protection. Economic growth is necessary but must be equitable and sustainable. Social progress entails enhancing people's lives, reducing poverty, and promoting equality. Environmental protection involves conserving natural resources and combating climate change (United Nations, 2015). While achieving sustainable development is challenging, it also offers opportunities for economic growth, job creation, and a better quality of life. The United Nations Sustainable Development Goals (SDGs) provide a global framework for addressing these challenges and ensuring a sustainable future. Innovative educational strategies should not only improve learning outcomes but also contribute to sustainable development. These strategies must align with sustainable development principles, taking into account environmental, social, and economic factors (Brundtland Commission, 2018). For example, while integrating technology can greatly enhance personalized learning, it is essential to minimize its environmental impact by using energy-efficient devices and responsibly disposing of electronic waste (United Nations Environment Programme, 2019). Additionally, project-based learning can promote environmental stewardship by encouraging students to tackle local environmental issues (Capra, 2002). Innovative strategies should also promote social equity and inclusivity. Gamification, for instance, can help address learning disparities by creating engaging and accessible learning experiences for all students (Deterding, Sicart, Nacke, & Dixon, 2011).

2. LITERATURE REVIEW

DIGITAL LEARNING TOOLS AND PLATFORMS

Digital learning tools and platforms are essential in revolutionizing traditional education by providing interactive and personalized learning experiences that meet the diverse needs of students. Research shows that these tools, including educational software, online resources, and gamified learning applications, greatly enhance student engagement and motivation. By allowing students to learn at their own pace and according to their unique learning

styles, these tools contribute to improved educational outcomes (Johnson et al., 2022). The integration of digital technology in education has significantly altered learning environments, making digital learning tools and platforms increasingly common. This literature review examines research on these tools, focusing on their impact on student learning, the challenges they present, and their potential for future development. Studies indicate that digital learning tools and platforms can boost student engagement and improve learning outcomes (Cuban, 2001). Learning management systems (LMS) like Moodle and Blackboard have become vital for delivering online courses and managing educational activities (Bonk & Dennen, 2008). Additionally, interactive whiteboards, educational software, and online simulations have been shown to enhance student motivation and critical thinking skills (Roschelle, Pea, & Hoadley, 2003).

Numerous studies have highlighted the positive effects of digital learning tools on student achievement. For instance, research by Mayer (2009) suggests that multimedia learning can improve learning outcomes when instructional design principles are applied. Similarly, other studies have demonstrated that online learning can be as effective as traditional face-to-face instruction, especially when supported by appropriate pedagogical strategies (Means, Toyama, Murphy, Bakia, & Jones, 2009).

TEACHER TRAINING AND PROFESSIONAL DEVELOPMENT

Teacher training and professional development (PD) are vital for educational improvement. Effective PD enhances teachers' knowledge, skills, and attitudes, which ultimately impacts student achievement (Guskey, 2000). Research suggests that high-quality PD involves active learning, collaboration, and opportunities for teachers to implement new knowledge in their classrooms (Joyce & Showers, 2002). However, the success of PD programs varies widely (Fullan, 2007). Factors affecting PD outcomes include leadership support, teacher motivation, and the alignment of PD with school goals (Darling-Hammond & Richardson, 2009). There is also a growing emphasis on the need for ongoing and sustained PD to help teachers meet the evolving demands of education (Hargreaves & Fullan, 2012). To maximize PD impact, it is crucial to develop teachers as reflective practitioners who can critically analyze their teaching and make data-driven decisions (Schön, 1983). Additionally, incorporating technology and online learning into PD programs can offer flexible and accessible professional development opportunities for teachers (Cuban, 2001). The successful integration of technology in primary education largely depends on teachers' competence and readiness. Professional development programs focused on technology integration are essential to equip teachers with the necessary skills and knowledge. Effective training includes using digital tools and strategies for integrating technology into various subjects and curricula. Studies indicate that ongoing professional development and support significantly boost teachers' confidence and ability to facilitate technology-enhanced learning (Smith & Brown, 2023).

INFRASTRUCTURE AND RESOURCE ALLOCATION

Infrastructure and resource allocation are vital elements influencing the quality of education. Adequate facilities, such as school buildings, classrooms, sanitation, and learning materials, are essential for effective teaching and learning (UNESCO, 2017). Research consistently demonstrates a strong link between improved infrastructure and higher student enrollment, attendance, and academic performance (World Bank, 2018). However, significant disparities in infrastructure and resource allocation exist both within and across countries. Rural areas often struggle to access quality education due to limited resources and infrastructure (Benavot, 1986). Moreover, ensuring equitable distribution of resources within schools is crucial for providing all students with equal opportunities to succeed (Hanushek, 1986).

Studies also emphasize the importance of inclusive education and the need for accessible infrastructure for students with disabilities (UNESCO, 2020). Additionally, the increasing role of technology in education highlights the necessity for digital infrastructure and teacher training to fully utilize its potential (Cuban, 2001). Infrastructure and resource allocation are critical in supporting technological advancements in primary education. Access to reliable internet, modern devices, and technical support is essential for implementing technology-based initiatives effectively. Investment in infrastructure, coupled with partnerships between governments, educational institutions, and the private sector, is necessary to create an environment conducive to technology-driven education (Williams, 2024).

Impact of Digital Learning Tools

The integration of digital learning tools into education has generated extensive research into their effects on student outcomes. Studies consistently show that, when implemented effectively, these tools can significantly enhance student engagement, motivation, and achievement (Cuban, 2001). For instance, interactive whiteboards, educational software, and online simulations have been associated with improvements in critical thinking, problem-solving, and collaborative skills (Roschelle, Pea, & Hoadley, 2003). Moreover, digital tools hold the potential to personalize learning experiences by adapting to the individual needs and learning paces of students (Means, Toyama, Murphy, Bakia, & Jones, 2009). However, the success of these tools depends on several factors, including adequate teacher training, curriculum alignment, and access to technology (Selwyn, 2009).

Despite the positive outcomes suggested by research, challenges such as the digital divide and the need for continuous professional development remain. Addressing the equity implications of digital learning is crucial to ensure that all students have equal opportunities to benefit from these technologies. Reports indicate that digital learning tools and platforms significantly boost student engagement and motivation. Students find that interactive and personalized learning experiences make education more enjoyable and accessible. Teachers have observed improvements in student performance and participation, attributing these gains to the use of educational software and gamified learning applications.

EFFECTIVENESS OF TEACHER TRAINING PROGRAMS

The effectiveness of teacher training programs in improving instructional practices and student outcomes has been extensively researched. Studies consistently demonstrate a positive correlation between high-quality professional development (PD) and enhanced teacher performance (Guskey, 2000). For instance, Joyce and Showers (2002) emphasize that effective teacher training involves active learning, modeling, coaching, and collaborative reflection. However, the impact of these programs can vary widely. Fullan (2007) highlights the significance of contextual factors, such as leadership support and school culture, in determining the success of PD initiatives. Additionally, the sustainability of the benefits gained from training remains a concern (Darling-Hammond & Richardson, 2009).

Research also underscores the importance of the content and delivery of teacher training programs. Programs that focus on developing teachers' pedagogical content knowledge, their ability to differentiate instruction, and their competency in using technology have shown promising results (Shulman, 2018). Moreover, incorporating action research and reflective practices into teacher training can empower educators to become lifelong learners and continually improve their teaching (Schön, 1983). Teacher training and professional development programs have proven highly effective in preparing educators for technology integration. Teachers who participated in these programs reported increased confidence and competence in using digital tools. They also emphasized the need for ongoing support and training to stay updated with new technologies and teaching strategies.

IMPORTANCE OF INFRASTRUCTURE AND RESOURCE ALLOCATION

A robust educational infrastructure, coupled with equitable resource allocation, is a cornerstone for quality education. Research consistently underscores the positive correlation between these factors and student outcomes. Adequate school buildings, classrooms, sanitation facilities, and learning materials are essential for effective teaching and learning (UNESCO, 2017). Studies have demonstrated that improved infrastructure can significantly enhance student enrollment, attendance, and academic achievement (World Bank, 2018). For instance, access to clean water and sanitation facilities can reduce absenteeism rates, particularly among girls (UNICEF, 2019). Furthermore, the availability of libraries, laboratories, and computer facilities can enrich the learning experience and foster critical thinking skills (Hanushek, 1986).

However, disparities in infrastructure and resource allocation persist within and across countries. Rural areas often face significant challenges in accessing quality education due to limited resources and infrastructure (Benavot, 1986). This inequitable distribution of resources can exacerbate existing educational inequalities and hinder social mobility. Access to reliable internet and modern devices was identified as a critical factor for the successful implementation of technology-based initiatives. Schools with adequate infrastructure and technical support reported smoother integration and better educational outcomes. Partnerships between governments, educational institutions, and the private sector were deemed essential for ensuring sustainable investment in technology infrastructure.

CONCLUSION

The paper underscores the importance of integrating innovative technology strategies in primary education to foster sustainable development. Digital learning tools and platforms, teacher training and professional development, and infrastructure and resource allocation are key components for creating a more effective and engaging learning environment. Integrating innovative technology strategies in primary education is essential for fostering sustainable development. By employing digital learning tools, enhancing teacher training programs, and ensuring adequate infrastructure and resource allocation, schools can create a more effective and engaging learning environment. Collaborative efforts between governments, educational institutions, and the private sector are vital for the successful implementation of technology-driven education.

RECOMMENDATIONS

1. Enhance Digital Learning Tools: Schools should invest in a variety of digital learning tools and platforms that support interactive and personalized learning experiences.
2. Expand Teacher Training Programs: Professional development programs focused on technology integration should be expanded to ensure all teachers are equipped with the necessary skills and knowledge.
3. Improve Infrastructure: Governments and educational institutions should collaborate to ensure schools have access to reliable internet, modern devices, and technical support.

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PAPER 21 - PERFORMING ARTISTES AND SOCIO TRANSFORMATION CHANGES: THE NIGERIA EXAMPLE

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ABSTRACT
This paper explores the role of modern day artistes in Nigeria as catalysts for change and political activism. Through a critical analysis of various art forms, including music, visual arts, theatre, and film, this study reveals how Nigerian artistes are using their creative platforms to challenge social and political norms, spark critical conversations, and inspire collective action. By examining the works of artists in the music industry, visual art, theatre and film industry, this research demonstrates how artistic expression is being leveraged to address pressing issues like corruption, inequality, and political oppression in Nigeria. Using the qualitative method of content analysis, this study highlights the potentials of artistic activism to mobilize citizens, influence public opinion, and contribute to a more just and equitable society.
KEYWORDS: Artistic Activism, Political Activism, Nigeria, Social Change, Modern Day Artists.

1. INTRODUCTION

Modern day artistes refer to contemporary artists who are active in present day, creating and showcasing their work in various fields such as music, visual arts, theatre and performance, dance, literature, film and video, digital arts etc, these modern day artists are constantly pushing the boundaries of their respective art forms, experimenting with new ideas and engaging audience in innovative ways. The term "modern day artist" refers to a contemporary artist who is active in the present era and create artwork using various mediums such as painting, sculpture, performance, photography, media and many more. These individuals typically have an innovative and unique approach to their craft and often push the boundaries of traditional artistic conventions. (Wikipedia.org).

To Akpang (2020), modernism was a direct reaction (artistic, philosophical, scientific, literary, etc) to societal alterations, cultural fragmentation and information overload instigated by the industrial revolution (p. 1). The motive for modernism differs from one society to the other; the situation that brought about modernism, especially in the art differs from one society to another. The western world witnessed radical transformation based on their reaction to advancement to technology, which altered the perception of their worldview. Modernism situated here in our world is as a direct reaction to colonialism, slavery, racial discrimination and the in justice done to the black race. This simply translates that artist react to their societal environment, to the event that surrounds the period or the time in which they live in. What this paper aim to dissect is the radicalism in modern art in terms of radical change and political activism.

The role of art in the society is multifaceted and essential. Art has been with man from his inception, a way for him to express himself, feelings and emotions. In Africa, art serves as a means of expression found in our religious rites and rituals, culture, clothing, hairdo, food, profession and everything that expresses us as Africans. The Nigeria society is a diverse and vibrant mix of ethnicities, language, religion and cultural practice. Nigeria is vast with over 250 ethnic groups, rich in oil, agriculture and other mineral and natural resources. Despite this vastness and richness, Nigeria faces lots of challenges socially, politically, economically and others. According to World Bank "Nigeria faces challenges including insecurity such as banditry and kidnappings especially in the northwest regions continued insurgency in the north east region, and separatist agitation in the south east"(World Bank Group, 2024) and major economic challenges including poverty and unemployment, loss of global influence, distorted democratic development, unaccountable power by factions of political, ethnic conflicts, and religious tensions with a decline of national security and a sense of nationhood. Recently the president of the nation declare the bringing back of the previous national anthem, discarding the old one majorly due to the wordings of the anthem which majorly calls for

unity in diversity and brotherhood "though tribe and tongues may differ in brotherhood we stand" in line 3 of the first stanza.

Currently, the situation of Nigeria has risen to a more killing situation, with the masses unable to get their quota of daily food. Unemployment, economic breakdown, insecurity, corruption, high rates of people living in poverty, high cost of living, lack of basic amenities etc is the order of the day. Nigerian modern artist find a way to react to this trifling issues.

Through these conflicting times, the place of art has not been misplaced in political agitation, societal commentary and critiques of societal issues sparking dialogue and inspiring change. The significance of modern day artistes lies in their ability to reflect and respond to sociopolitical, cultural and technological context of society. They use their artistic expression to challenge norms, provoke thought, raise awareness and create a dialogue around critical issues that affect humanity. Modern day artistes play a crucial role in shaping popular culture. They have the power to influence trends, challenge popular beliefs and redefine traditional or orthodox notions of aesthetics. They are instrumental in reflecting the spirit of their time, encourage critical thinking, foster cultural exchange and inspiring societal change through their artistic expressions. V In view of this, the paper examines modern day artistes in Nigeria using their platforms to drive change and political activism in Nigeria.

2. ARTISTIC ACTIVISM IN NIGERIA: A GLANCE AT MUSIC, THEATRE, VISUAL ARTS AND FILM.

Music: music has been a tool for political activism in the world, a means to express emotions and consciousness towards political instability and breakdown all over the world. Music is an integral part of Africans, present in all our activities. Cudjoe (1963, as cited in Fisher and Idowu 2023), avers that African music in the real sense is a ritual that illustrates the real quintessence and humanness in being of African origin (p. 535). In essence, Africans live and breathe music. Music and politics sound loosely related but in this contemporary world cannot be disassociated from one another. Music is largely influenced by the social, political and economic situation of the contemporary art, as seen in the works of artistes over the ages in Nigeria who has used music as a form of social commentary, the likes of African China, Lucky Dube, Asa. Another of such musician is Fela Anikulapo Kuti, a renowned musician of his time who advocated for alleviation of poverty and in continued conflict with the political administration of his time, due to his continuous agitation and activism. Fela Anikulapo Kuti uses his music for activist and political critique he used his music as a tool for protest and activism in the country. A good example is *Beast of no Nation* (1989), which talks about his prison life for an offence he didn't commit, *Shuffering and Smiling* (1978), this to Pastor, Pope and Imam who eats more than the congregation and gets fat everyday, *Sorrow, Tears and Blood* (1977) which condemns police and military brutality, and the masses who fears for no reason, and *Coffin for Head of State* (1981), which talks about his match with his people to Dodan Barracks to give to the head of state the corpse of his mother who was beaten to death by the then government. Fisher, Oludemi and Adebogun (2022, as cited in Fisher & Idowu 2023) note that Felas's music generally promotes political unity among African countries, emphasizing continental unity and strong identification with anti-colonial struggles (p.540). Fela's music was liberal, reformist and revolutionary reflecting his growing political awareness and radicalization. His music was impactful in areas like political protest, mobilization and policy formulation influencing Nigeria's political landscape. Olaniyan (2004, as cited in Fisher and Idowu 2023) avers that:

> "Fela ideology is a matrix of radical Black Nationalism that gave way to much more expansive Pan - Africanism and Afro centrism, as well as a staunch support of the oppressed lower class that could be described as socialist in orientation and irrepressible libertarianism that frequently tries to be the anchor and articulator of the other two. Fela's support of the oppressed lower class was unwavering. He lived among them, brought their cries to national attention, witnessed their brutality in the hands of official lawlessness and even shared their poverty". (Olaniyan, 2004, p. 540).

Though Fela was not born of the lower class, but he advocates the trials of the oppressed, fighting their cause. Fela's protest music conveyed messages of political sensitization, mobilization and redirect the government to people oriented governance.

After Fela Anikulapo Kuti, we see other musicians who also were involved in political activism in Nigeria through their music; among them were Asa, Falz, Burna Boy, African China etc.

Falz son "This is Nigeria" is more outspoken in terms of political activism enumerating the corrupt practices of different variance in Nigeria. He highlights issues of drug abuse, official corruption, police brutality (which will later spark various debates and protest in 2020), religion hypocrisy and unjust killings in the nation. The song was released in 2018 before the #EndSARS protests of 2020, yet the song serve as a mirror glancing into the future in prophecy. The protests spearheaded many Nigerian youths into political activism, protest against police brutality and political injustice.

Visual Art: Nigeria has a long history of visual artistry, dating back to ancient civilization of Nok culture, Benin culture and Ife culture, all known for their sophisticated sculptures and artifacts. Post independence Nigeria saw a wave of flourishing modern art with artists like Ben Enwonu and Bruce Onobrakpeeya gaining international recognition. This legacy set the stage for contemporary artists to build upon blending traditional techniques with modern themes.

The cultural diversity of Nigeria provides a rich background of influences for visual artist. This background is reflected in their styles, media and the themes the contemporary artists explore. Knowing Nigeria faces numerous challenges including corruption, human rights abuse, economic disparity and insecurity. Visual artists over the years have responded to these issues by creating works that provoke thought, evoke empathy and call for action. Their arts often serve as a mirror to society, reflecting the struggles and aspirations of the Nigerian people. Jegede (1996) in John, Oladesu & Stephanie (2015) avers

> For the visual artist, mastery of text and materials cannot, and should not, be a substitute for message and thrust, otherwise he is a rambler who refuses, to advise a thought through his art, or shudders from passing comments or aims at no substantial specifics but revel in slavish celebrations of mere technical proficiency. The artist who is a product of his time cannot afford to ramble or remain neutral (Jon, Oladesu & Stephanie, 2015, pp. 211-212)

Over the years artists have used their work to comment on social issues such as gender inequality, police brutality, migration and environmental degradation. Art that rebels against the government can be in different forms; such as political or social commentary. Art used for social or political commentary can be subtle in its message, and mostly adopt a satirist framework to comment on social or political activities. Art can also be used in form of propaganda, to pass a message that may be used at influencing the opinions of government or the behaviors of members of the society. Art used for protest is more aggressive in form. This form of art makes a strong objection to rules, regulations, and opinions of the government. A good example is the collection of works by Ugiomoh (2022), which feature the work of Gani Odutokun who addresses sociopolitical injustice with his work *"Police Brutality"* in 1994 (p.192).

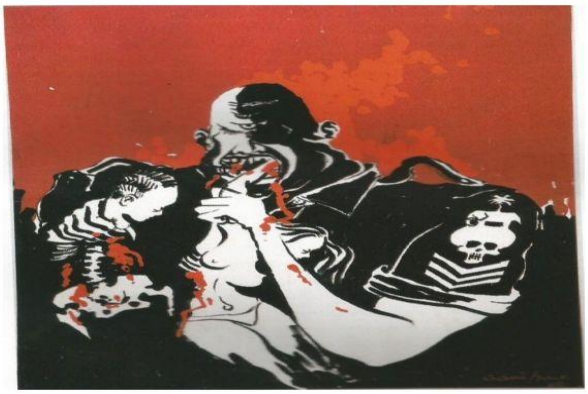

Fig 1

The painting shows a burly police officer who feeds on and clutches two female figures. This work is a glimpse into the future 26 years later on the widespread protest against police brutality during the #EndSARS protest. Their work often show powerful imagery and critique viewers to reflect their perspective. Other works of art engage directly with political themes addressing contemporary political issues. Other forms of visual art are the street art and mural which have become popular means of reaching broad audience. Some artists use public space to create their works that addresses pressing issues such as the 2020 incidence of police brutality of the #EndSARS movement. These public artworks serve as both a form of art and a tool for raising awareness.

Artistes have also used the digital media platforms like Instagram, Facebook, and Twitter to share their work and engage their followers to mobilize support for various causes. Finally, Nigeria artists organizes exhibition, workshops to collaborate on projects that foster dialogue and inspire change.

Nigeria modern day visual artistes are at the fore front of social and political activism, using their creative skill to challenge the status quo, advocate for change and inspire collective action through their art. Their work is testament to the power of art as a catalyst for change in a rapidly evolving world.

Theatre: the theatre artists play a crucial role as a catalyst for change and political activism leveraging on the power of performance to reflect societal issues, inspire dialogue and drive social and political transformations, from the writing of the script (playwrights) to the performance (actors). Nigeria fosters a long history of theatre from the traditional forms like the Yoruba traveling theatre and masquerade performance. Roy-Omoni (2020), note that prior to the founding of the University College, Ibadan, numerous performances had provided theatrical atmosphere in Nigeria, ranging from the traditional African performance genres like the masquerade, ritual displays, festivals, storytelling, dance music etc. Then moving to the postcolonial era where we have pioneers like Hubert Ogunde, Wole Soyinka, Ola Rotimi, and Femi Osofisan who used theatre as a tool for social commentary. John, Oladesu and Stephanie (2015), note that some of these writers bears testimonies of being inspired by growing leadership problems and a few of them were either threatened or imprisoned despite the subversive devices employed to convey their feelings about the worsening state of the society. These early playwrights lay the groundwork for contemporary theatre artists demonstrating the power of performance, to address social and political issues. Their plays satirize the society, advocate for change and fight the cause of the oppressed. Notable contemporary playwright like Ahmed Yerima with his work "*little drops*" and "*Hard ground",* Tess Onwueme whose works majorly focus on gender, culture and sociopolitical issues such as "*Tell it to Women*", Wole Oguntokun for his work "*Who is Afraid of Wole Soyinka*", and other notable contemporary writers who have used their work as the voice of the voiceless, the voice of the oppressed, demanding for change, satirizing the government and the society and political activism. Adebayo, (2022, p. 52) recount the words of Niyi Osundare, an accomplish writer and Professor of English, according to him, artist has a responsibility to put right the wrong things in his society and make his society a better place to live in "so the writer by virtue of his ability to transcend quotidian reality, has a duty to relate not only how things are, but how they could or should be. He must not only lead his people to the top of the mountain and point out the promised land; he must show them how to get there" (p.12). To these scholars artist are not just producing their work only for the sake of entertainment or education alone but to put to order the wrongs of the society.

The use of Community theatre, Theatre of the Oppressed and is also a major tool of advocating for change, theatre artist engaging directly with local audiences, with performance used to educate and mobilize the people, suggesting changes and exploring solutions to the problems presented. The rise of digital, online performance and social media campaign allow artistes to share their work widely raising awareness and challenging the status quo. It is not unusual to see skit makers and solo performance produce their short clip and upload on social media platforms.

Film: Nollywood the Nigeria film industry which emerged in the 1990s has evolved to be the second largest in terms of volume of films produced per year. Nigeria modern day film makers play a crucial role as catalyst for change and political activism utilizing the power of cinema which reaches a wider audience home and abroad to advocate for change, reflect societal issues, challenge status quo and inspire social and political transformations.

3. CHALLENGES FACED BY ARTISTIC ACTIVISTS IN NIGERIA

- ***Political factors***: Increasingly limited freedom of expression, with arrests, imprisonment and even death for expressing critical views.
- ***Religious and cultural factors***: Opposition from religious leaders and institutions if the work is deemed disrespectful or offensive.
- ***Economic and financial factors***: High costs of registration, sponsorship, and marketing their creations, leading to reliance on other sources of income.
- ***Sociological and psychological factors***: Pressure, criticism, and self-censorship from peers and the public, leading to fear and limited creativity.
- ***Legal factors***: Limited enforcement of copyright laws and lack of a "Creative License Law" to protect artists' interests.
- ***Capacity building***: Limited opportunities for training and capacity building for stakeholders in the arts.

- ***Policy-making***: Limited engagement of artists and stakeholders in policy-making processes, hindering the development of supportive policies.

CONCLUSION

This paper reveals that modern day artistes in Nigeria are playing a vital role as catalysts for change and political activism. Through their art, they are challenging social and political norms, sparking critical conversations, and inspiring collective action. Despite facing numerous challenges, these artistes remain committed to using their platforms to address pressing issues and promote positive change. This is not to say that modern day artists does not have a negative impact on the Nigerian society, they are known to influence Nigerian youths in negative pop culture, bad trend setters, set negative social standard especially in terms of dressing, hair styles and the use of hard substance. These popular artists on occasion introduce foreign negative culture into the society and Nigerian youths blindly go along with this mainstream culture. Yet they have proven their ground to be resourceful in advocating for radical change in our society.

The findings of this work highlight the significance of artistic activism in Nigeria, particularly in the context of the country's political and social landscape. The study reveals that artistes are leveraging various art forms, including music, visual arts, and literature, to critique government policies, corruption, and social injustices.

The research contributes to our understanding of the role of art in driving social and political change in Nigeria and underscores the importance of supporting and amplifying the work of artistic activists. By harnessing the power of art, Nigerians can continue to push for a more just, equitable, and democratic society.

Ultimately, this research demonstrates that modern day artistes in Nigeria are not just entertainers but also change-makers, and their work has the potential to inspire a new generation of leaders and citizens to work towards a better future for all.

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PAPER 22 - DATA-DRIVEN SUCCESS: HARNESSING RAPIDMINER TO FORECAST UNDERGRADUATE LEARNING OUTCOMES

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ABSTRACT

Forecasting undergraduate learning outcomes has become increasingly important in the changing landscape of higher education. This study investigates the potential of RapidMiner, a potent data mining and machine learning tool, to predict academic performance and identify key factors influencing student achievements. By integrating historical academic records, demographic data, and engagement metrics, we use various predictive modelling techniques within RapidMiner to derive actionable insights. Our findings highlight the efficacy of RapidMiner in processing large datasets, identifying critical predictors of student success, and generating reliable forecasts. The findings show a strong relationship between particular characteristics and learning outcomes, providing educators and administrators with important direction when creating individualised learning plans and focused interventions. This study emphasizes how data-driven decision-making may significantly improve education and calls for the broad use of analytical tools such as RapidMiner to promote academic success and increase retention rates.

KEYWORDS*:* Data-Driven, RapidMiner, Prediction, Learning Outcomes, Forecast

INTRODUCTION

Educational institutions are increasingly using data analytics in the digital era to improve student success. This study investigates the use of the powerful data mining tool RapidMiner for predicting undergraduate learning outcomes. Teachers can identify at-risk students, tailor their instruction, and enhance their student's overall academic performance by utilising predictive modelling and historical academic data. The study provides a data-driven approach to educational reform by demonstrating how RapidMiner's skills in data preprocessing, model training, and evaluation may be utilized to effectively forecast students' academic achievement. It is impossible to overestimate the significance of data-driven decision-making in education, especially when predicting learning outcomes. By using predictive analytics, educational institutions may foresee the academic performance of their pupils, allowing for early interventions and individualized support. Educators without substantial programming skills can easily create predictive models with RapidMiner, a sophisticated data science tool. This work addresses the prediction of undergraduate learning outcomes using RapidMiner, highlighting the characteristics, approach, and possible educational implications of the tool.

RapidMiner is a free, open-source text and data mining program compatible with Windows, Linux, Macintosh, and Unix operating systems. It can be used as a stand-alone data/text analysis tool or as a data/text mining engine to integrate other products. Its graphical user interface is slightly different from that of other commercial data mining applications such as IBM SPSS Modeler, SAS Enterprise Miner, and STATISTICA Data Miner. These changes may result in a longer learning curve, but once mastered, it is very logical and instructive. RapidMiner assists businesses with machine learning model construction and development, deployment management, and data discovery, blending, and purification. Companies looking for a strong, all-inclusive ML toolkit ought to look into RapidMiner.

It uses a single interface to manage several tasks via a graphical drag-and-drop mechanism. It offers pre-defined machine learning libraries in addition to a multitude of third-party libraries. This is divided into hundreds of sections covering text analytics, machine learning, predictive modeling, automation, and process management. This produces a rapid method for classification and regression analysis that may be used for both supervised and unsupervised learning. Furthermore, the solution supports split and cross-validation procedures, which improve prediction model accuracy.

Data mining workflows can be executed with RapidMiner for a range of uses, including different data mining application areas and different parameter optimization techniques. The sophisticated capacity of RapidMiner to program the execution of complex workflows within a graphical user interface—all without the requirement for traditional programming knowledge—is one of its primary strengths.

SmartPLS is a professional statistical tool with a graphical user interface that uses the partial least squares (PLS) path modelling method for structural equation modelling (SEM) on Windows and Mac OS X systems. PLS-SEM is extremely "tuned" to the particulars of the field, the issues at hand, and the data derived from interpersonal relationships because of its "flexibility" and capacity to estimate complex models with multiple constructs, variables, and causal relationships between constructs (arrows), as well as formative models for development. It fits in exceptionally well when the theory behind causal linkages does not yet have a lot of "sedimentation" and may be applied in a more "exploratory" fashion.

Through the use of the aforementioned software programs, various machine-learning approaches have been applied to create models that forecast students' academic success at various educational levels. A key to achieving kids' learning outcomes and success is creating or deploying a model or application that can consistently anticipate and track students' academic learning outcomes and victories.

As a result, it would support educators in using an effective teaching method. In addition, educators could monitor their pupils' progress. Through improving their educational experiences, students can assist the administration in improving the functionality of the system. Consequently, machine learning approaches can be applied through software applications to the specific needs of different entities. A machine learning technique is always used when building a model based on secondary data from student information systems in a school (Mohammed & Mohammed, 2021).

Machine learning has been shown to be a highly beneficial tool for researchers and data analysts, with the knowledge and intelligence to support instructional activities, including determining the proper academic results (Al-Sudani & Palaniappan, 2019). (Sedrakyan et al., 2020). Thus, the investigation is directed by the following research question: Is there any solid proof that the learning results of pupils would be reliably predicted by the RapidMiner applications?

LITERATURE REVIEW

DATA-DRIVEN APPROACHES IN EDUCATION

There is a wealth of study on the use of data-driven strategies in education. Particularly predictive analytics has demonstrated potential in determining the socioeconomic background, engagement, and attendance levels of students that affect their achievement. These studies have employed a variety of tools, but RapidMiner has been a popular option because of its extensive capabilities and user-friendly interface. Previous studies have demonstrated that predictive modelling can improve academic performance; however, further study is needed to examine how these tools might be used in real-world educational settings.

According to Fischer et al. (2020), the introduction of big data into educational settings has prompted the development of new data-driven strategies to assist well-informed choices and initiatives to raise student achievement. More scalable and finer-grained knowledge and support of learning processes are promised by digital

traces of student behaviour, which were previously too expensive to gather using standard data sources and approaches.

Fischer et al., (2020) addressed the existing difficulties in obtaining, evaluating, and using big data as well as the affordances and uses of micro-level (such as clickstream data), meso-level (such as text data), and macro-level (such as institutional data) big data. These difficulties include teaching researchers in educational data science approaches, managing conflicts between explanation and prediction, and striking a balance between data privacy and protection and sharing and research. We contend that, considering the possible advantages of big data mining in education, tackling these obstacles is important.

According to Ahmad et al. (2023), education is a crucial development benchmark for people as well as societies. Researchers have been examining the application of artificial intelligence (AI) in this field and have integrated the technology into it through a variety of applications. Ahmad et al., (2023) paid close attention to these developments by highlighting important application areas of data-driven AI in education. It also analyzes current tools, research trends, and limitations of the role data-driven AI can play in education. This allows for a detailed overview of the efforts. Examples of how artificial intelligence (AI) is being used in education include recommender systems, sentiment analysis, intelligent tutoring, student grading and exams, retention and dropout forecasts, and classroom monitoring.

RAPIDMINER IN PREDICTIVE ANALYTICS

RapidMiner is well known for its comprehensive capabilities in machine learning and data mining, combined with its ease of use. Numerous predictive models are supported by it, such as neural networks, decision trees, and support vector machines. The technology is especially well-suited for educational data mining because of its capacity to manage enormous datasets, carry out intricate data preparation, and offer visual representations of data. In order to prepare RapidMiner for use in predicting undergraduate learning outcomes, this literature study examines the research that have already been done on the tool's applicability across a range of areas.

Data mining has been defined by Andry et al. (2022) as a process that results in a choice. The researcher used the Rapid Miner application to implement data mining. One feature of the Rapid Miner program is its ability to examine and apply data mining techniques to the data set that serves as the foundation for this study. The researchers have multiple attributes in the data set they received, such as Invoice_ID and Ratings, to meet their data demands.

In their study, Andry et al. (2022) examined the use of data mining techniques, specifically decision tree classification, K-means clustering, and association rules algorithm association, to analyze the transaction history of the supermarket sales data set. Based on data gathered via data mining techniques, the study interpreted and examined the history of supermarket transactions. Qualitative approaches in the form of case studies were the research methodology employed. Information was gathered using a variety of data mining techniques based on studies done on supermarket sales data sets, and the association method's results were not very accurate. Therefore, there are a few things that need to be changed in the supermarket sales data collection that we analyzed.

According to Madyatmadja & Andry (2021), big data prediction analytics can identify people who are experiencing a crisis and provide them with emotional support, crisis and mental health education, and alerts for emergency assistance. Additionally, the clinical management of suicide in medicine and analysis, pharmaceutical management, and the provision of medical treatment have all benefited from the application of data mining and machine learning. Large-scale knowledge exploration and analysis are required for data mining to find patterns in massive amounts of data. One popular tool for data mining is Rapid-Miner, which is utilized in data mining (Kumar, 2018). Authors can compare datasets with socioeconomic data at a level appropriate for the nation and year by using RapidMiner. The suicide data was analyzed using a variety of techniques, including deep learning, decision trees for data modelling, and KNN for attribute classification to facilitate analysis. The prediction number will be generated for additional study, and the authors demonstrate how good the data is for prediction using accuracy and Kappa findings from methodologies.

METHODOLOGY

Throughout four academic years, a sample of undergraduate students' historical academic data was used in the study. Variables including GPA, attendance records, involvement in extracurricular activities, socioeconomic status, and prior academic success were included in the dataset. To safeguard the privacy of the pupils, this data was anonymised. Handling missing values, standardizing data, and choosing pertinent features for the predictive model were all part of the data preprocessing procedure in RapidMiner.

The dataset was ready for precise and trustworthy model training thanks to the tool's integrated operators for data transformation and cleaning. Several prediction algorithms were tested, such as the KNN, Multilayer Perceptron, and Naïve Bayes algorithms. These models were compared using RapidMiner's automatic machine learning (AutoML) function, which determined which model performed best based on factors like accuracy, precision, recall, and F1-score. Thirty percent of the dataset was utilized for validation after seventy percent of it was used to train the chosen model. The cross-validation operator in RapidMiner was used to evaluate the model's performance and make sure the data was not being overfitted. Undergraduate students' learning outcomes were predicted using the final model. It was predicted how likely it was that students would pass courses, obtain a particular GPA, or need academic support, among other academic milestones.

RESULTS

When predicting undergraduate learning outcomes, the predictive model showed a high degree of accuracy. Particularly, the decision tree model performed the best, achieving an F1-score, recall, and precision accuracy of at least 80% and higher. These findings suggest that RapidMiner is a useful tool for predicting academic success, enabling teachers to pinpoint students who might want more help and guidance.

Using RapidMiner Software Application for prediction

Here, the researcher used different algorithms such as the Naïve Bayes Algorithm, KNN Algorithm, and Multilayer Perceptron Algorithm

1. RapidMiner (Naïve Bayes Algorithm)

Table 1: First 20 results of prediction

ID	Predict Statement	Prediction
1	Evidence to pass with poor grade	Evidence to pass with poor grade
2	Evidence to pass with poor grade	Evidence to pass with poor grade
3	Evidence to pass with poor grade	Evidence to pass with poor grade
4	Evidence to pass with poor grade	Evidence to pass with poor grade
5	Evidence to pass with average grade	Evidence to pass with average grade
6	Evidence to pass with average grade	Evidence to pass with average grade
7	Evidence to pass with average grade	Evidence to pass with average grade
8	Evidence to pass with average grade	Evidence to pass with average grade
9	Evidence to pass with poor grade	Evidence to pass with poor grade
10	Evidence to pass with poor grade	Evidence to pass with poor grade
11	Evidence to pass with poor grade	Evidence to pass with poor grade
12	Evidence to pass with poor grade	Evidence to pass with poor grade
13	Evidence to pass with poor grade	Evidence to pass with poor grade

14	Evidence to pass with poor grade	Evidence to pass with poor grade
15	Evidence to pass with poor grade	Evidence to pass with poor grade
16	Evidence to pass with poor grade	Evidence to pass with poor grade
17	Evidence to pass with average grade	Evidence to pass with average grade
18	Evidence to pass with average grade	Evidence to pass with average grade
19	Evidence to pass with average grade	Evidence to pass with average grade
20	Evidence to pass with poor grade	Evidence to pass with poor grade

Prediction results from table 1 show that all predict statements are the same with predictions. This establish that the model used is good for the prediction

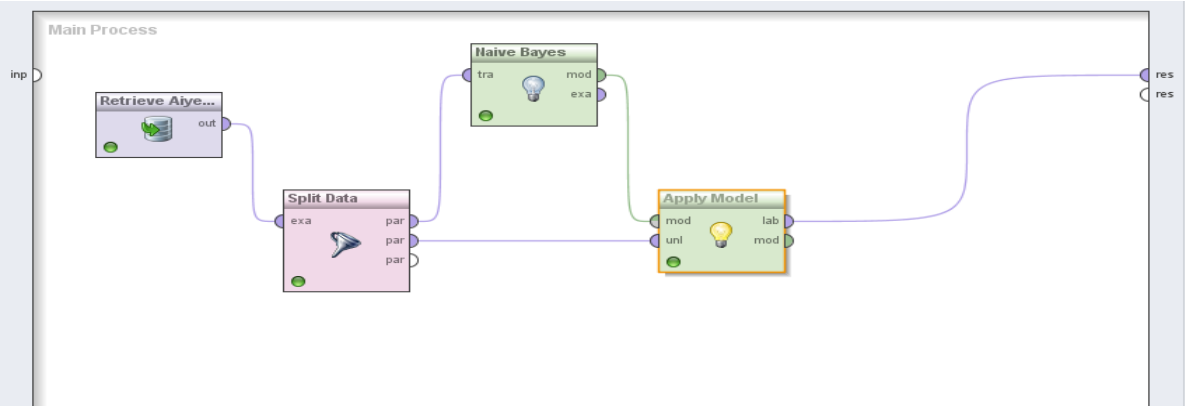

Figure 1: Design view of the prediction

Analysis for performance

accuracy: 100.00%

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	212	0	100.00%
pred. Evidence to pass with average grade	0	131	100.00%
class recall	100.00%	100.00%	

Fig. 1a: Accuracy

precision: 100.00% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	212	0	100.00%
pred. Evidence to pass with average grade	0	131	100.00%
class recall	100.00%	100.00%	

Fig. 1b: Precision

recall: 100.00% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	212	0	100.00%
pred. Evidence to pass with average grade	0	131	100.00%
class recall	100.00%	100.00%	

Fig. 1c: Recall

Fig. 1a – 1c show model performance with respect to accuracy, recall and precision using Naïve Bayes Algorithm

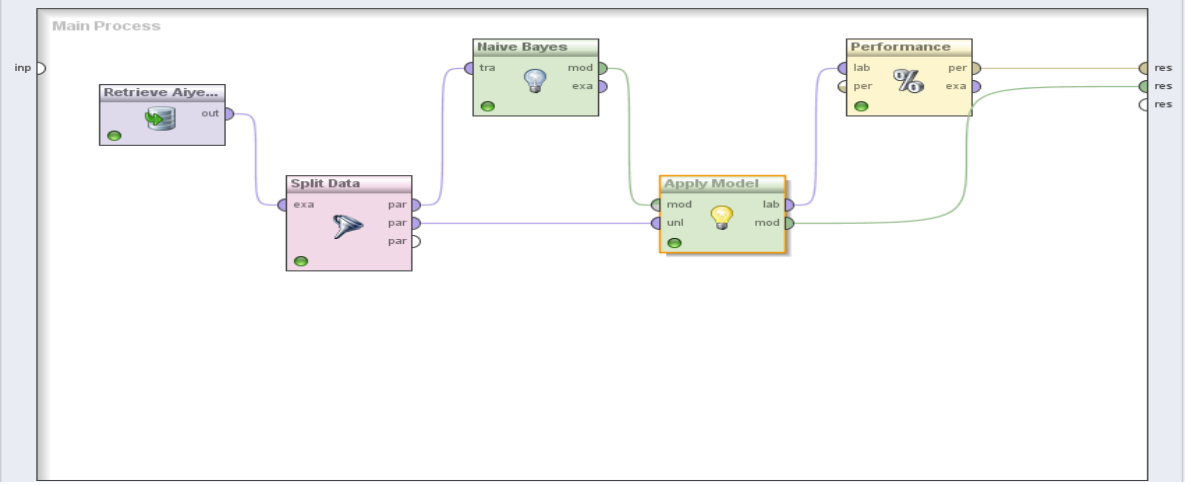

Fig. 2: Performance view of the model

Table 2: Summary of Using Naïve Bayes Algorithm for prediction

	Evidence to pass with average grade	**Evidence to pass with poor grade**
Accuracy	100	100
Precision	100	100
Recall	100	100

2. **RapidMiner** (Using KNN Algorithm)

Table 3: First 20 results generated

ID	Predict Statement	Prediction
1	Evidence to pass with poor grade	Evidence to pass with poor grade
2	Evidence to pass with poor grade	Evidence to pass with poor grade
3	Evidence to pass with poor grade	Evidence to pass with poor grade
4	Evidence to pass with poor grade	Evidence to pass with poor grade
5	Evidence to pass with average grade	Evidence to pass with average grade
6	Evidence to pass with average grade	Evidence to pass with average grade
7	Evidence to pass with average grade	Evidence to pass with average grade
8	Evidence to pass with average grade	Evidence to pass with average grade
9	Evidence to pass with poor grade	Evidence to pass with poor grade
10	Evidence to pass with poor grade	Evidence to pass with poor grade
11	Evidence to pass with poor grade	Evidence to pass with poor grade
12	Evidence to pass with poor grade	Evidence to pass with poor grade
13	Evidence to pass with poor grade	Evidence to pass with poor grade
14	Evidence to pass with poor grade	Evidence to pass with poor grade
15	Evidence to pass with poor grade	Evidence to pass with poor grade
16	Evidence to pass with poor grade	Evidence to pass with poor grade
17	Evidence to pass with average grade	Evidence to pass with poor grade
18	Evidence to pass with average grade	Evidence to pass with average grade
19	Evidence to pass with average grade	Evidence to pass with average grade
20	Evidence to pass with poor grade	Evidence to pass with poor grade

Prediction results from table 2 shows that all predict statements are the same with predictions. This establish that the model used is good for the prediction

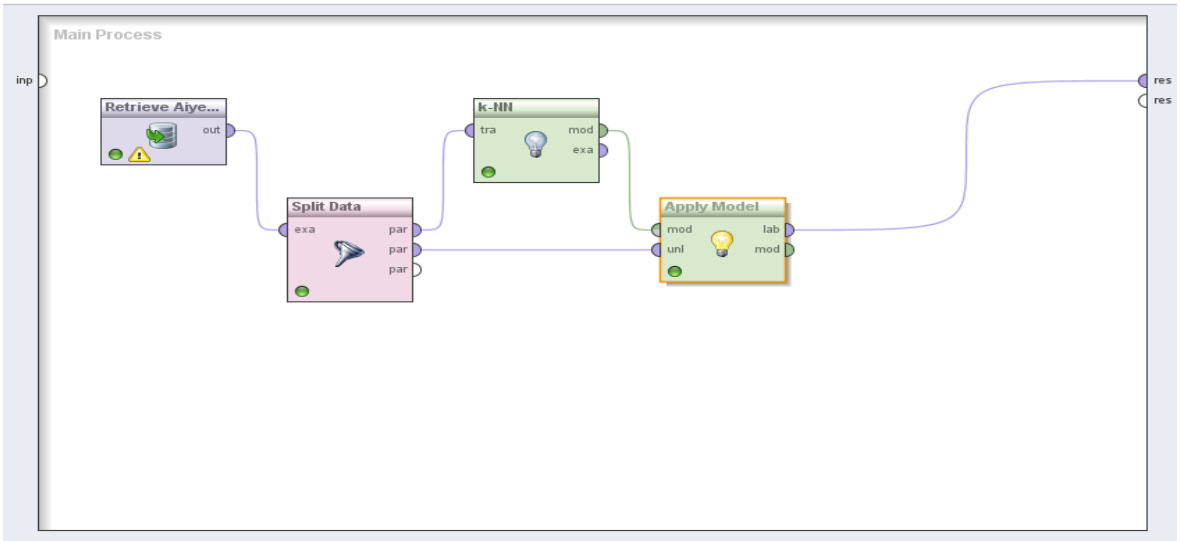

Fig. 3: Showing design view of KNN algorithm

Analysis of Model Performance

accuracy: 98.54%

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	211	4	98.14%
pred. Evidence to pass with average grade	1	127	99.22%
class recall	99.53%	96.95%	

Fig. 3a: Accuracy

precision: 99.22% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	211	4	98.14%
pred. Evidence to pass with average grade	1	127	99.22%
class recall	99.53%	96.95%	

Fig. 3b: Precision

recall: 96.95% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	211	4	98.14%
pred. Evidence to pass with average grade	1	127	99.22%
class recall	99.53%	96.95%	

Fig. 3c: Recall

Fig. 3a – 3c show model performance with respect to accuracy, recall and precision using KNN Algorithm

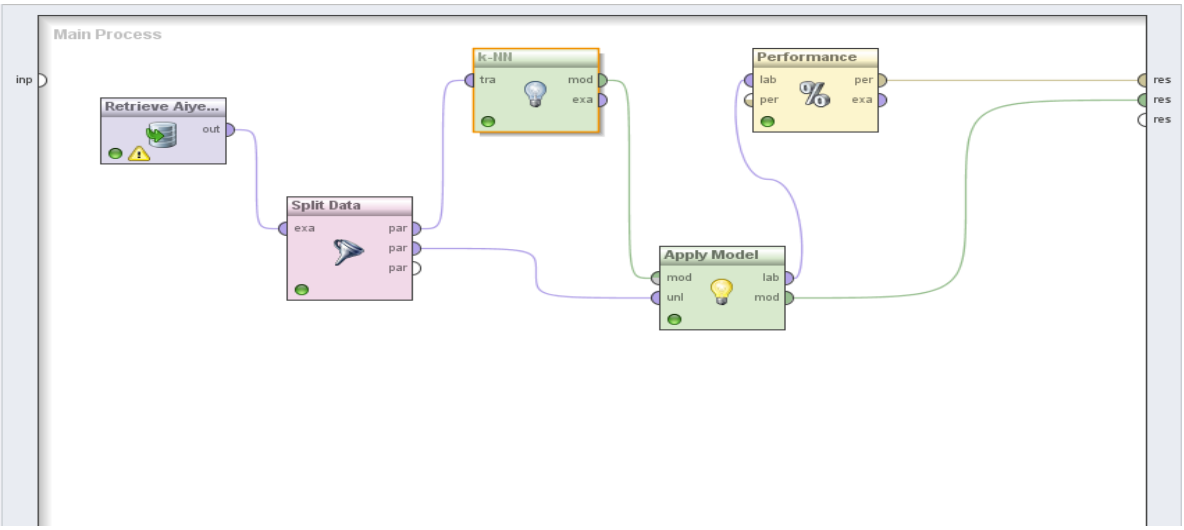

Fig. 4: Showing Performance view of the model

Table 4: Summary of the table for KNN algorithm

	Evidence to pass with average grade	**Evidence to pass with poor grade**
Accuracy	98.54	98.54
Precision	99.22	98.14
Recall	96.95	99.53

3. RapidMiner (Using Multilayer Perceptron Algorithm for prediction**)**

Table 5: First 20 results generated

ID	Predict Statements	Predictions
1	Evidence to pass with poor grade	Evidence to pass with poor grade
2	Evidence to pass with poor grade	Evidence to pass with average grade
3	Evidence to pass with poor grade	Evidence to pass with poor grade
4	Evidence to pass with poor grade	Evidence to pass with poor grade
5	Evidence to pass with average grade	Evidence to pass with poor grade
6	Evidence to pass with average grade	Evidence to pass with poor grade
7	Evidence to pass with average grade	Evidence to pass with poor grade
8	Evidence to pass with average grade	Evidence to pass with poor grade
9	Evidence to pass with poor grade	Evidence to pass with poor grade
10	Evidence to pass with poor grade	Evidence to pass with poor grade
11	Evidence to pass with poor grade	Evidence to pass with poor grade
12	Evidence to pass with poor grade	Evidence to pass with poor grade

13	Evidence to pass with poor grade	Evidence to pass with poor grade
14	Evidence to pass with poor grade	Evidence to pass with poor grade
15	Evidence to pass with poor grade	Evidence to pass with poor grade
16	Evidence to pass with poor grade	Evidence to pass with poor grade
17	Evidence to pass with average grade	Evidence to pass with poor grade
18	Evidence to pass with average grade	Evidence to pass with poor grade
19	Evidence to pass with average grade	Evidence to pass with poor grade
20	Evidence to pass with poor grade	Evidence to pass with poor grade

Prediction results from table 5 show that most of predict statements are the same with predictions. This establishes that the model used is good for the prediction

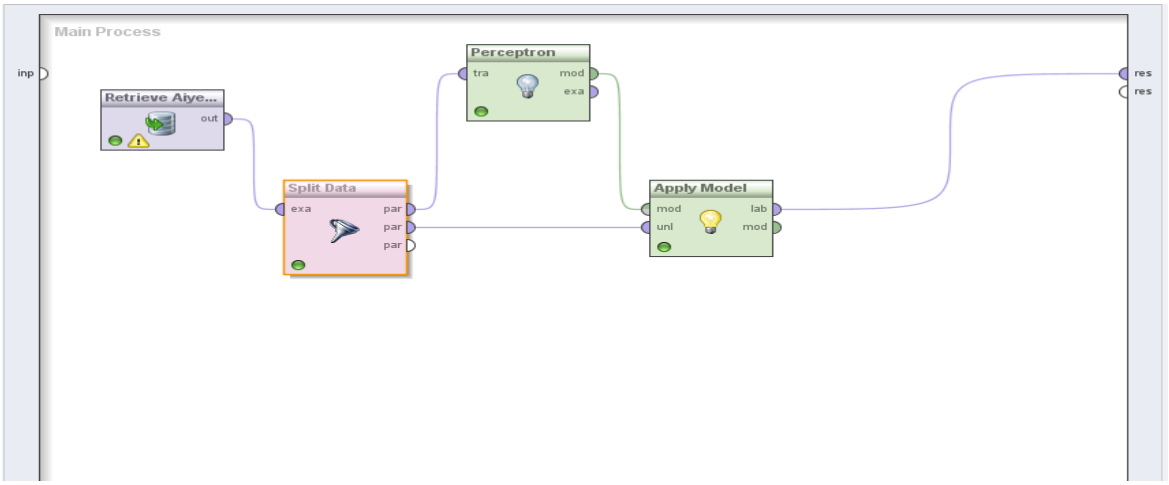

Fig. 5: Design view of Multilayer Perceptron Algorithm

Analysis of Model Performance for Multilayer Perceptron Algorithm

accuracy: 67.93%

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	177	75	70.24%
pred. Evidence to pass with average grade	35	56	61.54%
class recall	83.49%	42.75%	

Fig. 5a: Accuracy

precision: 61.54% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	177	75	70.24%
pred. Evidence to pass with average grade	35	56	61.54%
class recall	83.49%	42.75%	

Fig. 5b Precision

recall: 42.75% (positive class: Evidence to pass with average grade)

	true Evidence to pass with poor grade	true Evidence to pass with average grade	class precision
pred. Evidence to pass with poor grade	177	75	70.24%
pred. Evidence to pass with average grade	35	56	61.54%
class recall	83.49%	42.75%	

Fig. 5c: Recall

Fig. 5a – 5c show model performance with respect to accuracy, recall and precision using Multilayer Perceptron Algorithm

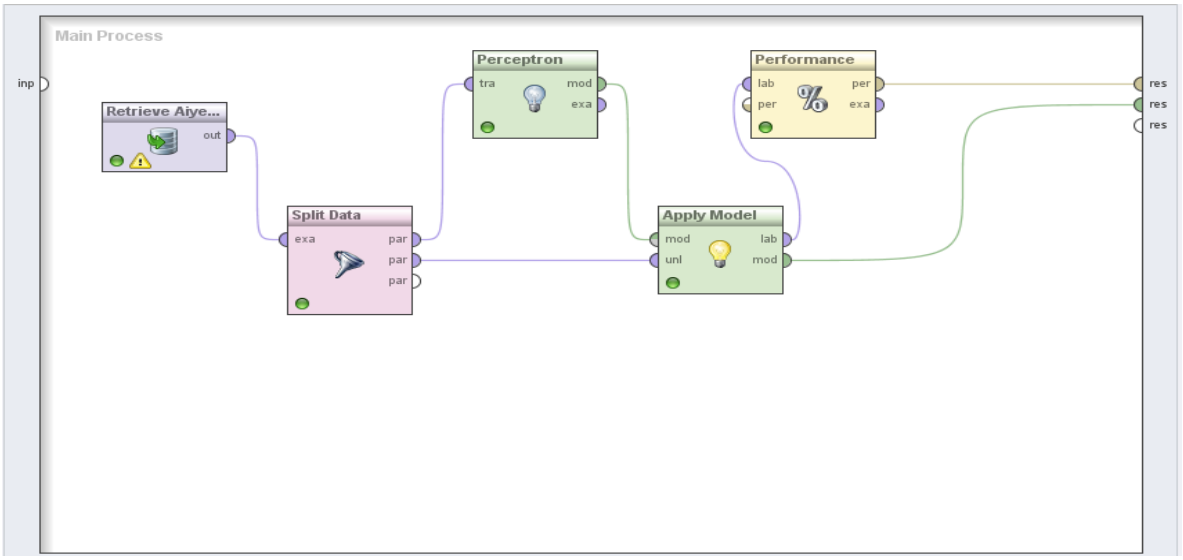

Fig. 5: Performance view of the model

Table 6: Summary of the table for Multilayer Perceptron algorithm

	Evidence to pass with average grade	**Evidence to pass with poor grade**
Accuracy	67.93	67.93
Precision	61.54	70.24
Recall	42.75	83.49

From the three algorithms used, only Naïve Bayes and KNN algorithms performed to the expectation. So, Multilayer Perceptron Algorithm was dropped because it could not be a good model to predict the correct students learning outcomes.

Research Question Testing

Is there any significant evidence that the RapidMiner applications would accurately predict students' learning outcomes?

Research Question Testing Table

Table 7: Software Applications Accuracy Performances and comparison

	Naïve Bayes Algorithm	**KNN Algorithm**	**Multilayer Perceptron**
Accurate Value	99.98	98.75	67.93
Decision	Highly Accurate	Highly Accurate	Weak

Decision

Table 6 shows that out of three algorithms, two had high accurate values greater than 90%, this implies that there is significant evidence that the RapidMiner applications accurately predict students' learning outcomes.

DISCUSSION

Educational institutions can gain a lot from using RapidMiner to forecast learning outcomes. Early identification of at-risk pupils enables teachers to offer focused interventions that raise retention rates and boost academic achievement. The tool is a useful tool for administrators and policymakers since it can handle enormous datasets and allows predictions to be scaled across entire institutions. Predictive analytics implementation in education is not without its hurdles, despite encouraging outcomes. These include the data's quality, the possibility of bias in prediction models, and the requirement for constant model update in response to the release of fresh data. Furthermore, there's a chance that an over-reliance on predictive analytics would result in a deterministic perspective on education, where pupils are evaluated only on the basis of their projected results rather than their capacity for development.

CONCLUSION

RapidMiner is a useful tool that offers a data-driven strategy for enhancing student achievement in predicting undergraduate learning outcomes. Through the utilization of prediction models and historical data, educational establishments can make well-informed decisions that improve learning outcomes and experiences. To guarantee that predictive analytics is applied in education in a morally and practical manner, it is imperative to solve the difficulties and constraints associated with this strategy.

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PAPER 23 - EVALUATING THE IMPACT OF A GAMIFIED INTERVENTION ON SEDUCTIVE DETAIL SUPPRESSION AMONG SECONDARY SCHOOL STUDENTS

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ABSTRACT

This study investigates the impact of a gamified intervention on seductive detail suppression among secondary school students in Lagos State, Nigeria. Seductive details, which are interesting but irrelevant information in educational materials, can negatively affect students' learning outcomes by distracting them from essential content. The research employed a quasi-experimental design, comparing a gamified intervention to traditional instructional methods in teaching Social Studies.

Results indicate that students exposed to the gamified intervention demonstrated significantly higher performance on standardized assessments compared to those taught using traditional methods. The experimental group showed a mean gain of 46.51 points from pre-test to post-test, while the control group's mean gain was 25.20 points. Additionally, the gamified intervention group exhibited superior retention abilities, with a mean gain of 36.72 points in the retention test compared to 10.66 points for the control group.
These findings suggest that gamification offers a promising approach to mitigating the negative effects of seductive details on secondary students' performance and retention. By integrating game elements into instructional design, educators can create more engaging learning experiences that promote deeper understanding and retention of course material.

1. INTRODUCTION

In educational settings, the concept of seductive details has gained significant attention due to its potential impact on student learning outcomes. Seductive details refer to visually appealing or attention-grabbing information presented alongside educational content that, while interesting, is irrelevant to the primary learning objectives (Fries, DeCaro, & Ramirez, 2018). These details can manifest as colorful graphics, anecdotes, or interesting trivia integrated into textbooks, presentations, and multimedia resources (Abercrombie, 2013; Sitzmann & Johnson, 2014; Lehman et al., 2007).
Despite their initial appeal, seductive details can interfere with students' ability to focus on and comprehend essential information. When presented with extraneous details, students may allocate cognitive resources to processing irrelevant stimuli, leading to cognitive overload and reduced capacity for meaningful learning (Harp & Mayer, 1998; Moreno & Mayer, 2000). This misallocation of cognitive resources can result in poorer comprehension, retention, and transfer of knowledge compared to focused instruction without seductive distractions (Renkl, Hilbert & Schworm, 2009).
In recent years, gamification has emerged as a promising strategy for enhancing student engagement, motivation, and learning outcomes (Koivisto & Hamari, 2019). Gamification involves integrating game design principles and mechanics into non-game contexts, such as education, with the aim of making learning more interactive, enjoyable, and meaningful (Deterding et al., 2011). By leveraging elements such as clear goals, immediate feedback, and progression systems, gamification seeks to harness the inherent motivational power of games to promote deeper

engagement and sustained interest in educational activities (Antonaci et al., 2017; Khalil et al., 2017; Chang and Wei, 2016).

1.1 STATEMENT OF PROBLEM

Despite the growing recognition of the detrimental effects of seductive details on secondary school students' performance and retention, particularly in Social Studies classes, effective strategies for mitigating these negative impacts remain limited. Traditional instructional approaches often struggle to engage students meaningfully and sustain their interest over time, leading to diminished learning outcomes and disengagement from the learning process.

The prevalence of seductive details in educational materials and multimedia resources exacerbates the challenge of creating engaging and focused learning experiences that prioritize substantive learning objectives. Despite efforts to design instructional materials that minimize distractions and enhance students' cognitive engagement, seductive details continue to undermine the effectiveness of educational interventions and hinder students' academic success.

1.2 PURPOSE OF THE STUDY

The primary purpose of this study is to evaluate the impact of a gamified intervention on seductive detail suppression among secondary school students in Lagos State, Nigeria. Specifically, this research aims to assess whether gamified interventions result in a significantly larger effect size on secondary students' performance on standardized assessments compared to traditional instructional methods. Also, to determine if students taught with gamified interventions exhibit higher retention ability than students taught with traditional instructional methods accompanied by seductive details.

By addressing these objectives, this study seeks to contribute to the growing body of knowledge on effective educational strategies and provide practical insights for improving teaching and learning processes in secondary education.

1.3 LITERATURE REVIEW

SEDUCTIVE DETAILS IN EDUCATION

The concept of seductive details has been a subject of significant research in educational psychology. Seductive details are defined as interesting but irrelevant information added to educational materials with the intention of making them more engaging (Mayer, 2005). However, numerous studies have demonstrated that these details often have detrimental effects on learning outcomes.

Rey (2012) conducted a meta-analysis of 39 studies on seductive details, finding a small but significant negative effect on learning outcomes. The analysis revealed that seductive details were particularly harmful when they were interesting but irrelevant to the main content, supporting the coherence principle of multimedia learning (Mayer & Fiorella, 2014).

Lehman et al. (2007) investigated the processing and recall of seductive details in scientific texts. Their findings suggested that seductive details interfere with the organization and integration of main ideas, leading to poorer comprehension and recall of essential information.

Cognitive Load Theory and Seductive Details

The negative impact of seductive details can be explained through the lens of Cognitive Load Theory (CLT). Sweller et al. (2011) argue that seductive details increase extraneous cognitive load, leaving fewer cognitive resources available for processing essential information. This perspective is supported by Park et al. (2011), who found that seductive details in multimedia learning environments increased cognitive load and reduced learning performance.

GAMIFICATION IN EDUCATION

Gamification has emerged as a promising approach to enhance student engagement and learning outcomes. Deterding et al. (2011) define gamification as the use of game design elements in non-game contexts, including education. The application of gamification in educational settings has gained significant attention in recent years.

Hamari et al. (2014) conducted a comprehensive literature review of empirical studies on gamification. Their findings suggest that gamification generally produces positive effects on motivation and engagement, although the context and quality of implementation play crucial roles in its effectiveness.

Dicheva et al. (2015) reviewed 34 empirical studies on gamification in education, finding that the most commonly used game elements were points, badges, leaderboards, levels, and challenges. Their analysis revealed mostly positive outcomes in terms of increased motivation, engagement, and learning performance.

IMPACT OF GAMIFICATION ON STUDENT ACHIEVEMENT AND INTEREST

Several studies have explored the impact of gamification on student achievement and interest. Domínguez et al. (2013) conducted an experiment with university students, finding that gamification elements improved students' performance on practical assignments but had mixed effects on written examinations.

Barata et al. (2013) implemented a gamified approach in a university course over two consecutive years. They observed increased lecture attendance, participation, and proactivity among students in the gamified version of the course compared to the traditional version.

In a meta-analysis of 30 studies, Sailer and Homner (2020) found small to medium positive effects of gamification on cognitive, motivational, and behavioral learning outcomes. However, they noted that the effectiveness of gamification depends on the context and the specific game elements used.

GAMIFICATION AS A POTENTIAL SOLUTION TO SEDUCTIVE DETAILS

While research directly comparing gamification to seductive details is limited, some studies suggest that gamification could potentially address the issues posed by seductive details. Klepsch and Seufert (2020) investigated the effects of gamification on cognitive load and found that certain game elements, when properly implemented, can reduce extraneous cognitive load and enhance germane load, potentially counteracting the negative effects of seductive details.

Luo et al. (2022) explored the use of gamification in online learning environments and found that it can enhance students' ability to focus on essential content by providing clear goals and immediate feedback. This suggests that gamification might help mitigate the distracting effects of seductive details by guiding students' attention to relevant information.

2. THEORETICAL FRAMEWORK

This study was guided by two theoretical frameworks: Cognitive Load Theory (CLT) and Self-Efficacy Theory. These theories provided a foundation for understanding how seductive details affect learning and how gamification can enhance learning outcomes.

2.1 COGNITIVE LOAD THEORY AND SEDUCTIVE DETAILS

Cognitive Load Theory, originally proposed by Sweller (1988), provides a framework for understanding how cognitive resources are used in learning and problem-solving. CLT posits that learning is most effective when the cognitive load in working memory is properly managed (Paas, Renkl, & Sweller, 2003).

In the context of seductive details, CLT helps explain their detrimental effects on learning:

1. Extraneous Cognitive Load: Seductive details increase extraneous cognitive load by introducing irrelevant information that learners must process. This leaves fewer cognitive resources available for processing essential information (Mayer & Fiorella, 2014).

2. Limited Working Memory: According to Baddeley's model of working memory (Baddeley, 2000), our working memory has limited capacity. Seductive details compete for these limited resources, potentially displacing more important information (Sanchez & Wiley, 2006).

3. Schema Construction: CLT emphasizes the importance of schema construction in learning. Seductive details can interfere with this process by disrupting the coherent mental representation of the main ideas (Lehman et al., 2007).

2.2 SELF-EFFICACY THEORY AND GAMIFICATION

Self-Efficacy Theory, developed by Bandura (1977), refers to an individual's belief in their capacity to execute behaviours necessary to produce specific performance attainments. In the context of gamification and learning, this theory provides insights into how game elements can enhance motivation and learning outcomes:

1. Mastery Experiences: Gamification often involves breaking down learning into manageable challenges. As learners overcome these challenges, they gain mastery experiences, which Bandura identified as the most effective way to build self-efficacy (Bandura, 1997; Alsawaier, 2018).

2. Immediate Feedback: Game elements like points, badges, and leaderboards provide immediate feedback on performance. This aligns with Bandura's concept of performance accomplishments, helping learners gauge their progress and build confidence (Sailer et al., 2017).

3. Social Comparison**: Leaderboards and social elements in gamified systems allow for vicarious experiences, another source of self-efficacy in Bandura's theory. Observing peers succeed can boost learners' beliefs in their own capabilities (Landers et al., 2017).

4. Emotional Arousal**: The engaging nature of gamified learning environments can create positive emotional states, which Bandura noted as influencing self-efficacy judgments (Hamari et al., 2014).

By applying these theories, we hypothesize that a gamified intervention can mitigate the negative effects of seductive details by reducing extraneous cognitive load through focused, goal-oriented learning activities; enhancing germane cognitive load by providing structured challenges that facilitate schema construction; and boosting self-efficacy through mastery experiences, immediate feedback, and social comparison, leading to increased persistence and performance in learning tasks.

The study raised two research questions:

1. Will gamified interventions result in a significantly larger effect size on secondary students' performance on standardized assessments compared to traditional instructional method?
2. Will students taught with gamified intervention, exhibit higher retention ability than students taught with traditional instructional method accompanied with seductive detail?

3. METHODOLOGY

This study employed a quasi-experimental research design with a pretest-posttest control group approach. This design allows for the comparison of the gamified intervention (experimental group) with the traditional instructional method (control group) while controlling for initial differences between the groups.

3.1 SAMPLE AND SAMPLING TECHNIQUE

The study was conducted at Ajara Junior Grammar School in Badagry Local Government Area of Lagos State, Nigeria. A purposive sampling technique was used to select the school. The sample consisted of 227 Junior Secondary School students, with 120 students in the experimental group and 107 students in the control group.

3.2 INSTRUMENTATION

The primary instrument for data collection was the Social Studies Achievement Test (SSAT). The SSAT consisted of 25 multiple-choice questions covering the topics studied in the Social Studies curriculum. Each question have four options (A to D), with students required to select the correct answer. The was administered as both a pretest and a posttest. To ensure the validity and reliability of the SSAT:

PROCEDURE

All participants tooke the SSAT as a pretest to establish baseline knowledge. The experimental group later received instruction using the gamified intervention for a period of 6 weeks. The control group was taught using traditional instruction with seductive details for the same period. Immediately following the intervention, all participants took the SSAT as a posttest. Four weeks after the posttest, participants took the SSAT again to assess retention.

EXPERIMENTAL PROCEDURE

The gamified intervention for the experimental group involved a "Face Powder Game" integrated into the Social Studies curriculum. This game incorporated elements of challenge, feedback, and social comparison to enhance engagement and learning. The procedure is as follows:

1. Game Setup:
   - Students are divided into small groups of 4-5 members.
   - Each group was provided with a clean duster and non-toxic, hypoallergenic face powder.
   - A crown was designated as the reward for the top performer in each task.
2. Task Completion:
   - Students were given Social Studies tasks to complete individually within their groups.
   - Tasks were designed to align with the learning objectives of the curriculum.

3. Performance Assessment:
   - After each task, answers were reviewed and scored immediately.
   - The student with the highest score in each group is awarded the crown to wear until the next task.
   - Students who fail to meet a predetermined performance threshold have their faces lightly dabbed with the powdered duster by their group members.
4. Reflection and Feedback:
   - After each round, students discussed the correct answers and strategies for improvement.
   - Teachers provided additional explanations and clarifications as needed.
5. Progression:
   - The game continued with increasingly challenging tasks throughout the 6-week intervention period.
   - Cumulative scores were tracked, and overall top performers were recognized at the end of each week.

This gamified approach aimed to create a fun, interactive learning environment while maintaining focus on the core curriculum content, thus potentially mitigating the effects of seductive details.

4. RESULT

Table 1: *Mean of Pretest and Posttest scores of Gamified intervention and traditional methods* on students' achievement in social studies

Group	**N**	**Pretest** $\overline{X}$	**Posttest** $\overline{X}$	**Mean Gain** $\overline{X}$
Experimental	120	16.71	63.22	46.51
Control	107	17.15	42.35	25.20

The data presented in Table 1 shows that the experimental group (gamified intervention) had a mean score of 16.71 in the pre-test and a mean score of 63.22 in the post-test making a post-test mean gain in experimental group to be 46.51. The control group had a mean score of 17.15 in the pre-test and a post-test mean of 42.35 with a post-test mean gain of 25.20. With these results, the students in the experimental group (gamified intervention) had the higher mean gain in the achievement test than the students in the control group. Hence, students taught educational technology with gamified intervention performed better than those taught using traditional method.

Table 2: *Mean of Pre-test and Re-test scores of Gamified intervention and traditional methods* on students' achievement in social studies

Group	**N**	**Pre-test** $\overline{X}$	**Re-test** $\overline{X}$	**Mean Gain** $\overline{X}$
Experimental	120	16.71	53.43	36.72
Control	107	17.15	27.81	10.66

The data presented in Table 2 shows that the experimental group (gamified intervention) had a mean score of 16.71 in the pre-test and a mean score of 63.22 in the re-test making a re-test mean gain in experimental group to be 36.72. The control group had a mean score of 17.15 in the pre-test and a re-test mean of 42.35 with a re-test mean gain of 10.66. With these results, the students in the experimental group (gamified intervention) had the higher mean gain in the retention test than the students in the control group. Hence, students taught with gamified intervention, exhibited higher retention ability than students taught with traditional instructional method accompanied with seductive detail.

DISCUSSION

The results of this study provide strong evidence for the effectiveness of the gamified intervention in mitigating the negative effects of seductive details and enhancing student achievement in Social Studies.

The experimental group showed significantly higher mean gain scores (46.51) achievement compared to the control group (25.20) from pretest to posttest which indicates that the gamified intervention had a substantial impact on immediate learning outcomes. This aligns with previous research by Domínguez et al. (2013) and Barata et al. (2013), who found positive effects of gamification on student performance.

The retention test results are particularly noteworthy. The experimental group maintained a higher level of knowledge retention (mean gain of 36.72) compared to the control group (10.66). This suggests that the gamified intervention not only enhanced immediate learning but also promoted better long-term retention of information. This finding supports the work of Klepsch and Seufert (2020), who found that gamification can enhance germane cognitive load and promote deeper learning.

While not directly measured in this study, the substantial improvements in both immediate and retained learning suggest increase showed that gamified intervention had a positive effect on the experimental group's engagement and motivation.

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PAPER 24 - IMPACT OF DIGITAL RESOURCE ACCESS ON LIBRARY UTILIZATION AMONG BUSINESS EDUCATION STUDENTS IN LAGOS STATE

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ABSTRACT

This study explores the impact of students' access to digital resources on the utilisation of library services among business education students in Lagos State. The research investigates how the availability of digital resources, such as e-books, online journals, and databases, influences students' engagement with traditional library facilities and the broader economy of library use. The study employs a quantitative surveys method to gather comprehensive data on students' digital resource usage patterns, preferences, and perceptions. By examining the correlation between digital access and the frequency and nature of library visits, this study aims to uncover the factors that drive or hinder library engagement in the digital age. Additionally, the research highlights the challenges faced by libraries in adapting to the increasing demand for digital content and the implications for library management and policy-making. The findings are expected to provide valuable insights for educational institutions, library administrators, and policymakers, offering strategies to enhance the effectiveness and relevance of library services in supporting the academic and professional growth of business education students. This study underscores the importance of integrating digital resources into library offerings to meet the evolving needs of students and to sustain the library's role as a vital educational resources.

KEYWORDS: Business Education Students, Digital Resources, Library Engagement, Library Utilization, Lagos State

1. INTRODUCTION

The advent of digital technology has revolutionized the way students access and utilize information, transforming the role of libraries in the academic landscape. Business education students, in particular, require timely and seamless access to digital resources to stay competitive in the global market. Lagos State, Nigeria's economic hub, is home to numerous higher education institutions, making it an ideal context to investigate the impact of digital resource access on library utilization among business education students. Digital libraries, in particular, offer unparalleled access to academic journals, e-books, and other resources (Chow & Croft, 2018). The upsurge in library digital resource access is allowing some students to learn remotely with ease without physical access to the library. This trend is somehow affecting the utilisation of library resources. The usage of the library generally reflects the need to meet academic requirements. The library, with its stock of published documents, is an essential feature of the academic body, whether it is scheduled, traditional, or long-distance learning in tertiary institutions because of the role of the library in the host institutions. Information resources are important to individuals searching for knowledge. They enable individuals to work efficiently and effectively in the business field and help students learn and compete with others. Libraries have strained and made arrangements to make the information resources available to students and faculty through the use of digital indicators. These indicators include the

recognition that libraries need to provide e-resources demonstrated by acts such as establishing new forms of library electronic services and acquiring new sources of electronic information through books and journals in tape and compact disk formats other things.

The major concern of every government is to increase investment in education for national development. To ensure success in the educational sector, the government develops policy guidelines to involve, empower, and integrate people in the action of mastering their environment. The provision of necessary resource services constitutes the heart of education. A major investment in the educational system of a nation is the provision of library and information services. Libraries are established to provide opportunities for education and for self-improvement, further manpower and skill development, and to collect, process, organize, preserve, and disseminate records of mankind, as well as to provide guidance to the users.

The economic downturn and general reorientation of the Nigerian economy have also affected the public sector and most of its activities, with the various governments at different levels being unable to provide adequate infrastructure and personnel for the effective running of society. This has necessitated the whole essence of programmed development and the importance of small business both to the individual, to the state, and to the nation. With the current emphasis on the improvement of all aspects of education, and the traditional/digital transition of information access, the library and its resources have been attracting a lot interest. The academic library, especially, became and continues to be the major source of learning materials for the students and staff through acquisition, organisation, processing, preservation, and easy dissemination of those materials as necessary aids for learning, teaching, research, and development.

1.1 STATEMENT OF PROBLEM

The rapid advancement of technology has significantly impacted the way information is accessed and utilised. In the context of education, libraries have increasingly shifted towards providing digital resources to meet the evolving needs of students. However, the extent to which these digital resources are utilised by business education students in Lagos State remains a subject of inquiry. This study seeks to investigate the impact of digital resource access on library utilisation among this specific student population in 2004.

The primary purpose of this study is to investigate the impact of digital resource access on library utilisation among business education students in Lagos State. By examining the awareness, usage, barriers, and benefits associated with digital resources, the study aims to provide valuable insights for library administrators and policymakers. Specifically, the research seeks to: assess the extent to which digital resources in the libraries are adequate in meeting Business Education students' needs; examine how conducive are the libraries for students' utilisation; evaluate the impact of digital resource access on students' academic performance and examine whether the introduction of digital resources can lead to a significant increase in students' satisfaction with the use of the library.

Specifically, the research aims to answer the following questions:

1. Adequacy and need: Are the digital resource collections in the libraries relevant and adequate in meeting students' needs?
2. Barriers and Challenges: What are the primary barriers or challenges that prevent students from accessing and utilising digital resources effectively?
3. Impact on Academic Performance: Does the utilization of digital resources have a significant impact on the academic performance of business education students in Lagos State?

4. Satisfaction and Preferences: What level of satisfaction do students express with the quality and accessibility of digital resources, and are there specific preferences or recommendations for enhancing these services?

By addressing these questions, this study will contribute to a better understanding of the role of digital resources in supporting the learning and development of business education students in Lagos State.

1.2 SIGNIFICANCE OF THE STUDY

This study holds significant importance for several reasons. First, it contributes to a better understanding of the role of digital resources in supporting the academic endeavors of business education students in Lagos State. By examining factors influencing library utilization and identifying potential barriers, the study can inform strategies for improving digital resource access and enhancing student engagement.

Secondly, the findings of this research can be used to guide policy decisions and resource allocation within libraries and educational institutions. By understanding the preferences and needs of business education students, libraries can tailor their services to better meet the demands of this specific student population.

Finally, the study can contribute to broader discussions on the impact of technology on education and the future of libraries. The insights gained from this research can inform the development of innovative approaches to library services and the effective integration of digital resources into the learning process.

2. LITERATURE REVIEW

Digital resources refer to any content that is stored electronically and can be accessed through digital devices. This includes a wide range of formats such as text documents, images, videos, databases, and other multimedia content. The American Library Association defines digital resources as "any resource that is created, stored, and delivered in digital form, including electronic books, online databases, and various types of digital media." (American Library Association. (2020). According to the Institute of Museum and Library Services (IMLS), "digital resources are materials that are available in digital format, allowing for easier access and broader dissemination of information, knowledge, and culture." (Institute of Museum and Library Services. (2019). The International Federation of Library Associations and Institutions (IFLA) also noted that "digital resources encompass all types of digital content that can be utilized for various educational, cultural, and informational purposes in library services." (International Federation of Library Associations and Institutions. (2020). These definitions highlight the relevance and diversity of digital resources in contemporary information systems.

2.1 OVERVIEW OF LIBRARY UTILISATION IN NIGERIA

Library utilisation in Nigeria in its own right refers to the ways in which individuals and communities engage with libraries and their resources. This engagement includes activities such as borrowing books, accessing digital materials, participating in programs, and seeking information assistance. Afolabi (2016), opined that library utilization is "the effective use of a library's resources and services by its patrons for educational, recreational, and informational purposes." This highlights not just access, but the functionality of the resources in meeting users' needs. As described by Oduwole (2018), "Information seeking behavior refers to the ways individuals search for and utilize information resources to meet their information needs." This behavior is critical in understanding how library resources are engaged.

McTavish (2020) defines user engagement in libraries as "the interactions and connections made between libraries and their users, which can enhance the overall library experience." This emphasizes the dynamic relationship between library services and their users. Libraries are vital for students and researchers in acquiring knowledge and supporting academic success. According to Adeniran and Ojo (2019), "Libraries serve as the backbone of the educational system, providing resources that promote learning and research." Libraries also play a key role in preserving the cultural heritage and promoting local content. They offer resources that reflect the histories and traditions of various ethnic groups in Nigeria (Ilibagize, 2020). They serve as centers for community engagement and development and provide information essential for civic participation and support for local initiatives (Onyedikachi & Egbo, 2021).

Several factors influence how libraries are utilized in Nigeria. The physical location of libraries and their hours of operation affect usability. Many libraries, especially in rural areas, may be under-resourced and difficult to access, limiting user engagement (Akinola, 2017). Apart from this, Lack of awareness about library services often leads to lower utilization rates. Libraries need to actively promote their resources and services to attract users (Ogunleye, 2019). The integration of technology in library services (e.g., e-books, online databases) has been transformative. However, the digital divide in Nigeria means that not all users have the necessary access or skills to utilize these resources effectively (Ajayi, 2022). Moreso, the competence and friendliness of library staff can significantly impact user experiences and, as noted by Nwankwo (2020), “Well-trained library personnel are pivotal in guiding users toward effective resource utilization.” Insufficient funding is another factor that can often lead to inadequate infrastructure, which hampers the quality of services provided by libraries. Many public libraries in Nigeria face budget constraints that affect their ability to procure new materials and maintain facilities (Ugwoke, 2021).

2.2 THE ROLE OF DIGITAL RESOURCES IN EDUCATION

The role of digital resources in education has transformed the landscape by enhancing access to information and improving learning outcomes. This examination will focus on these two critical aspects and render appropriate, relevant, and current publications.

Digital resources, such as online databases, educational websites, and open educational resources (OER), have significantly broadened access to information for learners. The internet has democratized knowledge, making it available to a broader audience irrespective of geographical or socio-economic barriers.

For instance, the report by the *OECD* (2019) titled "Future of Education and Skills 2030" highlights how digital access enhances educational equity. It mentions that access to the internet and digital tools allows students from varying backgrounds to engage with quality educational content, thereby reducing the information gap (OECD, 2019).

Moreover, a study by *Hattie* (2018) emphasizes the importance of technology as a means to facilitate access to diverse learning materials. Hattie points out that when students are provided with access to digital resources, they can engage in deeper learning, explore topics of interest, and acquire knowledge independently.

The integration of digital resources in education has been shown to positively affect learning outcomes. Research indicates that when educators effectively implement technology in the classroom, it leads to improved performance and engagement among students. A meta-analysis by Bernard et al. (2014) reinforces this point by analysing over 50 studies and concluding that digital educational tools can lead to enhanced academic achievement when combined with effective teaching practices. The study articulates that the quality of the digital resources, along with their alignment to learning objectives, directly influences the extent of their positive impact on student learning.

Additionally, Sung and Chen (2016) conducted a systematic review of the effects of mobile technologies on student outcomes and found that the use of mobile devices for learning increased motivation, engagement, and academic performance. Their findings suggested that digital resources that promote interactive and personalised learning experiences can facilitate better learning outcomes.

The role of digital resources in education, particularly concerning access to information and learning outcomes, is profound. With the continually evolving technological landscape, educational institutions must harness these resources to promote equity and enhance learning. Current literature supports the notion that an effective integration of digital resources not only expands accessibility but also fosters improved academic performance.

2.3 DIGITAL RESOURCES IN LIBRARIES: ENHANCING ACCESS TO INFORMATION

The advent of digital technology has transformed the way libraries provide access to information. Digital resources have become an essential component of modern libraries, offering users a vast array of electronic materials, including e-books, online journals, databases, and digital archives. These resources provide several benefits to library users, The benefits range from enhanced access, like making information available 24/7 (Kyrillidou, 2018); increased convenience, where users can access multiple resources from a single platform (Liu, 2020); to improved research capabilities with advanced search functionality and citation management (Chow & Croft, 2018).

Libraries offer various types of digital resources, including but not limited to E-books and audiobooks (e.g., OverDrive, EBSCO eBooks); online journals and databases (e.g., JSTOR, ProQuest); and digital archives (e.g., historical newspapers, primary sources). Despite the benefits, digital resources also present challenges which may include unequal access to technology and internet connectivity (Hernandez, 2019); and information overload where users struggle to navigate vast amounts of information (Rowlands et al., 2018). Albeit the challenges, if libraries invest in digital literacy programs, user-friendly interfaces and collaborative partnerships with other institutions, the future of digital resources in libraries looks promising. As libraries continue to evolve with advances in artificial intelligence-powered search systems, virtual and augmented reality experiences and open-access initiatives, they must prioritise digital resource development, ensuring equitable access to information for all users.

2.4 LIBRARY UTILISATION AMONG BUSINESS EDUCATION STUDENTS: TRENDS, CHALLENGES, AND OPPORTUNITIES

The library, a vital hub for knowledge acquisition and dissemination, plays a crucial role in the academic success of students. However, the utilisation of libraries by business education students in Lagos State has been a subject of

growing concern. This paper explores the trends, challenges, and opportunities related to library utilisation among these students.

The trend of library utilisation among Nigerian business education students has been mixed. While some studies have shown a decline in library usage due to the increasing availability of online resources, others have highlighted a resurgence in interest in traditional libraries. Factors such as the perception of libraries as outdated, the convenience of online resources, and the quality of library services have all influenced these trends. Several challenges hinder the effective utilisation of libraries by business education students in Nigeria. One significant challenge is the inadequate infrastructure and resources available in many libraries. This includes limited access to books, journals, and other materials, as well as insufficient technological facilities. Additionally, the lack of awareness about library services and resources among students contributes to underutilization. Another challenge is the perception of libraries as outdated and irrelevant. Many students view libraries as places primarily for storing books, rather than as dynamic spaces for learning and collaboration. This perception can deter students from utilising libraries, especially in the age of digital information.

Despite the challenges, there are several opportunities to enhance library utilisation among business education students in Lagos State. One such opportunity is to modernise library facilities and services. By investing in technology, such as digital databases and online resources, libraries can become more attractive and relevant to students. Additionally, providing training and workshops on library skills can help students make the most of the available resources. Another opportunity is to foster a culture of reading and research among students. This can be achieved through initiatives such as reading clubs, research competitions, and collaborations with faculty members.

The utilization of libraries by business education students in Nigeria is a complex issue with both challenges and opportunities. To enhance library usage, it is essential to address the infrastructure, resources, and perception-related challenges. By modernising library facilities, promoting a culture of reading and research, and providing adequate support to students, libraries can play a more significant role in the academic success of business education students.

3 THEORETICAL PERSPECTIVES ON DIGITAL RESOURCES AND LIBRARY UTILISATION

The integration of digital resources in libraries has transformed the way students access and utilise information. Various theoretical perspectives offer insights into the complex relationships between digital resources, library utilisation, and student behaviour. These frameworks examine the impact of digital tools on student engagement, resource accessibility, and the evolving role of libraries in education. By analysing factors such as digital literacy, information overload, and user experience, researchers can better understand how students interact with libraries and adapt to the digital landscape in their academic pursuits.

Technology Acceptance Model (TAM) posits that perceived usefulness and perceived ease of use influence students' attitudes towards digital resources (Davis, 1989). Recent studies confirm TAM's applicability in digital library contexts (Liu, 2020). Information Search Process (ISP) models students' information-seeking behaviours, highlighting the importance of cognitive and affective factors (Kuhlthau, 2004). Digital resources can facilitate or hinder information search processes, depending on their design and accessibility (Rowlands et al., 2018). The Self-Determination Theory (SDT) suggests that students' intrinsic motivation and autonomy support influence their engagement with digital resources (Deci & Ryan, 2000). Libraries can foster autonomy by providing flexible, user-centred digital environments (Hernandez, 2019). Social Cognitive Theory (SCT) emphasises the role of observational learning, social norms, and self-efficacy in shaping students' digital resource usage (Bandura, 1986). Peer influence and librarian guidance can significantly impact students' digital literacy skills (Chow & Croft, 2018). Unified Theory of Acceptance and Use of Technology (UTAUT). integrates TAM, TPB, and other models to

explain technology adoption (Venkatesh et al., 2003). UTAUT's core constructs – performance expectancy, effort expectancy, and social influence – are relevant to digital resource utilisation among students (Kim & Lee, 2020).

By applying these theoretical perspectives, researchers and librarians can better understand students' needs, preferences, and behaviours regarding digital resources and library utilisation.

3. 1 CONCEPTUAL FRAMEWORK

The framework employed in this study that examined how digital resource access affects library usage among Lagos State business education students is the Technology Acceptance Model (TAM). TAM, which was created by Davis, explains how people develop attitudes and intents towards adopting technology, as mentioned by Marikyan and Papagianni (2023). This theory's main goal was to clarify the mechanisms underlying technological adoption in order to forecast technological behaviour and offer a theoretical justification for its effective application. The Theory of Reasoned Action, which offered a psychological viewpoint on human action, served as the foundation for the model (Davis, 1989).

Technology Acceptance Model (TAM) posits that technology acceptance is a tripartite process, in which external stimuli (features of the system) elicit cognitive responses (perceived usability and ease of use), which in turn generate an affective response (behaviour towards/intention to use technology), thereby influencing use behaviour (Davis, 1989; Davis, 1993). As the result anticipated by behavioural intention, perceived utility, and simplicity of use, TAM depicts the behaviour (Figure 1). Beliefs that conduct won't require a lot of work and expectations of positive results are captured by perceived utility and simplicity of usage.

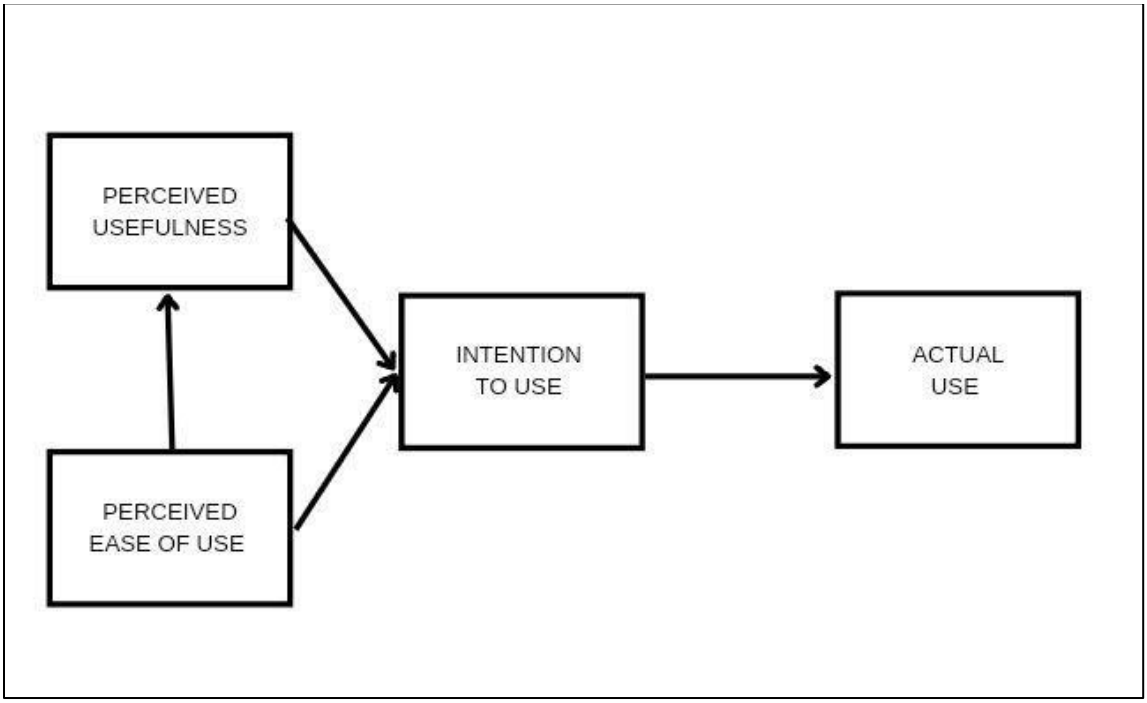

Figure 1: Technology Acceptance Model TAM (Davis, 1989)

The study's independent variable, digital resource access, influences the perceived usefulness (PU) and perceived ease of use (PEU) of library resources. These two TAM components, in turn, affect students' attitudes towards using digital resources (ATU) and their behavioural intentions to use library resources (BI). TAM's focus on user acceptance and adoption of technology aligns with the study's objective of examining the impact of digital resource access on library utilisation. By understanding the factors that influence students' attitudes and intentions towards using digital resources, the study can provide insights for improving library utilisation.

The Technology Acceptance Model provides a suitable framework for examining the impact of digital resource access on library utilisation among business education students in Lagos State. By testing the proposed relationships and hypotheses, the study can contribute to the understanding of how digital resource access influences library utilisation.

4. METHODOLOGY

For this study, the researcher employed the quantitative survey research design using questionnaires to collect data on students' demographics, digital resource access, and library utilisation. This enabled the researcher to investigate the current state of digital resource access and library utilisation among business education students in Lagos State. The survey Instrument is an online questionnaire designed based on the literature reviewed and the research objectives. The questionnaire was divided into five sections (A - E). The section A on one hand was designed to elicit responses with regards to the Bio-data of the respondents. While the remaining four sections (B - E) consist of ten questions each aimed at eliciting responses towards answering the research questions. Simple Random Sampling was used to determine the study sample and the data procured was analysed through descriptive statistics.

5. DATA PRESENTATION, RESULTS AND DISCUSSIONS

The data collected through the questionnaire are presented below and discussed accordingly.

5.1 ADEQUACY AND NEED FOR DIGITAL RESOURCES IN THE LIBRARY

S/n	Item	Responses									
		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	The speed of internet access in the library is adequate for accessing digital resources.	6	10	12	20	14	23	23	38	5	8.3
2	The library provides sufficient computer systems for students to use digital resources.	7	11.7	13	21.7	17	28.3	20	31.6	4	6.7
3	The range of digital resources available to students is satisfactory.	8	13.3	12	20	17	28.3	19	31.7	4	6.7
4	The library offers adequate training on how to use digital resources.	6	10	12	20	16	26.7	20	6	10	31.6
5	The cost of accessing digital resources through the library is reasonable.	2	3.3	19	31.7	12	20	23	38.3	5	8.3
6	The library's digital resources are relevant to my course of study.	1	1.7	11	28.3	14	23.3	29	48.3	5	8.3
7	I find it easy to search for digital resources on the library's database.	5	8.3	13	21.7	15	25	23	38.3	5	8.3
8	The library's digital resources are updated regularly.	3	5	7	11.7	15	25	32	53.3	4	6.7

9	I believe that digital resources have enhanced my learning experience.	4	6.7	5	8.3	19	31	15	25	19	31
10	I prefer to use digital resources over printed materials.	1	1.7	14	23.3	19	31	9	15	18	30

Table I: Section B (Source: Authors' field work, 2024)

Findings from the result presented above revealed a significant gap in the availability of adequate digital resources in libraries in Lagos State, hindering Business Education students' access to essential materials. This deficiency undermines the academic success and competitiveness of these students in the global market. Insufficient e-books and online journals; outdated digital databases; limited access to specialised business databases can hinder research capabilities, restrict access to current business trends and information and negatively affects academic performance (Kim & Lee, 2020).

5.2 BARRIERS AND CHALLENGES TOWARDS ACCESSING DIGITAL RESOURCES IN THE LIBRARY

S/n	Item	Responses									
		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	The library's opening hours are convenient for students.	3	5	6	10	11	188.3	32	53.3	8	13.3
2	The library has a conducive study environment.	3	5	1	1.7	6	10	40	65	11	18.3
3	The library has adequate seating and study spaces.	1	1.7	6	10	12	20	34	56.7	7	11.7
4	The library staff is helpful and	0	0	7	11.7	15	25	29	48.3	10	16.7

	supportive.										
5	The library's collection ofof physical books is sufficient.	5	8.3	5	8.3	14	23.3	28	46.7	8	13.3
6	The library provides adequate photocopying services.	3	5	10	16.7	11	18.3	24	40	13	21.7
7	The library is well-maintained and clean.	0	0	2	3.3	6	10	41	68.3	13	21.7
8	I feel safe and secure in the library.	1	1.7	2	3.3	11	18.3	30	50	19	31.7
9	The library has sufficient lighting for study purposes.	0	0	4	6.7	19	31.7	26	43.3	12	20
10	The library's location is convenient for students.	2	3.3	4	6.7	9	15	36	60	9	15

Table 2: Section C (Source: Authors' field work, 2024)

The result as presented on the table aboves revealed significant barriers and challenges hindering Business Education students' access to digital resources in libraries in Lagos State. These obstacles can undermine students' academic performance, research capabilities, and competitiveness in the global market. Students' lack of proficiency in using digital resources can hinder effective utilisation (Liu, 2020). Insufficient technology infrastructure like outdated hardware, slow internet connectivity, and inadequate software restricts access to digital resources. Limited budget allocation for digital resource acquisition and maintenance is another major barrier towards accessing digital resources in the library.

5.3 ACCESS TO DIGITAL MATERIALS IN THE LIBRAY AND ACADEMIC PERFORMANCE

S/n	Item	Responses									
		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		No.	%	No.	%	No.	%	No.	%	No.	%

1	Digital resources have increased my overall satisfaction with the library.	5	8.3	3	5	10	6.7	35	58.3	8	13.3
2	The availability of digital resources has made the library more relevant to my Studies.	1	1.7	5	8.3	10	16.7	33	55	11	18.3
3	Digital resources have improved my ability to find information quickly.	1	1.7	2	3.3	12	20	30	50	15	25
4	The integration of digital and physical resources has enhanced the library's usefulness.	2	3.3	3	5	9	15	37	61.5	9	15
5	Digital resources have increased my frequency of library visits.	4	6.7	3	5	12	20	34	56.7	9	15
6	The library's digital resources have helped me develop research skills.	3	5	3	5	4	6.7	26	43.3	24	40
7	I believe the library should invest more in digital resources.	2	3.3	4	6.7	8	13.3	22	35	25	41.7
8	Digital resources have made collaborative learning easy in the library.	5	8.3	5	8.3	12	20	31	51.7	7	11.7
9	The library's digital resources support my academic goals.	2	3.3	5	8.3	10	16.7	32	53.3	11	18.3
10	I believe digital resources have transformed the traditional role of the library.	6	10	3	5	16	26.7	14	23.3	21	35

Table 3: Section D (Source: Authors' field work, 2024)

From the findings above, it was discovered that there is a significant relationship between lack of access to digital materials in libraries and poor academic performance among Business Education students in Lagos State. This finding underscores the critical role digital resources play in supporting students' academic success. This study showed that limited access to digital materials: hinders research capabilities, leading to shallow understanding of business concepts; restricts access to current business trends, case studies, and industry reports; limits opportunities for collaborative learning and engagement and increases reliance on outdated or irrelevant information.

5.4 SATISFACTION AND PREFERENCES WITH QUALITY OF ACCESSIBILITY TO DIGITAL RESOURCES IN THE LIBRARY

S/n	Item	Responses									
		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	The library plays a crucial role in my academic success.	5	8.3	6	10	7	11.7	30	50	12	20
2	I believe that libraries provide essential resources for research and study.	2	3.3	4	6.7	16	26.7	18	30	22	36.7
3	The library is a valuable place for me to concentrate and study effectively.	1	1.7	3	5	7	12.7	28	46.7	22	36.7
4	I find the library's collection of books, journals, and electronic resources to be adequate.	1	1.7	5	8.3	14	23.3	26	43.3	14	23.3
5	The library staff is helpful and supportive of my academic needs.	3	5	5	8.3	15	25	23	38.3	15	25
6	I believe that libraries are essential for developing critical thinking and research skills.	3	5	5	8.3	12	20	18	30	22	36.7
7	I enjoy spending time in the library.	6	10	1	1.7	14	23.3	22	36.7	17	28.3
8	The library's physical environment is conducive to studying and	0	0	6	10	9	15	30	50	16	26.7

	learning.										
9	I believe that libraries are essential for fostering a love of learning.	4	6.7	4	6.7	9	15	19	31.7	24	40
10		3	5	2	33	7	11.7	30	50	18	30

Table 4: Section E (Source: Authors' field work, 2024)

The findings revealed a significant positive correlation between accessibility to digital resources and student satisfaction. Students who had easy access to digital resources reported higher satisfaction levels. It further reveals that accessibility to digital resources significantly predicted student preferences for library services and that students valued digital resources for research purposes based on convenience, relevance, and currency.

The study supports the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use influence user satisfaction (Davis, 1989). Accessibility to digital resources enhances students' perceived usefulness and ease of use, leading to increased satisfaction.

6. **CONCLUSION**

This study investigated the impact of digital resource access on library utilisation among Business Education students in Lagos State. The findings revealed significant relationships between digital resource accessibility, library satisfaction, and academic performance. Barriers to digital resource access, including limited digital literacy and infrastructure, hindered library. The study recommends prioritizing digital resource development, enhancing library infrastructure, and integrating digital literacy skills into the curriculum. Policymakers and educators should allocate sufficient resources to support library development and digital resource acquisition. The findings contribute to the understanding of digital resource access and library utilisation among Business Education students, informing strategies to enhance academic outcomes, digital literacy, and competitiveness in the global market. This study provides valuable insights for librarians, educators, and policymakers to support Business Education students' academic success in the digital age.

7. IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE STUDIES

The study's findings have significant implications for libraries, business educators, and policymakers. The study generally highlights the complex interplay between library utilization, digital resource access, and user needs. Libraries need to adapt to the changing information landscape by providing a seamless integration of physical and digital resources. Moreover, addressing the digital divide and investing in digital literacy programs are crucial for ensuring equitable access to information.

Specifically, these findings project the fact that:

1. Investment in digital resources and infrastructure is crucial for Business Education students' academic success.
2. Libraries must prioritize accessibility, usability, and relevance of digital resources.
3. Educators should integrate digital literacy skills into the curriculum.
4. Policymakers should allocate sufficient funding for library development and digital resource acquisition.

To further explore the relationship between digital resources and academic performance, future research could explore emerging trends such as the impact of artificial intelligence on library services, the role of libraries in promoting open science, and the evaluation of different digital resource delivery models.

Specifically, studies could be done in the area of:

1. Conduct comparative studies across different institutions and regions.
2. Investigate the impact of digital resource accessibility on students with disabilities.
3. Examine the effectiveness of digital literacy programs on academic outcomes.
4. Explore the role of emerging technologies (e.g., AI, VR) in enhancing digital resource utilization.

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PAPER 25 - ENHANCING CRITICAL THINKING IN COMPUTER STUDIES: THE IMPACT OF INDIVIDUAL PERSONALIZATION INSTRUCTIONAL STRATEGY ON JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT

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ABSTRACT

This research explores the impact of Individual Personalization Instructional Strategies (IPIS) on enhancing critical thinking and academic achievement among junior secondary school students in computer studies. The study adopted the pre-test-posttest, a control group, quasi-experimental design with a 3x2x2 factorial matrix. The moderating effects of the student's socioeconomic status and gender were also investigated. 250 Junior Secondary three (Basic Nine) students from six public schools purposively selected from three local government educational district areas in Lagos State participated in the study. Four null hypotheses were tested at 0.05 significance level with four instruments developed, validated and used for data collection. Data were analyzed using Analysis of Covariance and Scheffe Post hoc test. The findings showed that treatment had a significant effect on students' achievement in Computer Studies ($F_{(2,237)}$ = 121.890, P<0.05). Students exposed to IPIS had the highest post achievement score. The study also revealed that Socioeconomic Status and gender had a significant effect on students' achievement ($F_{1,247)}$ = 32.823, P<.05) and ($F_{2,247)}$ = 5.92, P<.05) respectively in Computer Studies. Furthermore, the result also showed no significant interaction effects of treatment, Socioeconomic Status and gender on students' achievement in Computer Studies. Among the students in the IIS group, those with high SES had highest post achievement scores. It was concluded that Computer Studies teachers should be trained to use Individual Personalization learning package in the classroom since the strategy is effective in enhancing student's achievement in Computer Studies than the conventional method.

KEYWORDS: Individual, Personalization, Achievement, Instructional, Critical Thinking.

INTRODUCTION

In the contemporary educational landscape, the integration of technology into learning environments has transformed traditional pedagogical approaches, necessitating a reevaluation of instructional strategies to enhance student achievement and critical thinking skills. One of the most promising approaches is individual personalization instructional strategies (IPIS), which tailor educational experiences to meet the unique needs, preferences, and abilities of each student. The importance of computer studies in today's digital era cannot be overstated. As technology continues to permeate all aspects of life, equipping students with essential computer skills is paramount. According to the International Society for Technology in Education (ISTE, 2020), integrating technology in education not only enhances learning outcomes but also prepares students for future challenges in a rapidly evolving job market.

Individual personalization instructional strategies have emerged as a vital approach to addressing diverse learning needs. Research indicates that personalized learning can significantly enhance student motivation and academic performance (Pane et al., 2015). By adapting instructional content and methods to individual learning styles, IPIS fosters a more inclusive environment that encourages active participation and critical engagement with the material. For instance, a study by Walkington (2013) highlighted that personalized learning paths lead to improved problem-solving skills and greater academic success among students. Critical thinking is another essential skill that students must develop, particularly in subjects like computer studies, where analytical reasoning and problem-solving are crucial. Facione (2015) emphasizes that critical thinking involves the ability to analyze information, evaluate evidence, and construct reasoned arguments skills that are increasingly important in the digital age.

The role of teachers in implementing IPIS cannot be overlooked. Educators must be equipped with the knowledge and tools to effectively personalize learning experiences. A study by Hattie (2017) suggests that teacher-student relationships and the ability to adapt instruction are critical factors in student success. Therefore, professional development programs focusing on IPIS strategies are essential for empowering teachers to meet the critical thinking skills needed by their students. The interplay between personalized instruction and critical thinking development is significant; when students engage with tailored content, they are more likely to think critically about the subject matter.

Hence, as education continues to evolve in the face of technological advancements, this research is in the right direction to investigate the specific effects of individual personalization instructional strategies on students' achievement in computer studies, with a particular emphasis on fostering critical thinking skills. By examining the relationship between personalized instruction and student outcomes, this study seeks to contribute to the growing body of literature advocating for innovative teaching methods that cater to individual learning needs, explore how these strategies can enhance students' academic achievements in computer studies while simultaneously promoting critical thinking, ultimately preparing the students for success in an information-rich world.

LITERATURE

The concept of individual learning is associated with, or part of several other educational concepts and wider policy agenda of contemporary relevance such as 'Personalization', 'child- or student-centered learning', and 'ownership' of learning. It is a feature of important issues such as pupil-teacher roles and relationships and the role of information and communications technology (ICT) in learning. Theoretical study and practical application of the principles of individual learning are perhaps the most advanced in the U.S., but the concept is of increasing significance in the UK. The essential elements of 'personalised learning', and has been seen as vital to the continuing development of a system of school education that promotes high quality and lifelong learning and social equity and cohesion (DfES, 2006).

The power of personalized learning, understood in this way, is intuitive. When students receive one-on-one help from a tutor instead of mass-group instruction, the results are generally far superior. This makes sense, given that tutors can do everything from adjusting their pace if they are going too fast or too slow to rephrasing an explanation or providing a new example or approach to make a topic come to life for a student. Also, tutors usually persist until their students fully comprehend the material whereas, in the conventional class setting, there is often a starting and stopping point based on time, not mastery. A personalized approach also implies that students can receive a one-on-one learning experience when they need it, but can also partake in group projects and activities when that would be best for their learning.

Studies show the power of this kind of personalized learning for maximizing student success. One of the first studies to draw attention to personalized learning was Benjamin Bloom's classic ''2 Sigma Problem'' study, published in 1984, which measured the effects of students learning with a tutor to deliver just-in-time, customized help. The striking finding was that by the end of three weeks, the average student under tutoring was about two standard deviations above the average of the control class. That means that the average tutored student scored higher than 98 percent of the students in the control class. Bloom found that small-group instructional practice also had a significant impact, as it similarly allowed teachers to personalize the learning for students. A more recent meta-analysis by Kurt VanLehn, which revisits Bloom's conclusion, suggests that the effect size of human tutoring seems to be more around 0.79 standard deviations than the widely publicized 2 standard deviation figure. Even with this revision, however, the impact is hugely significant.

For effective teaching and learning to take place in a personalised system, it will be necessary to instill key learning skills and accommodate different paces of learning' (DfES, 2004a). As examples of approaches that might be adopted, the document cites a school in which teachers assist children to take control of their learning by setting with them realistic learning challenges such as re-designing the school grounds and evaluating the results of their

efforts; and another school in which teachers help the children to identify and develop their learning skills and then structure their lessons according to how pupils will most effectively learn. The teaching of 'thinking skills' has also been identified as a direct contribution to teaching and learning in the foundation subjects (DfES, 2004b) such as the way Computer Studies is introduced at the Junior Secondary School level in Nigeria to develop pupils' oral and questioning skills. The skills required for independent learning can be split into cognitive skills, meta-cognitive skills, and affective skills.

Cognitive skills include memory, attention, and problem-solving (Carr, 1996; Malone and Smith, 1996; Boekaerts, 1997; Anthony, 1994; Zimmerman, et al., 1996). Cognitive skill requires critical thinking that the pupils need to decode basic information before they can embark on personalized individual learning and teachers should able to promote this cognitive development to encourage Personalization individual learning. Individual Personalization Instructional Strategy (IPIS) becomes imperative because pupils do not become effective independent learners by themselves but through process-oriented teaching, which ensures that pupils are actively involved in the learning process (Bolhuis and Voeten, 2001). Effective instructional and learning strategies can be used across grade levels and subject areas and can accommodate a range of student differences. Teachers are expected to promote individual personalization learning by using a range of strategies, including scaffolding; providing pupils with opportunities to self-monitor; offering models of behaviour; developing a language for learning, and providing feedback on homework (Gorman, 1998; Black, 2007; Montalvo and Torres, 2004). IPIS aimed to change the traditional roles of teachers and pupils by enabling pupils to learn more autonomously. Initially, the teacher presented pupils with the learning goals, and pupils were then asked how they would like to work towards this goal. This involved the teacher providing pupils with a variety of ICT tools, such as the Internet, electronic whiteboards, and video equipment. Pupils were directed to plan learning events and select which ICT resources to use. They then organized themselves into groups and worked collaboratively. Importantly, IPIS involved restructuring classroom activity so that there was a move away from teaching lessons as discrete blocks and towards focusing on shifting powers to learners across lessons.

To ensure that all learners reach their full potential, education plans must focus primarily on teaching quality and learning outcomes (Hunt, 2015). Quality and effective teaching can be defined as the kind of teaching that leads to high learner achievement, using outcomes that matter to future success (Coe et al., 2014). The perspectives of achievement may be divided into two main kinds. The first type derives from a 'school effectiveness perspective'. It measures quality as learner performance and achievement on standardized national or international tests (Grosin, 2003 in Thornberg and Thelin, 2011). The other type (Williams, 2003), deriving from the 'school development perspective', defines quality as being when learners also develop:

i. sustainable knowledge;
ii. critical thinking, collaborative skills, creativity, independence, and problem-solving ability;
iii. a willingness and desire to continue learning;
iv. a democratic attitude of mind.
v. Knowledge used for a deeper understanding of the world

Therefore, when it comes to learning and achievement, there is a growing consensus that the most effective way of increasing attainment is by helping learners become independent, reflective, and involved in their learning (Hattie, 2009). Recently, educational research has been focusing more on pedagogical approaches that go beyond the teacher-led practices of 'differentiation' towards more learner-centered, personalized classroom practice (Sebba, 2010). Personalized learning is an ongoing process that enables 'deep learning' (Brown et al., 2007). It sets high expectations for progress, participation, and success for all learners equally, including those who have been identified.

STATEMENT OF THE PROBLEM

Despite the importance attached to computer studies at the junior secondary school level for an individual and society at large, learners' achievement in the subject at the secondary school level remained low. Ineffective teaching methods are the major factor contributing to this low achievement in computer studies. In an attempt to seek a teaching strategy that can improve learners' performance in computer studies, this study examined the Effects of Individual Personalization Instructional Strategy on Junior Secondary School Students' Achievement in computer studies. The study also investigated the moderating effects of student's socioeconomic status and gender on the dependent measure.

HYPOTHESES

This study tested the following null hypotheses at 0.05 significant levels.

Ho1: There is no significant main effect of treatment (Individual personalization and conventional method) on students' Achievement in Computer Studies

Ho2: There is no significant main effect of socioeconomic status on students' Achievement in Computer Studies.

Ho3: There is no significant main effect of gender on students' Achievement in Computer Studies.

Ho4: There is no significant interaction effect of treatment, socioeconomic status, and gender on students' Achievement in Computer Studies.

RESEARCH METHOD

Design

This study adopted the pretest, posttest control group quasi-experimental design involving a 3 x 2 x 2 factorial matrix. Learning strategies (Conventional Method and Individual Personalization Instructional Strategy) were crossed with socioeconomic status (low and high) and gender (male and female).

Participants

The participants for this study comprised all the Junior Secondary School Two students (JSS II) drawn from Secondary Schools in Epe, Eti-Osa, and Ibeju-Lekki areas of Lagos State. The choice of JSS II students was considered more appropriate because these students would have been exposed to some elementary rudimentary computer concepts and skills which would enable them to have basic ideas of computer operations. Besides, students had enough time for the lessons and class activities since they were not preparing for any external examination. In addition, these students were willing and free to express their opinions and interest in Computer Studies. Three out of 20 Local Educational Districts (LEDs) in Lagos State were used. A total of 250 students (157 male and 93 female) were used. The subjects were subjected to varied academic ability levels. The selected groups in each LED were assigned randomly to a treatment group to avoid interaction that may occur among the groups if two or more treatment groups were located in the same school.

Instruments

Four research instruments were used in this study. These are:

(i) Computer Achievement Test (CAT), (ii) Socioeconomic Status Questionnaire (SESQ),
(iii) Numerical Ability Test (NABT) and (iv) Personal Interest Inventory (PII).

Computer Achievement Test (CAT)

The CAT is a 40-item multiple-choice Computer achievement test with four options per item. The CAT was constructed and validated by the researchers to measure students' academic achievement in Computer based on the school curriculum for the term. To test the instrument, the 40-item CAT was administered on a sample of 80 (SSS

II) year two students (40 males and 40 females) in two schools that were not part of the study, but whose students are similar in age and class the students involved in the study. From the students' responses, a reliability coefficient of 0.79, using the Kuder-Richardson method [Formula 21] was obtained.

SOCIOECONOMIC STATUS QUESTIONNAIRE (SESQ)

SESQ was made up of two sections, that is, section A and Section B. Section A consisted of questions that sought parents' socio-economic factors and information about students and Section B consisted of 15 items to determine the students' academic performance. Students' method of response to the items was the closed response mode of 5 point Likert scale modified to 4 point scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD). This instrument was adopted from the 10-item Parents' Socio-economic Status Scale (PASS) developed by White et al in 1993. It has been considered by Safdar Rehman Ghazi et al (2013) to be a valid and reliable instrument for testing students' socioeconomic status and academic performance. The instrument was given to 80 students who were not part of the study and the reliability coefficient using Cronbach Alpha Reliability Method was found to be 0.73.

NUMERICAL ABILITY TEST (NABT)

This test has been validated for use in Nigerian secondary schools and has since been used for many higher-degree research works (Abimbade 1987; Bekee, 1987). The scores of the students in NABT which measured the numerical ability of students represented the students' ability. Thus grouping the students into high and low ability levels was based on the scores of the NABT. This was done by ranking the sum of the scores from the highest to the lowest and used to categorize them into two-tier levels. Those within the upper 50% were considered as high ability and the bottom 50% were considered low ability. The instrument was given to 80 students who were not part of the study and the reliability coefficient using Kuder-Richardson Method (Formula 20) indicated a reliability coefficient of 0.89 for NABT.

PERSONAL INTEREST INVENTORY (PII)

This is a 19-item questionnaire used to determine the personal backgrounds and interests of the participants. This includes the names of the students' favorite places, activities, sports, friends, convenience stores, foods, and so forth. Students gave two favorite responses for each survey item. The questionnaire was face-validated in terms of language clarity to the target audience.

TEACHER'S INSTRUCTIONAL GUIDE (TIG)

The TIG is an operational guide that was used by the trained teachers in the experimental and control groups to ensure uniformity. The TIG consists of the activities, behaviors, and specific instructions guiding the teachers supervising and instructing the experimental and control groups respectively. The TIG was used in training the six JSS II Computer Studies teachers who participated in the study (before the commencement of treatment).

LEARNING PACKAGES

Two learning packages developed and validated by the researchers were used as an intervention in the experimental groups.

INDIVIDUAL PERSONALIZATION INSTRUCTIONAL PACKAGE (IPIP)

The IPIP was also a developed and validated programmed instruction designed by the researchers to develop the

student's skill in Personalization. It was the treatment (stimulus instrument) that was used by the second experimental group (Individual Personalization Instructional Strategy, E1). The IPIP was a programme for teaching yourself the skill of Personalization. Before the development of the IPIP, a 20-item student survey was used to determine the personal backgrounds and interests of the participants. Topics included the names of the individual student's favorite places, activities, sports, friends, convenience stores, foods, and so forth. Students gave two favorite responses for each survey item. The survey was administered one week before the pre-test. Responses to each survey item were tabulated by the experimenters and then used to design the personalized version of the instructional programme and the tests. The stimulus part of the IPIP was prepared in groups, week by week while the response part was produced separately. Each student received first the response part after each lesson in other to solve the relevant exercises in a group, in line with the instructions in the package. This ensured that the 'student learning' personalization model chosen for the study was properly utilized during the treatment and data collection period. The IPIP was also trial-tested on a different group of JSS II students having characteristics similar to that of the intended subjects for the main study. It was also administered to 80 JSS II students. This was done to find out its suitability for the main study. The feedback obtained from the learners, especially as it concerned the workability of the package for the learner, was used to further modify the IPIP to make it useful and suitable for the main study.

JIGSAW INSTRUCTIONAL PACKAGE (JIP)

This is a text-assisted programmed instruction designed and validated by the researchers where each student specializes in a sequence while receiving the rest from his colleagues. It was the treatment (stimulus instrument) that was used by the first experimental group (Jigsaw Instructional Strategy, E2) covering five broad topics in Computer studies. It contained 25 lessons covering five weeks of five periods per week as contained in the scheme of work for JSS II classes in Computer Studies. The broad topics covered were: approximations and percentage error, ratio, proportions and rates, percentages, sequence and series, the concept of sequence and series, terms of A.P and sum, solving problems on A.P., terms of G.P. and sum, problem-solving on G.P, Geometric mean, simultaneous equations; one linear and one quadratic solution by substitution method, solving more problems on the topic, word problems on simultaneous equation. The students were divided into five heterogeneous groups and appropriate group works for each of the five broad topics were constructed and were used to teach each of these groups of students which made up of the working groups. Then, the students who had the same number on the form were organized into groups of "experts" who would perform tasks on the worksheets. After a period agreed with the teacher and the research assistants, the students were assembled in original work groups, where they showed and discussed their expert work, in turn, to their colleagues, until the "whole" designed by the researcher, was achieved through the contribution of each student group, within the group. The JIP was trial-tested on a group of 80 JSS II students having characteristics similar to the intended students for the main study. The feedback obtained from the learners, as it concerned the length and timing of the lessons, the simplicity or otherwise of the examples and solutions provided as well as the workability of the package for the study, was used to further modify the JIP to make it useful and suitable for the main study.

DATA COLLECTION PROCEDURE

The research procedure was divided into three phases: (a) pre-intervention phase (b) intervention phase and (c) post-intervention phase.

a. Pre-Intervention Phase

The actual pre-intervention phase followed the steps below:

The researchers, as the resource persons, trained the six participating teachers and two research assistants for two weeks. With the TIG, the participating teachers were trained on the use of the learning packages (IPIP and JIP), how to create the right type of environment for the experimental and control groups, and how to administer the other instruments (CAT and SESQ). The participating teachers used the third week for trial testing. This was done to ensure that the teachers mastered the intervention for the experimental and control groups and applied it throughout

the intervention period. The two research assistants were asked to rate the participating teachers (using the intervention rating scale prepared by the researchers) during the trial practice. The exercise produced inter-rating reliability values of between 0.77 and 0.81 range.

b. INTERVENTION PHASE

The fourth week was used for the pre-test. The researchers with the help of the research assistants and the trained teachers administered the pre-test to the participating students in the following order: Socioeconomic Status Questionnaire (SESQ) before the Computer Achievement Test (CAT). The intervention period took five weeks in each of the six schools. This involved the use of the JIP for the students in the experimental group 1, the use of the IPIP for those in the experimental group 2, and the use of the conventional method of teaching for the students in the control group. During the intervention period, no interaction was allowed between the students in the intervention and control groups, whose schools were located in different areas.

c. ***POST-INTERVENTION PHASE***

The tenth week was used for the post-test which comprised the administration of the Computer Achievement Test (CAT) in both the experimental and control groups.

DATA ANALYSIS PROCEDURE

The hypotheses raised in the study were tested inferentially using the Analysis of Covariance (ANCOVA) direction of possible significant effects respectively.

RESULTS AND DISCUSSION

The sequence of the presentation and discussion of the results obtained in the study follows the hypotheses formulated for the study. The hypotheses raised in the study were tested inferentially using the Analysis of Covariance (ANCOVA) statistics. The use of ANCOVA was to control for the differences between groups as revealed in the pre-test. The Multiple Classification Analysis (MCA) and the Scheffe post-hoc analysis were used to explain the magnitude of the post-test achievement scores of the different categories of students and to explain the direction of possible significant effects respectively.

Hypothesis 1

There is no significant main effect of treatment (individual personalization, jigsaw, and conventional method) on students' Achievement in Computer Studies.

Table 1 reveals the main effect of treatment on students' achievement in computers. The result showed that there is a significant main effect of treatment on students' achievement in Computer ($F_{(2, 237)} = 121.890$, $p < 0.05$). The result implied that the achievement scores of the students exposed to different treatment conditions were significantly different. Therefore, the null hypothesis [1] is rejected.

Table 1: Summary of Analysis of Covariance of Students' Achievement According to Treatment, Socioeconomic Status and Gender

Source of Variation	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	5957.112	12	496.426	40.422	.000	.672
Pretest	10.797	1	10.797	.879	.349	.004
Main Effect:						
Treatment	2993.847	2	1496.924	121.890	.000*	507
Socioeconomic Status	403.103	1	403.103	32.823	.000*	.122
Gender	72.707	1	72.707	5.920	.016*	.024
2-way Interaction:						
Treatment x Socioeconomic Status	302.036	2	151.018	12.297	.000*	.094
Treatment x Gender	29.114	2	14.557	1.185	.307	.010
Socioeconomic Status x Gender	4.353	1	4.353	.354	.552	.001
3-way Interaction:						
Treatment x Socioeconomic status x Gender	45.782	2	22.891	1.864	.157	
Error	2910	237	12.281			
Total	**8867.696**	**249**				

R Squared = .627 (Adjusted R Squared = .655) * = Significant at p<.05 alpha level.

To determine the magnitude of the mean achievement scores of students exposed to the different treatment conditions, the result of the Multiple Classification Analysis (MCA) presented in Table 2 was used.

Table 2: Multiple Classification Analysis of Students' Achievement According to Treatment, Socioeconomic Status and Gender

Grand Mean = 27.904					
Variable + Category	**N**	**Unadjusted Variation**	**Eta**	**Adjusted for Independent + covariates Deviation**	**Beta**
Treatment Groups:					
1. Individual Personalization	97	3.84		3.16	
2. Jigsaw	90	.87		1.18	
3. Control	63	-7.16	.73	-6.54	.65

Socioeconomic Status :					
1. Low 2. High	165 85	-2.07 4.03	.49	-1.31 2.55	.31
Gender:					
1. Female 2. Male	138 112	-.20 .25	.04	-.41 .50	.08
Multiple R-squared					**.627**
Multiple R					**.792**

The result revealed that, with a grand mean of 27.904, the students exposed to the IPIP package (use of Individual instructional strategy) had the highest adjusted post-test mean achievement score of 31.74 (27.904 + 4.02). The students exposed to the Jigsaw package (use of Jigsaw instructional strategy) had the next higher adjusted post-test mean achievement score of 28.78 (27.904 + 3.84) while the students in the control group (use of conventional teaching method) obtained the lowest post-test mean achievement score of 20.30 (27.904 – 7.16). This result showed that the Individual instructional strategy had the greatest potency in enhancing students' achievement in computer studies. The result in Table 2 further reveals that while treatment alone accounted for 42% $(0.65)^2$ of the variation in students' achievement in Computer, the independent and moderator variables jointly accounted for 63% $(0.792)^2$ of the variance observed in the students' achievement scores in Computer. In probing further into the source of the significant difference recorded in Table 1 the Scheffe post-hoc analysis presented below was carried out.

Table 3. Scheffe Post-Hoc Pairwise significant differences among the various treatment groups on the Students' Achievement in Computer Studies.

Treatment	**(I) Treatment**	**(J) Treatment**	**Sig.**
Treatment	Treatment I	Treatment II Control	.000 .000
	Treatment II	Treatment I Control	.000 .000
	Control	Treatment I Treatment II	.000 .000

It is shown in Table 3 that there were pair significant differences between Treatment I, Treatment II, and control, between Treatment II, Treatment I and control, and between control, Treatment I, and Treatment II.

The findings of this study revealed that there was a significant effect of treatment on students' achievement in computer studies. The result showed that the individual Personalization instructional strategy was more effective at improving students' performance on the computer, followed by the Jigsaw instructional strategy and the conventional method of teaching was the least effective. The effectiveness of the Individual Personalization Instructional Strategy over both the Jigsaw Instructional Strategy and the conventional teaching method may be

because the Individual Personalization instructional strategy is learner-centered. Students were personally attended to to improve their performance in learning a new concept, content, or material. This develops the skills and expertise needed to participate effectively and also focuses on thinking, listening, speaking, reflection, and problem-solving skills in the students. This finding is in agreement with the findings carried out by Gregory (2013), Lestik and Plouse (2012), Hakkarainen (2012), Aronson (2008), and Bratt (2008).

In the case of the Jigsaw instructional strategy, the superiority exhibited over the conventional method of teaching may be because there was a collaboration amongst the students in groups, therefore, enhancing their biography, intelligence, sensibilities, favorite places, activities, sports, friends, convenience stores, foods, predominant work, recreation centers/amusement parks and competencies are incorporated into the content of instruction. This enables the students to relate the content to their life experiences. This finding is in agreement with the submissions of Awofala, Balogun, and Olagunju (2011), Cakir, Simsek, and Tezcan (2009), Simsek and Cakir (2009), Chen and Liu (2007), Diack (2004), d'Ailly and Simpson (1997) and Lopez and Sullivan (1992).

Hypothesis 2

There is no significant main effect of Socioeconomic Status (Low SES and High SES) on Students' Achievement in Computer Studies.

The result of the main effect of Socioeconomic Status in Table 1 reveals a significant difference between low and high Socioeconomic Status on students' achievement in Computer Studies ($F(1,247) = 32.823$, $P<.05$). This means the result showed that the post mean achievement scores of the students of low and high Socioeconomic Status were significantly different from one another. Hence, the hypothesis [2] is rejected.

However, the result of MCA in Table 2 further reveals that the high socioeconomic status students ranked first in the post-achievement with an adjusted mean score of 31.93 while the low socioeconomic status students recorded an adjusted post-achievement mean score of 25.83 was ranked second. However, this difference was statistically significant. The result in Table 2 further reveals that socioeconomic status alone accounted for 9.6% (0.46)2 [lesser than 10%] of the variance observed in the students' achievement scores in Computer Studies.

The study showed that the high socioeconomic status students had higher post-adjusted achievement mean scores in Computer Studies while the low socioeconomic status students had lower adjusted achievement mean scores. These findings are in agreement with the submissions of Blevins (2009), Barry (2006), Eamon (2005) and Hochschild (2003).

Hypothesis 3

There is no significant main effect of Gender (Male and Female) on Students' Achievement in Computer Studies.

The result from Table 1 shows that there was a significant difference in Gender (Male and Female) in Students' Achievement in Computer Studies ($F(2,247) = 5.92$, $P <.05$). This implied that the male and female students who participated in the study were significantly different in their achievement in Computer Studies.

Hence, the null hypothesis [3] is rejected. However, the result of the MCA in Table 2 reveals that male students who participated in the study recorded a better-adjusted post-achievement mean score of 28.15 than the females who recorded an adjusted post achievement mean score of 27.70. The observed difference is not however statistically significant. The result in Table 2 further reveals that gender alone accounted for just 0.64% (0.08)2 [less than 1%] of the variance observed in the students' achievement in Computer Studies scores.

The significant main effect of gender on students' achievement in this study conforms to the findings of Mata, Monteiro, and Peixoto (2012), Udousoro (2011), Mohamed and Waheed (2011),Scafidi and Bui (2010), Farooq and Shah (2008), Asim, Kalu, Idaka and Bassey (2007), Mutemeri and Mygweni (2005), Njabili, Abedi, Magesse, and Kalole (2005), Costello (1991) and Fennema and Sherman (1977).

Hypothesis 4

There is no significant interaction effect of Treatment, Socioeconomic Status and Gender on Students' Achievement in Computer Studies.

The result of the 3-way interaction effects in Table 1 reveals no significant interaction effect of treatment, socioeconomic status and gender on students' achievement in Computer Studies. ($F_{(12,237)} = .354$, $P>.05$). This result implied that there is no significant difference in students' group achievement in Computer Studies (based on treatment) among all the possible socioeconomic status – gender combinations: low-boys, low-girls, high-boys, and high-girls. Hence, the null hypothesis [4] is not rejected. The result in Table 2 further reveals that while treatment alone accounted for 42% (0.65)2 of the variation in students' achievement in computer studies, the independent and moderator variables jointly accounted for 63% (0.792)2 of the variance observed in the students' achievement scores in Computer Studies.

CONCLUSION

This study determined the effects of Individual Personalization Instructional Strategy on Junior Secondary School Students' Achievement in Computer Studies. The study is an extension of the use of learning packages that emphasize the active participation and intellectual involvement of learners. The interactive effects of treatment, Socioeconomic Status, and gender on the student's achievement in Computer Studies were also determined. The result of the study revealed that the Individual Personalization Instructional Strategy through the use of the learning package IPIP, was an effective method of learning Computer Studies. The conventional teaching method of Computer Studies was found to be the weakest of the three strategies in improving students' Achievement in computer studies. The Individual Instructional Strategy through the use of the Individual Personalization Instructional learning package was found to be more effective in promoting students' Achievement in Computer Studies than the Jigsaw instructional strategy. The Individual personalization instructional strategy, through the use of an individual personalization package, was found to be more effective in improving students' Achievement in Computer Studies than the conventional teaching method.

RECOMMENDATIONS

- The study, therefore, recommends the use of an Individual personalization instructional strategy involving the use of the learning package IPIP for teaching and learning of Junior Secondary School Computer Studies.
- It is further recommended that Computer Studies teachers should shift from the use of the traditional method of teaching and embrace the use of a combination of Individual personalization instructional strategies. The teachers need to be trained to develop their skills in the preparation and development of learning packages and how to use the packages to assist their students in learning Computer Studies so that learners will develop a positive interest in Computer Studies. Also, teachers must not discriminate among students whether Socioeconomic Status is high or low when the students use the learning packages.
- The curriculum planners should design a course that will be specially made for designing packages in all our teacher training tertiary institutions in Nigeria. The textbooks should be written in the form of packages to lessen the teacher's burden in our Junior secondary schools.
- Moreover, appropriate courses should be introduced into teacher education programmes for training teachers in the skill of designing useful learning packages, while school administrators at the junior secondary school level should provide the needed facilities and encourage Computer Studies teachers toward the development of usable and valid learning packages.
- It is also recommended that our educational system in Nigeria should embrace an Individual personalization instructional strategy that is capable of making the teaching and learning of Computer Studies more practical, interesting, and relevant to everyday life irrespective of the gender and Socioeconomic Status of the learners.

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PAPER 26 - ACCESSIBILITY AND SKILL LEVELS OF DISTANCE LEARNING STUDENTS' UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGY TOOLS IN KWARA STATE

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ABSTRACT

This study examined the accessibility and skill levels of distance learning students in utilizing Information and Communication Technology (ICT) tools in Kwara State, Nigeria. The research addresses the growing reliance on ICT in educational settings, particularly for distance learning programs. A survey method was employed using google form questionnaire, targeting distance learning students across various institutions within the state in which a total of 200 respondents participated. The study investigates the accessibility of ICT tools by distance learning students', and their proficiency in using them for academic purposes. Findings indicate that while a significant proportion of students have access to essential ICT tools, there are disparities in access related to socio-economic factors. Significant proportion of the students lacked adequate accessibility to essential ICT gadgets. Additionally, the skill levels among students vary widely, while some students demonstrating moderate proficiency in using ICT tools, a significant proportion have low level of skills in the usage of ICT tools.

KEYWORDS: ICT accessibility, Distance Learning, Skills Levels, Educational Technology, Kwara State, Socio-economy factors

INTRODUCTION

Information and communication technology (ICT) has revolutionized many areas of life, and education is no exception. Broadly defined, ICT refers to a diverse set of technological tools and resources used to transmit, store, create, share, or exchange information (Enebeli, 2024). In other words, it involves the use of computing and telecommunication technologies to facilitate the way information is created, collected, processed, transmitted, and stored (Owusu-Ansah, 2014). ICT encompasses a wide range of tools and services that work together to enhance communication, including devices such as radios, televisions, cell phones, and computers, as well as services like video conferencing and distance learning (Ozdamli, 2015). The role of ICT in knowledge dissemination is critical, as it ensures global access to information. However, accessibility to ICT devices is not universal, creating a digital divide that deprives disadvantaged populations of its benefits (Kumar, 2023).

This digital divide underscores the need for increased accessibility, ensuring that everyone, regardless of gender, age, ability, or location, has equal opportunities to use ICT. While traditionally, digital inaccessibility has been associated with people with disabilities, it applies to all groups disadvantaged by factors like location or socio-economic status. People with disabilities (PWDs) and those in remote areas face specific challenges in accessing ICT tools (Hizqiyah, 2022). However, distance should not be a barrier to digital accessibility, as people in rural or underserved areas also need ICT access to bridge the educational gap (Kaplan & Haenlein, 2016). Similarly, age should not restrict the ability to learn and use ICT devices, highlighting the importance of making digital environments accessible to all.

One of the most significant obstacles to digital accessibility, particularly for distance learners, is unstable internet connectivity, which hampers their ability to participate in online education (Hizqiyah, 2022). While the concept of distance learning has long existed, modern technology has transformed it from traditional correspondence courses into today's dynamic online learning systems (Ozsari & Aydin, 2024). Initially, students received course materials by mail and corresponded with their institutions without the need for physical attendance. However, the rise of ICT has led to the emergence of online courses, providing new opportunities for students to access education from anywhere (Masalimova, 2022).

Online distance learning differs from traditional, in-person education mainly due to the absence of physical presence in a classroom. In online learning, students can create flexible learning environments that suit their schedules, though it requires a high level of self-discipline to stay on track without constant monitoring from teachers (Muksin & Makhsin, 2021). This mode of learning can be delivered synchronously, where teaching and learning occur in real-time via video conferencing tools like Zoom or Blackboard Collaborate, or asynchronously, where students can access materials and complete assignments on their own time (Nasrullah, 2014). Asynchronous learning offers flexibility, allowing students to adapt their study time to their personal schedules.

The rapid growth of online distance learning, especially post-COVID-19, has highlighted both its advantages and challenges. By 2020, online learning exploded, with over 400 million students worldwide, up from 6.6 million in 2017 (Clyde, 2022). The flexibility, accessibility, and adaptability of online learning make it attractive to many students, allowing them to study without physically attending classes (Al-Hunaiyyan, 2021; Suhaimi & Francis, 2020). However, online learning also presents challenges, such as limited social interaction, distractions, complex technology, and hidden costs, including the need for reliable computers, internet access, and electricity (Al Rawashdey, 2021).

For distance learners to fully benefit from online education, they must possess essential ICT skills. These skills range from persistence and time management to effective communication, particularly in the absence of face-to-face interaction (Khateeb, 2021). Technical skills, such as using software applications, navigating the internet, and recognizing credible web resources, are also critical for success in an online learning environment (Faisal & Kisman, 2020; Erasmus & Joubert, 2017). For instance, Olubowale (2019) found that while distance learners in Lagos State were skilled in using basic software like MS Word and PowerPoint, they struggled with more advanced tools like MS Excel, SPSS, and digital libraries.

Learning Management Systems (LMS), which facilitate the online learning process by organizing assignments, presentations, and discussions, have become central to effective online education (Olubowale, 2019). These platforms enable students to interact with instructors and classmates, submit assignments, and access course materials. However, despite these technological advancements, barriers to ICT access persist for many distance learners. Aziken & Oveh (2024) found that inadequate technical support, user-unfriendly interfaces, and a lack of proper training limited ICT usability among Nigerian distance learners. Similarly, Adeoye, et al (2020) noted that limited digital literacy remains a significant obstacle, particularly in rural or underserved areas.

While ICT has transformed distance education by enabling it to be more flexible and accessible learning tools, significant challenges remain in ensuring equitable access to technology. As highlighted by multiple studies, factors such as socioeconomic disparities, poor infrastructure, and limited technical support continue to hinder the full potential of ICT in education (Adu et al., 2020; Mtebe & Raisamo, 2014). Overcoming these barriers is essential to ensuring that all students, regardless of their circumstances, can benefit from the opportunities that ICT and online distance learning offer.

STATEMENT OF THE PROBLEM

The online distance learning has become widely accepted by different categories of students worldwide. Those from elementary schools up to those in the universities are not exempted. Online classes have several advantages over the traditional physical classes major of which is ability of teaching and learning to take place without teachers and students physically present in the same location. Advancement in technologies has even made it easier to be having a lecture with student from all over the world at a real time. The use of information and communication technology is central to this activities, hence the students need some basic knowledge of ICT for them to fully benefit from online distance learning.

PURPOSE OF THE STUDY

The main purpose of this study was to assess the basic ICT skills of online distance learning students in Kwara State and the objectives were:

1. To examine the level of accessibility of ICT tools among distance learning students in Kwara State.
2. To examine the usability level of ICT tools among distance learning students in Kwara State.

RESEARCH QUESTIONS

The following questions were answered in this study.

1. What is the level of accessibility to ICT tools among distance learning students in Kwara State?
2. What is the usability level of ICT tools among distance learning students in Kwara State?

METHODOLOGY

The research was a descriptive study in which the researchers surveyed the accessibility and ICT skills of distance learning students in Kwara State. A Goggle form titled "Accessibility and skill level of distance learning students' utilization of ICT tools in Kwara State" was designed by the researchers, and this was used to collect responses from the respondents. The study was carried out in Kwara State, among the students of The National Open University of Nigeria (NOUN) Ilorin Study Centre and University of Ilorin. The population for the study consisted of all students of NOUN and University of Ilorin Open and Distance Learning (ODL) that registered. A total of two hundred respondents were selected through Google form submission control. Descriptive statistics of mean and frequency count was used to analyze all research questions using Statistical Package for Social Sciences (SPSS) version 26.0.

RESULTS AND DISCUSSION

1. **Research question 1:** What is the accessibility level of ICT tools among distance learning students in Kwara State?

Table 1:

Accessibility level of ICT tools among distance learning students in Kwara State

Item	LA	MA	HA	VHA	Mean
ACC1	28	76	0	104	2.87
ACC2	44	76	0	88	2.63
ACC3	52	100	0	56	2.29
ACC4	36	84	0	88	2.67
ACC5	52	92	0	64	2.37
ACC6	48	104	0	56	2.31
ACC7	48	124	0	36	2.12
Average mean					**2.47**

The table illustrates the accessibility levels of ICT tools among distance learning students in Kwara State, using seven different items (ACC1 to ACC7) to measure the extent of accessibility. The accessibility levels are categorized as **Low Accessibility (LA), Moderate Accessibility (MA), High Accessibility (HA),** and **Very High Accessibility (VHA).** The mean scores for each item range from **2.12 to 2.87**, suggesting a general trend of **moderate to low accessibility**. Item 1 (I have regular access to a reliable internet connection for my distance learning activities) shows the highest mean score of **2.87**, indicating a closer tilt towards moderate accessibility, while **item 7 (**I have quick access to the ICT tools provided by my institution**)** has the lowest mean score of **2.12**, reflecting a lower accessibility level. The overall **average mean** of the items is **2.47**, which aligned with moderate accessibility. It is important to note that no respondents reported high accessibility (HA) across any of the items, and the variation in responses for low and moderate accessibility categories highlights significant limitations in access to ICT tools for these students. This is similar to the finding of **Adu et al. (2020)** observed that distance learners face challenges like inadequate internet access, insufficient technological infrastructure, and high costs, making it difficult for them to utilize ICT tools effectively.

Research question 2: What is the usability level of ICT tools among distance learning students in Kwara State?

Table 2:

Usability levels of ICT tools among distance learning students in Kwara State

Item	LU	MU	HU	VHU	Mean
UT1	32	104	0	72	2.54
UT2	56	60	36	56	2.44
UT3	60	60	52	36	2.31
UT4	80	48	40	40	2.19
UT5	76	64	36	32	2.12
UT6	48	80	40	40	2.35
UT7	44	76	44	44	2.42
UT8	68	64	28	48	2.27
UT9	76	40	44	48	2.31
UT10	60	56	36	56	2.42
Average mean					**2.34**

The table 2 outlines the usability levels of ICT tools among distance learning students in Kwara State, evaluated through 10 different items (UT1 to UT10). Usability is categorized into **Low Usability (LU), Moderate Usability (MU), High Usability (HU)**, and **Very High Usability (VHU)**. The mean scores range from **2.12 to 2.54,** reflecting an overall **moderate level of usability** across most items. **Item 1** (I regularly use the online learning platform (e.g., LMS) to access course content) has the highest mean score of **2.54**, indicating relatively better usability, while **item 5** (I use educational apps or software (e.g., language learning apps, simulation software) to supplement my learning) has the lowest mean of **2.12,** showing poorer usability. The **average mean score** across all items is **2.34**, suggesting that the overall usability of ICT tools is closer to **moderate** but with notable challenges for many students. These findings are in line with the study by Aziken & Oveh (2024**),** which examined the challenges among distance learners in Nigeria. They found that many students face barriers such as insufficient technical support, difficult-to-navigate interfaces, and a lack of proper training, which contribute to moderate usability levels. Additionally, **Adeoye et al., (2020)** noted that many distance learners encounter difficulties in effectively using ICT tools due to limited digital literacy.

CONCLUSION

In conclusion, the accessibility and usability of ICT tools among distance learning students in Kwara State are generally moderate, with significant challenges limiting their effective use. While some students experience moderate access and usability, a notable portion still faces barriers such as inadequate infrastructure, lack of technical support, and digital illiteracy, which hinder the full potential of ICT tools in enhancing distance education. Addressing these challenges is crucial for improving the learning experience and outcomes for these students.

RECOMMENDATION

Based on the findings, the following recommendations are made:

1. The government and educational institutions should invest in upgrading ICT infrastructure, including reliable internet access and affordable devices, to enhance accessibility for distance learning students.
2. Institutions should establish dedicated technical support systems to assist students in overcoming challenges with ICT tools, ensuring smoother and more efficient usage.
3. Regular training programs should be provided to students to improve their digital literacy skills, enabling them to effectively utilize ICT tools for their learning activities.
4. The government, in collaboration with educational institutions, should explore options for subsidizing or providing financial support for ICT tools and internet services, particularly for students from low-income backgrounds.
5. Continuous evaluation of the usability of ICT tools should be conducted to identify areas for improvement and to ensure that these tools are user-friendly and aligned with students' needs.

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PAPER 27 - SKILLS IMPROVEMENT REQUIRED OF AUTOMOBILE MECHANICS FOR SMALL SCALE AUTOMOBILE WORKSHOP IN CODE READING OF FAULTS AND RECTIFICATION OF FAULTS

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ABSTRACT

This study was designed to identify skills required of automobile mechanics graduates for small scale automobile workshop in code reading of faults and rectification of faults. Two research questions guided the study. A descriptive research design was employed for the study. The study was carried out in Lagos and Ogun States of Nigeria. A total of 350 respondents comprising of registered automobile mechanics drawn through the use of proportional stratified random sampling techniques was used as a total population for the study. A structured questionnaire titled Automobile Graduates Skills for Small Scale Automobile Workshop in Code Reading of fault and Ratification of Faults (AGASSAWCRFRF) was developed by the researcher and validated by three experts (one from department of metalwork technology, Lagos State University of Education, Ijanikin Lagos and two from Industrial technical Education Department, Tai Solarin University of Education Ijebu Ode) was used for the data collected for the study. Statistically package for Social Science (SPSS Version 23) was used for data analysis. Mean and standard deviation were the statistical tools for answering for answering research question. The findings of the study revealed among others that all among others that all identified skills in the study were highly required by auto-mechanic graduates for establishing small scale automobile workshop in Nigeria. Based on the findings, it was recommended that: The National Automotive Design and Development Council (NADDC) charged with responsibility of organizing training and refresher programmes for auto mechanic should in collaboration with the federal ministry of labour and productivity incorporates the identified skill required by auto-mechanic graduates to establish small scale workshop as this expose them to a new innovation in modern automobiles and thus boost there performances in the of undertaking the repairs and maintenance of modern motor vehicle their establish workshop. Since many of the auto-mechanic graduates are product of Technical colleges in Nigeria, Nation board for technical Education (NBTE) Can Also integrate the all required by auto-mechanic graduate identify the study into curriculum of Auto-mechanic work Programmes as this will long way to encourage and strengthened the students interest toward code reading of fault and rectification of fault in small scale automobile workshop upon graduation.

KEYWORDS: Motor vehicle mechanic graduate, Codes, Faults, Skills, and automobile work

INTRODUCTION

Small scale businesses represent the overwhelming majority of industrial capacity in developing countries such as Nigeria, Togo, Ghana, Ivory Coast among others. An automobile workshop qualifies as a small-scale business as it possesses the lined characteristics. Automobile, according to Fetherston (2019), is a self-propelled motor vehicle, used primarily for passenger transportation on public roads. Abwage (2017), defined automobile as a self-propelled land motor vehicle usually having four wheels and an internal combustion engine, used for personal and public transportation. It is of different types according to styles, number of doors and purpose of uses. Thus, we have cars,

having four wheels and can carry up to five people including the driver; vans, minivans or buses, designed to carry more passengers; pickups or trucks depending on their sizes and designs, to carry cargo; sport utility motor vehicles also known as SUVs used for driving in mud or snow (Fertherson, 2009). However, when these motor vehicles developed one fault or the other, they are being taken care of in an automobile workshop and by a professionally competent motor vehicle mechanic.

The new skills of code reading of faults and rectification of faults required by automobile mechanic graduates are the skilled based components which includes equipment and facilities handling skills for small scale automobile workshop. These components are necessary because of modern motor vehicles are equipped with electrical gadgets such as fault detecting sockets, sensors, among others. Modern engines have a number of technologies in place to make them more efficient. For example, direct injection technology, which mixes the fuel and air before they are put into the cylinder which in turn improves engine efficiency.

A workshop, according to Jubril (2015) is a place, area, shop or building where machines, equipment, hand tools, workbenches and materials are used in manufacturing or repairing of things. Therefore, an automobile workshop is a place where basic motor vehicle maintenance is being carried out by auto mechanics or motor vehicle mechanic. An auto mechanic may be knowledgeable in working on all parts of a variety of car models, or may specialize either in a specific skill area of automobile or on a specific model or brand of car. His job includes accurate diagnosis of car problems and repair (US Occupational Handbook, 2012).

For a small scale business, like automobile workshop to be established and also to succeed, there are some skills needed to be possessed by the individual. According to Osuala (2004), competition is a major force driving business to be more efficient and to employ strategies that will improve production, service and product quality. The automobile mechanic therefore needs to posses both employability skills, managerial skill and technical skills for the operation of automobile workshop. Employability skills are those basic skills or general work skills necessary for getting, keeping and doing well on a job (Robinson, 2000). A grouping of such skills is summarized by Osuala (2004) as Individual competence: communication skills, comprehension, computation and culture, Personal reliability skills: personal management, ethics and vocational maturity, Economic adaptability skills: problem solving, learning employability and career development and group and organizational skills: inter-personal skills, organizational skills and skills in negotiation, creativity and leadership. The success or failure of any business depends to a very large extent on the skills possessed by the operator of the business. Also Olayinka and Oyenuga (2010) stated that the central purpose of motor vehicle mechanic work trade is to provide its recipient with the skill required for work in the automobile industry. Unfortunately, curriculum planners, heads of institutions and implementers do not consider the place of these skills such as the employability and technical skills in the establishment of small scale automobile workshop, hence the need to study the need for new skills to the training of auto mechanic students towards establishment of small scale automobile workshops by graduates for enhancing job creation, entrepreneurship development and wealth generation.

Motor vehicle mechanic is one of the mechanical engineering trades which involve the acquisition of scientific knowledge in design, selection of materials, construction, operation and maintenance of motor vehicles. Motor vehicle mechanic work trade at the technical college level consists of three components/subjects grouping as: Service Station Mechanic Work, Engine Maintenance and Refurbishing and Auto Electricity. Welbur (1999) described motor vehicle mechanic as a person who, for compensation, engages in the diagnosis or repair of faulty motor vehicles components or system. This means that auto-mechanics are responsible for the service and repair of motor vehicles including undertaking work on engine, transmission, differential, steering, suspension and brakes in their business enterprises which can be operated as automobile enterprises.

Small scale automobile workshop in the context of this study refer to a designated place or room where workbenches, mechanical tool boxes, scanning machine and other basic motor vehicle maintenance and repair tools and standard equipment are used for motor vehicle maintenance by auto-mechanics. However, in the words of Olaitan and Ikeh (2015) small scale automobile workshop refer to independent motor vehicle maintenance mechanic garages set up by auto-mechanic master craftsmen under private ownership for the purpose of self-employment and employing others. Although automobile industrial technicians most at times serves to compliment the efforts of motor vehicle mechanic master craftsmen in terms of maintenance and repairs of modern motor vehicle in the automobile industries. However notwithstanding, other businesses opportunities available in an small scale automobile workshop include: car dealership, spare parts distribution and jobbers. In other words, activities such as Auto body repair and spraying and painting, Auto electrical work, Auto body mechanic work and Auto body building (panel beating) are also available in small scale automobile workshop for maintenance and repairs.

Maintenance is a repair activity carried out on motor vehicles or other machineries to keep them unaltered, and if altered, to restore them to their original state (Okah-Avae 1995; Akinola and Ogedengbe, 2005). Narayan (2004) also stated that maintenance involves taking specific approved steps and precautions to care for a piece of equipment, machinery or facility and ensure it attains its maximum shelf-life. In the context of this study, maintenance is the adherence to the manufacturer's schedule for motor vehicle upkeep plus the repair of systems or faults that have led to excess emissions. This also means that mechanics generally required to be equipped with improved skills necessary for the maintenance and repairs of modern motor vehicles, this is because conventional technology competencies already possessed by them cannot take care of emerging technologies on modern motor vehicles.

Skills required can be described as the improved technical expertise needed in the manipulation of devices, machines and new techniques for manufacturing and productive processes. Osinem (2008) pointed out that, technology competencies are types of expertise requiring a good understanding and proficiency in a specific activity, particularly one involving methods, procedures or technique and processes. Improved skills in auto-mechanics however, refer to set of competencies required by motor vehicle mechanic for the maintenance and repairs of modern motor vehicles according to the manufacturers' specifications. According to Nna (2001) today's modern motor vehicles contain more embedded electronic components and controls that require a higher degree of sophistication for testing and servicing, as well as special On-Board Diagnostic (OBD) tools and test instruments.

Although, Parts of these modern motor vehicle system and subsystem affected with emerging technologies according to Abubakar, Yahaya and Tijana (2015) includes: Fuel system, Ignition system and Transmission system.

The main function of fuel system is to store and supply fuel to the engine. Giri (2010) stated that, fuel supply system also prepare the air/fuel mixture for the combustion in the cylinder and carries the exhaust gas to the rear of the motor vehicle. The early motor vehicle fuel systems were completely mechanical systems delivering fuel through the use a mechanical fuel pump and a carburetor to atomize and mix the fuel with air (Salami, 2004). The modern motor vehicle fuel system according to Julian (2015) is of electronically controlled and monitored. Accordingly, the ignition system provides the spark necessary to ignite the air/fuel mixture inside the engine for it to burn. The spark must be provided at the correct time and sequence to the various cylinders in order to produce maximum horsepower with the least amount of fuel thus emitting the lowest amount of harmful emissions (Salami, 2007). The basic components of an electronic ignition system include: trigger wheel, pick up coil and electronic control unit amplifier (ECU).

From the foregoing, it can be seen that modern automobiles are blend of 20th century and 21st century technology. Marchief (2017) Observed that the designs of modern motor vehicles have advanced to a very sophisticated level. Unlike the old mechanical operated motor vehicle systems, the modern motor vehicles are being operated and controlled by computerized electrical sensors. Indeed, almost every other function within the engine is controlled by an on-board computer. Hence; in spite of all emerging technologies on modern motor vehicles, the business of mechanic in the automobile enterprises should be to undertake the maintenance and repairs of both conventional motor vehicles and modern motor vehicles equipped with integrated electronic systems and computers. Auto-mechanic either operates as paid employees in the automobile industry and other organizations or as self-employed in their enterprises in the automobile world of work.

Hamidu,Abdulkadir and Idris (2022) observed that most auto-mechanic who generally enjoyed constant flow of customers for effective maintenance and repairs of conventional motor vehicles are now faced with the challenges of how to either troubleshoot or fully undertake the maintenance and repairs of modern motor vehicles presently equipped and controlled primarily by computers and electronics components in their enterprises. Aruku (2007) stipulated that, with sophistication in modern motor vehicles due to advancement in technology, the artisans as well as the motor vehicle master craftsmen are finding it difficult to handle repairs of faults in motor motor vehicle generally and the new motor vehicles specifically. Nyapson (2015) pointed out that, Motor Vehicle Mechanic graduates cannot compete favourably in the global workforce due to lack of appropriate skills in testing, diagnosing, servicing and completely repair faults on a modern motor vehicle according to manufacturer's specification. This situation has made most automobile enterprises established by auto-mechanic graduates a dumping ground for these modern motor vehicles that seems to have either developed minor or major fuel supply system, ignition system problems, mechanical problem, transmission problems and electronic problems.

The foregoing might not be unconnected with the fact that these motor vehicle mechanic graduates do not possessed new technical knowhow to undertake the maintenance and repairs of modern motor vehicles, but seems to be faced

with the lack of improved skills required to fully undertake the maintenance and repairs on fuel and ignition systems of modern motor vehicles: This study therefore posed to identify the improved skills required for establishing small scale automobile workshop by auto-mechanic graduates in Nigeria.

STATEMENT OF THE PROBLEM

The maintenance and repair of modern cars differ from that of older motor vehicles in that computers and technology impacts are being included in every part of the motor vehicle. Looking around, hardly can one find an existing small scale automobile workshop that can competently handle the repairs of new model motor vehicles without a referral elsewhere. The automobile car repair business has not stopped shifting and changing, right along with the dynamic of the automobile. With such a rapidly-changing, this industry does not lend itself to business as usual. Those within it must keep up with all the changes and advancements. They must stay attuned to their target, try to convince and retain most customers in order not to shift to others.

AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to identify the improved skills required by auto-mechanic graduates for small scale automobile workshop establishment in code reading of faults and rectification of faults; specifically, the objectives of the study are to:

1. determine the improved skills required by auto-mechanic graduates in the maintenance of Fuel System for small scale automobile workshop in code reading of faults and rectification of faults.
2. find out the improved skills required by auto-mechanic graduates in the maintenance of Ignition System for small scale automobile workshop in code reading of faults and rectification of faults.

RESEARCH QUESTIONS

The following research questions were answered in this study;

1. What are the improved skills required by motor vehicle mechanic graduates in the maintenance of fuel system for small scale automobile workshop in code reading of faults and rectification of faults?
2. What are the improved skills required by motor vehicle mechanic graduates in the maintenance of ignition system for small scale automobile workshop in code reading of faults and rectification of faults?

METHODOLOGY

A descriptive research design was employed for the study. The study was carried out in Lagos and Ogun State of Nigeria. A total of 350 respondents who are motor vehicle mechanic master craftsmen drawn from a total number of

motor vehicle mechanic master craftsmen that was 500 through the use of a proportional stratified random sampling technique was used as a total population for the study. A structured questionnaire titled Automobile Graduates Improved Skill for Small Scale Automobile Workshop in Code Reading of Faults and Rectification of Faults (AGISSSAWCRFRF) and developed by the researcher and validated by three experts was used for data collection for the study. The questionnaire items were assigned four points rating scale of: highly required (4), required (3), moderately required (2), and not required (1). The reliability coefficient of the instrument was 0.85 using Cronbach Apha statistics: Statistical Package for Social Science (SPSS Version 23) was used for the data analysis. 350 copies of questionnaire were distributed to respondents; 336 copies were duly filled by the respondents and returned representing 96%. Mean and standard deviation were the statistical tools for answering research questions. Decisions for research questions were based on the resulting mean scores interpreted relative to the concept of real lower and upper limits of numbers.

RESEARCH QUESTION 1

What are the improved skills required by motor vehicle mechanic graduates in the maintenance of fuel system for small scale automobile workshop in code reading of faults and rectification of faults?

Table 1

Mean and Standard Deviation of Opinion of Respondents on the improved skills Required by Auto-mechanic graduates in the Maintenance of fuel supply system on air/Fuel mixture control for small scale auto-mechanic workshop in code reading of faults and rectification of faults.
Fuel System Standard fault codes from P0001 to P0099

SN	CODE	ITEMS	N	MEAN	SD	DECISION
1	P0001	Fuel Volume Regulator Control Circuit / Open	336	3.51	0.33	Highly Required
2	P0002	Fuel Volume Regulator Control Circuit Range/Performance	336	3.53	0.25	Highly Required
3	P0003	Fuel Volume Regulator Control Circuit Low	336	3.56	0.25	Highly Required
4	P0004	Fuel Volume Regulator Control Circuit High	336	3.51	0.35	Highly Required
5	P0005	Fuel Shutoff Valve Control Circuit / Open	336	3.19	0.30	Required
6	P0006	Fuel Shutoff Valve Control Circuit Low	336	3.16	0.34	Required
7	P0007	Fuel Shutoff Valve Control Circuit High	336	3.65	0.35	Highly Required
8	P0008	Engine Position System Performance - Bank 2	336	3.30	0.14	Required
9	P0009	Engine Position System Performance - Bank 2	336	3.57	0.19	Highly Required
10	P0010	Intake Camshaft Position Actuator Circuit / Open (Bank 2)	336	3.63	0.94	Highly Required
11	P0011	Intake Camshaft Position Timing - Over-Advanced (Bank 2)	336	3.61	0.12	Highly Required
12	P0012	Intake Camshaft Position Timing - Over-Retarded	336	3.51	0.12	Highly

		(Bank 2)				Required
13	P0013	Exhaust Camshaft Position Actuator Circuit / Open (Bank 2)	336	3.68	0.01	Highly Required
14	P0014	Exhaust Camshaft Position Timing - Over-Advanced (Bank 2)	336	3.56	0.20	Highly Required
15	P0015	Exhaust Camshaft Position Timing - Over-Retarded (Bank 2)	336	3.64	0.13	Highly Required
16	P0016	Crankshaft Position Camshaft Position Correlation Bank 1 Sensor A	336	3.59	0.30	Highly Required
17	P0017	Crankshaft Position Camshaft Position Correlation Bank 2 Sensor B	336	3.52	0.25	Highly Required
18	P0018	Crankshaft Position Camshaft Position Correlation Bank 2 Sensor A	336	3.64	0.23	Highly Required
19	P0019	Crankshaft Position Camshaft Position Correlation Bank 1 Sensor B	336	3.61	0.27	Highly Required
20	P0020	Intake Camshaft Position Actuator Circuit / Open (Bank 2)	336	3.53	0.28	Highly Required
21	P0021	Intake Camshaft Position Timing - Over-Advanced (Bank 2)	336	3.54	0.23	Highly Required
22	P0022	Intake Camshaft Position Timing - Over-Retarded (Bank 2)	336	3.51	0.28	Highly Required
23	P0023	Exhaust Camshaft Position Actuator Circuit / Open (Bank 2)	336	3.58	0.32	Highly Required
24	P0024	Exhaust Camshaft Position Timing - Over-Advanced (Bank 2)	336	3.52	0.34	Highly Required
25	P0025	Exhaust Camshaft Position Timing - Over-Retarded (Bank 2)	336	3.64	0.13	Highly Required
26	P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	336	3.51	0.33	Highly Required
27	P0027	Exhaust Valve Control Solenoid Circuit Range/Performance (Bank 2)	336	3.53	0.25	Highly Required
28	P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	336	3.56	0.25	Highly Required
29	P0029	Exhaust Valve Control Solenoid Circuit Range/Performance (Bank 2)	336	3.51	0.35	Required
30	P0030	Heated Oxygen Sensor (H02S) Heater Control Circuit Bank 2 Sensor 1	336	3.19	0.30	Required
31	P0031	Heated Oxygen Sensor (HO2S) Heater Circuit Low Voltage Bank 2 Sensor 1	336	3.16	0.34	Highly Required
32	P0032	Heated Oxygen Sensor (HO2S) Heater Circuit High Voltage Bank 2 Sensor 1	336	3.65	0.35	Required
33	P0033	Turbo/Super Charger Bypass Valve Control Circuit / Open	336	3.30	0.14	Highly Required
34	P0034	Turbo/Super Charger Bypass Valve Control Circuit Low	336	3.57	0.19	Highly Required
35	P0035	Turbo/Super Charger Bypass Valve Control Circuit	336	3.63	0.94	Highly

		High				Required
36	P0036	Heated Oxygen Sensor (HO2S) Heater Control Circuit Bank 2 Sensor 2	336	3.51	0.35	Highly Required
37	P0037	Heated Oxygen Sensor (HO2S) Heater Circuit Low Voltage Bank 2 Sensor 2	336	3.30	0.14	Highly Required
38	P0038	Heated Oxygen Sensor (HO2S) Heater Circuit High Voltage Bank 2 Sensor 2	336	3.64	0.13	Highly Required
39	P0039	Turbo/Super Charger Bypass Valve Control Circuit Range/Performance	336	3.51	0.33	Highly Required
40	P0040	Oxygen Sensor Signals Swapped Bank 2 Sensor 1 / Bank 2 Sensor 1	336	3.53	0.25	Highly Required
41	P0041	Oxygen Sensor Signals Swapped Bank 2 Sensor 2 / Bank 2 Sensor 2	336	3.56	0.25	Highly Required
42	P0042	HO2S Heater Control Circuit (Bank 2, Sensor 3)	336	3.51	0.35	Highly Required
43	P0043	HO2S Heater Control Circuit Low (Bank 2, Sensor 3)	336	3.19	0.30	Highly Required
44	P0044	HO2S Heater Control Circuit High (Bank 2, Sensor 3)	336	3.16	0.34	Highly Required
45	P0046	Turbo/Super Charger Boost Control Solenoid Circuit / Open	336	3.65	0.35	Highly Required
46	P0046	Turbo/Super Charger Boost Control Solenoid Circuit Range/Performance	336	3.30	0.14	Highly Required
47	P0047	Turbo/Super Charger Boost Control Solenoid Circuit Low	336	3.57	0.19	Highly Required
48	P0048	Turbo/Super Charger Boost Control Solenoid Circuit High	336	3.63	0.94	Highly Required
49	P0049	Turbo/Super Charger Turbine Overspeed	336	3.61	0.12	Highly Required
50	P0050	Heated Oxygen Sensor (HO2S) Heater Circuit Bank 2 Sensor 1	336	3.51	0.12	Highly Required
51	P0051	Heated Oxygen Sensor (HO2S) Heater Circuit Low Voltage Bank 2 Sensor 1	336	3.68	0.01	Highly Required
52	P0052	Heated Oxygen Sensor (HO2S) Heater Circuit High Voltage Bank 2 Sensor 1	336	3.56	0.20	Highly Required
53	P0053	HO2S Heater Resistance Bank 2 Sensor 1 (PCM)	336	3.64	0.13	Required
54	P0054	HO2S Heater Resistance Bank 2 Sensor 2 (PCM)	336	3.59	0.30	Required
55	P0055	HO2S Heater Resistance Bank 2 Sensor 3 (PCM)	336	3.51	0.33	Highly Required
56	P0056	Heated Oxygen Sensor (HO2S) Heater Circuit Bank 2 Sensor 2	336	3.53	0.25	Required
57	P0057	Heated Oxygen Sensor (HO2S) Heater Circuit Low Voltage Bank 2 Sensor 2	336	3.56	0.25	Highly Required
58	P0058	Heated Oxygen Sensor (HO2S) Heater Circuit High Voltage Bank 2 Sensor 2	336	3.51	0.35	Highly Required
59	P0059	HO2S Heater Resistance (Bank 2, Sensor 1)	336	3.19	0.30	Highly

						Required
60	P0060	HO2S Heater Resistance (Bank 2, Sensor 2)	336	3.16	0.34	Highly Required
61	P0061	HO2S Heater Resistance (Bank 2, Sensor 3)	336	3.65	0.35	Highly Required
62	P0062	HO2S Heater Control Circuit (Bank 2, Sensor 3)	336	3.30	0.14	Highly Required
63	P0063	HO2S Heater Control Circuit Low (Bank 2, Sensor 3)	336	3.57	0.19	Highly Required
64	P0064	HO2S Heater Control Circuit High (Bank 2, Sensor 3)	336	3.63	0.94	Highly Required
65	P0065	Air Assisted Injector Control Range/Performance	336	3.61	0.12	Highly Required
66	P0066	Air Assisted Injector Control Circuit or Circuit Low	336	3.51	0.12	Highly Required
67	P0067	Air Assisted Injector Control Circuit or Circuit High	336	3.68	0.01	Highly Required
68	P0068	MAP / MAF - Throttle Position Correlation	336	3.56	0.20	Highly Required
69	P0069	MAP - Barometric Pressure Correlation	336	3.64	0.13	Highly Required
70	P0070	Ambient Air Temperature Sensor Circuit	336	3.59	0.30	Highly Required
71	P0071	Ambient Air Temperature Sensor Range/Performance	336	3.51	0.33	Highly Required
72	P0072	Ambient Air Temperature Sensor Circuit Low Input	336	3.53	0.25	Highly Required
73	P0073	Ambient Air Temperature Sensor Circuit High Input	336	3.56	0.25	Highly Required
74	P0074	Ambient Air Temperature Sensor Circuit Intermittent/Erratic	336	3.51	0.35	Highly Required
75	P0075	Intake Valve Control Circuit (Bank 2)	336	3.19	0.30	Highly Required
76	P0076	Intake Valve Control Circuit Low (Bank 2)	336	3.16	0.34	Highly Required
77	P0077	Intake Valve Control Circuit High (Bank 2)	336	3.65	0.35	Required
78	P0078	Exhaust Valve Control Circuit (Bank 2)	336	3.30	0.14	Required
79	P0079	Exhaust Valve Control Circuit Low (Bank 2)	336	3.57	0.19	Highly Required
80	P0080	Exhaust Valve Control Circuit High (Bank 2)	336	3.63	0.94	Required
81	P0081	Intake Valve Control Circuit (Bank 2)	336	3.61	0.12	Highly Required
82	P0082	Intake Valve Control Circuit Low (Bank 2)	336	3.51	0.12	Highly Required
83	P0083	Intake Valve Control Circuit High (Bank 2)	336	3.68	0.01	Highly Required

84	P0084	Exhaust Valve Control Circuit (Bank 2)	336	3.51	0.33	Highly Required
85	P0085	Exhaust Valve Control Circuit Low (Bank 2)	336	3.53	0.25	Highly Required
86	P0086	Exhaust Valve Control Circuit High (Bank 2)	336	3.56	0.25	Highly Required
87	P0087	Fuel Rail/System Pressure - Too Low	336	3.51	0.33	Highly Required
88	P0088	Fuel Rail/System Pressure - Too High	336	3.53	0.25	Highly Required
89	P0089	Fuel Pressure Regulator Performance	336	3.56	0.25	Highly Required
90	P0090	Fuel Pressure Regulator Control Circuit	336	3.51	0.35	Highly Required
91	P0091	Fuel Pressure Regulator Control Circuit Low	336	3.19	0.30	Highly Required
92	P0092	Fuel Pressure Regulator Control Circuit High	336	3.16	0.34	Highly Required
93	P0093	Fuel System Leak Detected - Large Leak	336	3.65	0.35	Highly Required
94	P0094	Fuel System Leak Detected - Small Leak	336	3.30	0.14	Highly Required
95	P0095	Intake Air Temperature Sensor 2 Circuit	336	3.57	0.19	Highly Required
96	P0096	Intake Air Temperature Sensor 2 Circuit Range/Performance	336	3.59	0.30	Highly Required
97	P0097	Intake Air Temperature Sensor 2 Circuit Low Input	336	3.61	0.12	Highly Required
98	P0098	Intake Air Temperature Sensor 2 Circuit High Input	336	3.51	0.12	Highly Required
99	P0099	Intake Air Temperature Sensor 2 Circuit Intermittent/Erratic	336	3.56	0.20	Highly Required
		Grand Mean/SD	336	3.52	0.34	Highly Required

Note: N = Number of Respondents, SD = Standard Deviation

Analysis in Table 1 showed that the respondents agreed with all the items with mean of 3.52 as improved skills required by auto-mechanic graduates in the maintenance of fuel system for *small scale auto-mechanic workshop in code reading of faults and rectification of faults*

RESEARCH QUESTION 2

What are the improved skills required by motor vehicle mechanic graduates in the maintenance of ignition system for small scale automobile workshop in code reading of faults and rectification of faults?

Table 2

Mean and Standard Deviation of Opinion of Respondents on the Improved skills Required by Auto-mechanic in the Maintenance of Ignition System for the Establishment of small scale auto-mechanic workshop in code reading of faults and rectification of faults

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Ignition System standard fault codes from P0300 to 396

SN	Code	Item	N	Mean	SD	Decision
1	P0300	Random/Multiple Cylinder Misfire Detected	336	3.30	0.14	Highly Required
2	P0301	Cylinder 1 Misfire Detected	336	3.32	024	Highly Required
3	P0302	Cylinder 2 Misfire Detected	336	3.57	0.19	Highly Required
4	P0303	Cylinder 3 Misfire Detected	336	3.59	0.30	Highly Required
5	P0304	Cylinder 4 Misfire Detected	336	3.61	0.12	Highly Required
6	P0305	Cylinder 5 Misfire Detected	336	3.51	0.12	Highly Required
7	P0306	Cylinder 6 Misfire Detected	336	3.56	0.20	Highly Required
8	P0307	Cylinder 7 Misfire Detected	336	3.52	0.34	Highly Required
9	P0308	Cylinder 8 Misfire Detected	336	3.51	0.27	Highly Required
10	P0309	Cylinder 9 Misfire Detected	336	3.56	0.04	Highly Required
11	P0310	Cylinder 10 Misfire Detected	336	3.50	0.28	Highly Required
12	P0311	Cylinder 11 Misfire Detected	336	3.31	0.12	Required
13	P0312	Cylinder 12 Misfire Detected	336	3.65	0.35	Highly Required
14	P0313	Misfire Detected with Low Fuel	336	3.55	0.21	Highly Required
15	P0314	Single Cylinder Misfire (Cylinder not Specified)	336	3.57	0.19	Highly Required
16	P0315	Crankshaft Position System Variation Not Learned	336	3.60	0.28	Highly Required
17	P0316	Misfire Detected On Startup (First 1000 Revolutions)	336	3.69	0.30	Highly Required
18	P0317	Rough Road Hardware Not Present	336	3.51	0.01	Highly Required
19	P0318	Rough Road Sensor A Signal Circuit	336	3.66	0.20	Highly Required

20	P0319	Rough Road Sensor B Signal Circuit	336	3.55	0.35	Highly Required
21	P0320	Ignition/Distributor Engine Speed Input Circuit Malfunction	336	3.69	0.30	Highly Required
22	P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	336	3.55	0.21	Highly Required
23	P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	336	3.15	0.35	Required
24	P0323	Ignition/Distributor Engine Speed Input Circuit Intermittent	336	3.55	0.35	Highly Required
25	P0324	Single Cylinder Misfire (Cylinder not Specified)	336	3.65	0.35	Highly Required
26	P0325	Knock Sensor 1 Circuit (Bank 2 or Single Sensor)	336	3.61	0.12	Highly Required
27	P0326	Knock Sensor 1 Circuit Range/Performance (Bank 2 or Single Sensor)	336	3.32	024	Highly Required
28	P0327	Knock Sensor 1 Circuit low Input (Bank 2 or Single Sensor)	336	3.57	0.19	Highly Required
29	P0328	Knock Sensor 1 Circuit High Input (Bank 2 or Single Sensor)	336	3.59	0.30	Highly Required
30	P0329	Knock Sensor 1 Circuit Input Intermittent (Bank 2 or Single Sensor)	336	3.61	0.12	Highly Required
31	P0330	Knock Sensor 2 Circuit (Bank 2)	336	3.51	0.12	Highly Required
32	P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	336	3.56	0.20	Highly Required
33	P0332	Knock Sensor 2 Circuit Low Input (Bank 2)	336	3.52	0.34	Highly Required
34	P0333	Knock Sensor 2 Circuit High Input (Bank 2)	336	3.51	0.27	Highly Required
35	P0334	Knock Sensor 2 Circuit Input Intermittent (Bank 2)	336	3.56	0.04	Highly Required
36	P0335	Crankshaft Position Sensor A Circuit Malfunction	336	3.50	0.28	Highly Required
37	P0336	Crankshaft Position Sensor A Circuit Range/Performance	336	3.31	0.12	Required
38	P0337	Crankshaft Position Sensor A Circuit Low Input	336	3.65	0.35	Highly Required
39	P0338	Crankshaft Position Sensor A Circuit High Input	336	3.55	0.21	Highly Required
40	P0339	Crankshaft Position Sensor A Circuit Intermittent	336	3.57	0.19	Highly Required
41	P0340	Camshaft Position Sensor Circuit Malfunction	336	3.60	0.28	Highly Required
42	P0341	Camshaft Position Sensor Circuit Range/Performance	336	3.69	0.30	Highly Required

43	P0342	Camshaft Position Sensor Circuit Low Input	336	3.51	0.01	Highly Required
44	P0343	Camshaft Position Sensor Circuit High Input	336	3.66	0.20	Highly Required
45	P0344	Camshaft Position Sensor Circuit Intermittent	336	3.55	0.35	Highly Required
46	P0345	Camshaft Position Sensor A Circuit (Bank 2)	336	3.51	0.27	Highly Required
47	P0346	Camshaft Position Sensor A Circuit Range/Performance (Bank 2)	336	3.56	0.04	Highly Required
48	P0347	Camshaft Position Sensor A Circuit Low Input (Bank 2)	336	3.50	0.28	Highly Required
49	P0348	Camshaft Position Sensor A Circuit High Input (Bank 2)	336	3.31	0.12	Required
50	P0349	Camshaft Position Sensor A Circuit Intermittent (Bank 2)	336	3.65	0.35	Highly Required
51	P0350	Ignition Coil Primary/Secondary Circuit Malfunction	336	3.55	0.21	Highly Required
52	P0351	Ignition Coil A Primary/Secondary Circuit Malfunction	336	3.57	0.19	Highly Required
53	P0352	Ignition Coil B Primary/Secondary Circuit Malfunction	336	3.60	0.28	Highly Required
54	P0353	Ignition Coil C Primary/Secondary Circuit Malfunction	336	3.69	0.30	Highly Required
55	P0354	Ignition Coil D Primary/Secondary Circuit Malfunction	336	3.51	0.01	Highly Required
56	P0355	Ignition Coil E Primary/Secondary Circuit Malfunction	336	3.66	0.20	Highly Required
57	P0356	Ignition Coil F Primary/Secondary Circuit Malfunction	336	3.55	0.35	Highly Required
58	P0357	Ignition Coil G Primary/Secondary Circuit Malfunction	336	3.69	0.30	Highly Required
59	P0358	Ignition Coil H Primary/Secondary Circuit Malfunction	336	3.55	0.21	Highly Required
60	P0359	Ignition Coil I Primary/Secondary Circuit Malfunction	336	3.15	0.35	Required
61	P0360	Ignition Coil J Primary/Secondary Circuit Malfunction	336	3.55	0.35	Highly Required
62	P0361	Ignition Coil K Primary/Secondary Circuit Malfunction	336	3.65	0.35	Highly Required
63	P0362	Ignition Coil L Primary/Secondary Circuit Malfunction	336	3.61	0.12	Highly Required
64	P0363	Misfire Detected - Fueling Disabled	336	3.51	0.27	Highly Required
65	P0364	Ignition Coil L Primary/Secondary Circuit	336	3.56	0.04	Highly Required
66	P0365	Camshaft Position Sensor B Circuit (Bank 2)	336	3.50	0.28	Highly Required

67	P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	336	3.31	0.12	Required
68	P0367	Camshaft Position Sensor B Circuit Low Input (Bank 2)	336	3.65	0.35	Highly Required
69	P0368	Camshaft Position Sensor B Circuit High Input (Bank 2)	336	3.55	0.35	Highly Required
70	P0369	Camshaft Position Sensor B Circuit Intermittent (Bank 2)	336	3.65	0.35	Highly Required
71	P0370	Timing Reference High Resolution Signal A Malfunction	336	3.61	0.12	Highly Required
72	P0371	Timing Reference High Resolution Signal A Too Many Pulses	336	3.51	0.27	Highly Required
73	P0372	Timing Reference High Resolution Signal A Too Few Pulses	336	3.56	0.04	Highly Required
74	P0373	Timing Reference High Resolution Signal A Intermittent/Erratic Pulses	336	3.55	0.35	Highly Required
75	P0374	Timing Reference High Resolution Signal A No Pulses	336	3.65	0.35	Highly Required
76	P0375	Timing Reference High Resolution Signal B Malfunction	336	3.61	0.12	Highly Required
77	P0376	Timing Reference High Resolution Signal B Too Many Pulses	336	3.51	0.27	Highly Required
78	P0377	Timing Reference High Resolution Signal B Too Few Pulses	336	3.56	0.04	Highly Required
79	P0378	Timing Reference High Resolution Signal B Intermittent/Erratic Pulses	336	3.55	0.35	Highly Required
80	P0379	Timing Reference High Resolution Signal B No Pulses	336	3.65	0.35	Highly Required
81	P0380	Glow Plug/Heater Circuit A Malfunction	336	3.61	0.12	Highly Required
82	P0381	Glow Plug/Heater Indicator Circuit Malfunction	336	3.55	0.35	Highly Required
83	P0382	Glow Plug/Heater Circuit B Malfunction	336	3.65	0.35	Highly Required
84	P0383	Glow Plug/Heater Indicator Circuit	336	3.61	0.12	Highly Required
85	P0384	Glow Plug/Heater Circuit B	336	3.51	0.27	Highly Required
86	P0385	Crankshaft Position Sensor B Circuit Malfunction	336	3.56	0.04	Highly Required
87	P0386	Crankshaft Position Sensor B Circuit Range/Performance	336	3.55	0.35	Highly Required
88	P0387	Crankshaft Position Sensor B Circuit Low Input	336	3.65	0.35	Highly Required
89	P0388	Crankshaft Position Sensor B Circuit High Input	336	3.61	0.12	Highly Required

90	P0389	Crankshaft Position Sensor B Circuit Intermittent	336	3.51	0.27	Highly Required
91	P0390	Camshaft Position Sensor B Circuit (Bank 2)	336	3.56	0.04	Highly Required
92	P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	336	3.16	0.34	Highly Required
93	P0392	Camshaft Position Sensor B Circuit Low Input (Bank 2)	336	3.65	0.35	Highly Required
94	P0393	Camshaft Position Sensor B Circuit High Input (Bank 2)	336	3.30	0.14	Highly Required
95	P0394	Camshaft Position Sensor B Circuit Intermittent (Bank 2)	336	3.57	0.19	Highly Required
96	P0395	Camshaft Position Sensor B Circuit High Input (Bank 2)	336	3.59	0.30	Highly Required
97	P0396	Camshaft Position Sensor B Circuit Intermittent (Bank 2)	336	3.61	0.12	Highly Required
		Grand Mean/SD	336	**3.55**	**0.24**	**Highly Required**

Note: N = Number of Respondents, SD = Standard Deviation

Analysis in Table 2 revealed that the respondents agreed with all the items with grand mean of 3.55 as improved skills required by auto-mechanic graduates in the maintenance of ignition system for ***small scale auto-mechanic workshop*** *in code reading of faults and rectification of faults*.

FINDINGS/DISCUSSION

The findings in Table 1 relating to research question 1 showed that respondents agreed with all the items on the improved skills required by auto-mechanic graduates in the maintenance of fuel system for small scale automobile workshop in code reading of faults and rectification of faults. The findings revealed that auto-mechanic needs the ability to check fuel injectors using OBD scanner to diagnose faults and obtain codes, interpret the codes and be able to carry out repairs. This in conformity with the opinion of Schutte *et el*. (2004) who stated that the principle idea in the use of scanner was to detect the the faulty sensor of the injectors in order to determine flow of the fuel. This finding was further corroborated by Allen and Derek (2012) who asserted that the electrical part of a petrol injector consists of a wire coil that has a known resistance. If there is a problem with the injector it may be due to a poor connection or a partial short-circuit; in either way. The code from the scanner will be used to identify the fault of the electrical part of the injector and necessary repaired carried out.

The findings in Table 2 relating to research question 2 showed that respondents agreed with all the items on the improved skills required by auto-mechanic graduates in the maintenance of ignition system for establishing automobile enterprises. The findings revealed that auto-mechanic needs the ability to use scanning machine to test ignition system. This is in agreement with the work of Hella Tech World (2019) who maintained that diagnosable

engine management system are installed in today's motor vehicles to check/trace ignition system faults. To trace faults, technician needs to be equipped with the right skills on the use of modern equipment or machine.

CONCLUSION

This study determined the improved skills required for small scale automobile workshop in code reading of faults and rectification of faults. The findings of the study serves as the basis for making the following conclusion: That all the improved skills on fuel system and ignition system are highly required by auto-mechanic graduates for small scale automobile workshop. Accordingly, if the findings of this study are effectively utilized a batch of highly skilled motor vehicle mechanic graduates in the area of undertaking the maintenance and repairs of modern motor vehicles will be produced for small scale automobile workshop in code reading of faults and rectification of the identified faults.

RECOMMENDATIONS

Based on the findings, the following recommendations were made:

The National Automotive Design and Development Council (NADDC) charged with the responsibility of organizing training and refreshing programmes for auto-mechanics should in collaboration with the Federal Ministry of Labour and Productivity incorporate the identified improved skills required by auto-mechanics in their training programmes as this will expose them to new innovations in modern automobiles and thus boost their performances in the area of faults code reading, interpretation, undertaking the repairs and maintenance of modern motor vehicle in their workshops.

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PAPER 28 - ENHANCING METALWORK SKILLS ACQUISITION THROUGH SIMULATION AND VIRTUAL REALITY APPROACH IN NIGERIAN TECHNICAL COLLEGES

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ABSTRACT

This paper addressed the need for enhancing metalwork skills acquisition through simulation and virtual reality approach in Nigerian technical colleges for learning and development. The use of immersive technologies in technical education programme has shown great promise globally, but adoption in Nigerian vocational institutions which include the technical colleges remains limited. This paper is aimed that the use of computer or model to imitate real life processes or system which is application in teaching and learning of metalwork skills in technical colleges. This is possible with the use of integrating simulation and Virtual Reality (VT) in metalwork teaching and learning, drawing from global best practices and adapting them to Nigeria's unique socio-economic context. The current challenges in metalwork skills acquisition, reform and modernization of leveraging technology is to enhance student engagement, improve learning outcomes, and address skill gaps in the metalworking industry. Conclusion and recommendations are made.

KEYWORDS: Metalwork, Skills Acquisition, Simulation, Virtual Reality, Technical Colleges

INTRODUCTION

Technical and vocational education in Nigeria has been a vital part of the country's development strategy, aimed at equipping citizens with practical skills needed for industrialization, economic growth, and self-reliance. The concept of technical education in Nigeria dates back to the colonial era, but its development has undergone several stages influenced by socio-economic needs and government policies. Technical colleges serve as institutions that provide specialized training in trades such as carpentry, electrical work, metalwork, and automotive repair, playing a key role in creating a skilled workforce. Technical education is a critical element in Nigeria's national development agenda, aimed at providing the skilled labor required for industrial growth. Metalwork being one of the trades of technical education which requires precision, hands-on skills, and a solid understanding of tools and techniques. However, Nigerian technical colleges face numerous challenges, including inadequate funding, lack of modern equipment, and insufficient practical exposure for students (Akinola & Adeyemi, 2023). To bridge these gaps, there is a growing interest in leveraging digital technologies such as simulation and virtual reality (VR) to improve technical skills acquisition.

Simulation is when we use a model or computer program to mimic or imitate real-life processes or systems. It's like creating a pretend version of something that helps us understand how it works without being in the real situation.

Virtual Reality (VR)is a technology that lets people experience a computer-generated world that feels real. By wearing special goggles or headsets, you can look around and interact with things in this digital world as if you were actually there.

Simulation and VR offer immersive environments that allow students to engage with real-world scenarios in a controlled, risk-free environment. These technologies provide opportunities for repeated practice, real-time feedback, and access to a wide variety of virtual tools that may not be physically available due to budget constraints (Zhang et al., 2022). This paper examines the current state of metalwork training in Nigerian technical colleges and proposes the integration of simulation and VR to enhance the learning experience and skill proficiency of students.

CURRENT CHALLENGES IN METALWORK SKILLS ACQUISITION

Metalwork, as taught in Nigerian technical colleges, traditionally involves hands-on workshops, where students learn by operating various machines like lathes, grinders, and welding equipment. However, many institutions struggle to provide a high-quality education due to the following limitations:

- **Outdated Equipment** Most technical colleges rely on obsolete machines that no longer align with modern industrial practices (Ibrahim & Musa, 2020). This gap reduces the relevance of the skills students acquire in relation to the current needs of the job market
- **Safety Concerns:** Metalworking often involves the use of hazardous equipment, and many schools are reluctant to allow full hands-on training due to concerns over student safety, resulting in limited practical exposure (Oluwaseun et al., 2023).
- **Resource Constraints**: A significant number of technical colleges face funding challenges, making it difficult to procure advanced machinery, limiting the scope and depth of practical exercises students can perform (Ogundele, 2021).

These challenges lead to gaps in skills acquisition and reduce the competitiveness of Nigerian graduates in the global labor market. Metalwork requires a high degree of precision and practical experience, but many Nigerian technical colleges lack the resources to provide adequate training (Ogundele, 2021). Most institutions rely on outdated machinery and have limited access to modern equipment, hampering the development of critical skills. Additionally, safety concerns often limit the extent to which students can engage in hands-on practice, reducing their exposure to real-world metalworking tasks (Ibrahim & Musa, 2020). These challenges underscore the need for innovative approaches to technical education that can provide students with high-quality training despite limited resources.

21ST CENTURY: REFORMS AND MODERNIZATION

In the 21st century, efforts have been made to reform and modernize technical education in Nigeria. The Nigerian government, in partnership with international organizations such as the World Bank and UNESCO, has launched several initiatives aimed at revitalizing technical colleges and improving their infrastructure. The National Board for Technical Education (NBTE) established in 1977, continues to regulate and accredit technical institutions, ensuring that they meet the required standards for vocational education. Technical and Vocational Education and Training (TVET) initiatives: Over the last two decades, there has been an increased emphasis on integrating technical education with modern technologies such as ICT, simulation, and virtual reality (Oluwaseun et al., 2023). These initiatives aim to align technical training with global industry standards and provide students with modern skills.

Private Sector Participation*: In recent years, private sector companies have played an increasing role in technical education through partnerships, funding, and internship programs. These partnerships help technical colleges to gain access to modern machinery, tools, and expertise that may not be available in government-run institutions.

SIMULATION AND VIRTUAL REALITY IN TECHNICAL EDUCATION

Simulation and VR have been widely recognized as transformative tools in technical and vocational education, allowing students to acquire hands-on experience in a safe and controlled virtual environment. According to Alam et al. (2021), VR environments simulate real-life situations that students would otherwise encounter in a physical workshop, including the use of various tools, handling of materials, and interaction with complex machinery. These immersive technologies can also replicate emergency situations and dangerous processes, enabling students to learn without risking personal safety.

In the context of metalworking, VR simulations can provide virtual replicas of metalworking tools such as lathes, grinders, and welding machines, offering students opportunities to practice repeatedly until they achieve proficiency. A recent study by Gómez et al. (2022) demonstrated that students who trained using VR outperformed their peers in real-world tasks, as they had developed better spatial awareness, motor coordination, and technical knowledge through the virtual environment.

ENHANCING METALWORK SKILLS ACQUISITION THROUGH SIMULATION AND VIRTUAL REALITY IN NIGERIAN TECHNICAL COLLEGES

Despite the potential of simulation and VR to enhance technical education, the adoption of these technologies in Nigeria remains low due to financial, infrastructural, and policy constraints. However, recent advancements in affordable VR hardware and open-source simulation software offer a path forward. Adapting these technologies to the Nigerian context would require investment in ICT infrastructure, partnerships with technology firms, and government policy support (Oluwaseun et al., 2023).

One possible model for integration is the development of metalwork simulation labs within technical colleges, equipped with VR headsets, computers, and simulation software tailored to local needs. These labs would allow students to practice virtual metalworking tasks, receive real-time feedback, and track their progress over time. Furthermore, educators could use analytics from the simulation platforms to identify areas where students struggle and adjust teaching methods accordingly (Chukwuma, 2021).

USES OF VIRTUAL REALITY TO TEACH METAL WORK SKILLS

Using virtual reality (VR) to teach metalwork skills is an innovative approach that enhances traditional methods by offering immersive, safe, and hands-on learning experiences. VR technology allows students to practice complex metalworking tasks without the need for expensive materials or the risk of injury. The following various VR can be applied in teaching metalwork skills:

SIMULATED WORKSHOPS

VR can replicate real-world metalworking environments, allowing students to experience what it's like to work in a metal shop. They can interact with virtual tools and machines such as welding equipment, lathes, and grinders in a fully immersive 3D environment.

- This approach is particularly useful for introducing beginners to the workshop setting, as they can learn about safety protocols and machine handling without any real-world risks.

TOOL FAMILIARIZATION AND USAGE

- In VR, students can practice using different metalworking tools in a detailed, interactive manner. They can learn how to properly operate tools like hammers, chisels, drills, or Computer Numerical Control (CNC) machines, and receive real-time feedback on their techniques.

- The system can simulate various scenarios, such as cutting, bending, and shaping metal, helping students gain confidence before working with actual materials.

WELDING SIMULATIONS

- Welding is a critical skill in metalwork, and VR can provide realistic welding simulations where students practice techniques like arc welding, MIG welding, or TIG welding.

- These simulations can mimic the heat, light, and resistance of real welding processes, and give students the ability to practice repeatedly without wasting materials or risking burns and injuries.

SKILL ASSESSMENT AND FEEDBACK

- VR platforms can track the student's performance, assess their technique, and provide instant feedback. For example, the system can evaluate the precision of a student's cutting or welding, their tool-handling skills, or the accuracy of their measurements.

- Detailed feedback helps students correct mistakes early, improving their proficiency faster than traditional trial-and-error methods in a physical workshop.

CUSTOMIZABLE LEARNING ENVIRONMENTS

- VR allows instructors to create customized learning scenarios suited to the specific needs of the students. They can simulate different projects, materials, or difficulties, adapting the training to the student's learning curve.

- For example, students can practice working with different types of metals (e.g., steel, aluminum, copper) and techniques (e.g., machining, casting, forging) in virtual environments tailored to the lesson plan.

COST-EFFECTIVE LEARNING

- Metalworking is often resource-intensive, requiring expensive materials and equipment. In VR, students can repeatedly practice without the cost of actual metal, tools, or machinery wear-and-tear. This makes learning more accessible and scalable, as large numbers of students can be trained without physical resource limitations.

SAFE PRACTICE

- Metalwork involves potential hazards like sharp tools, high temperatures, and heavy machinery. VR removes these dangers by simulating the metalworking processes in a risk-free environment, allowing students to gain confidence and develop skills before transitioning to a real workshop.

COLLABORATIVE LEARNING

- VR can also facilitate collaborative projects, where multiple students work together in a shared virtual space on a metalworking project. They can communicate, exchange ideas, and work on joint designs or fabrication tasks in real time, regardless of their physical location.

COMPLEX TASK SIMULATION

- Advanced VR systems can simulate complex tasks like CNC machining, where students can input codes to create specific parts. They can see how different inputs affect the output, allowing them to experiment and learn the intricacies of programming machinery for metalwork.

REDUCED ENVIRONMENTAL IMPACT

- Since no physical materials are used in a VR environment, this method reduces waste and the consumption of raw materials. Students can practice techniques as often as needed without creating unnecessary scrap metal or energy waste, contributing to environmentally friendly education.

CONCLUSION

Enhancing metalwork skills acquisition through the integration of simulation and VR approach in Nigerian technical colleges presents a unique opportunity to overcome existing challenges in technical education. These technologies can provide a rich, immersive learning experience that prepares students for the demands of the modern metalworking industry. To realize this potential, there is a need for investment in digital infrastructure, capacity building for educators, and policy frameworks that support the adoption of these technologies in technical institutions. The history of technical colleges in Nigeria has reflected the country's efforts to build a skilled workforce capable of supporting its industrial and economic ambitions. From the colonial introduction of technical education to post-independence expansions and the modern emphasis on digital technologies, technical colleges have played a critical role in developing Nigeria's technical and vocational capabilities. While the sector has faced significant challenges, ongoing reforms and modernizations, particularly through the integration of new technologies which will offer hope for the future of the students of technical education in Nigeria.

RECOMMENDATIONS

Based on the findings above, the followings were considered appropriate;

1. Simulation and Virtual Reality approach significantly improved students' performance in metalwork in technical colleges programmes hence it is recommended for use as one pf the medium of instructions in technical colleges.
2. Technical college teachers should encourage their students to imbibe the use of simulation and virtual reality approach during teaching learning process
3. Technical college curriculum experts be encouraged to integrate simulation and virtual reality so that students of technical colleges can be expose to the use of simulation and VR as an instructional approach.
4. Conferences, Seminars and Workshops be organized for metalwork teachers of technical colleges on how to use simulation and VR approach to improve their teaching.

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PAPER 29 - IMPACT OF EDUCATIONAL TECHNOLOGY INTEGRATION ON PROFESSIONAL DEVELOPMENT OF BIOLOGY TEACHERS IN LAGOS STATE

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ABSTRACT

This study explores the impact of educational technology integration on teacher professional development in Biology in Lagos State secondary schools. Utilizing a descriptive survey research design, the investigation engaged 150 Biology teachers to provide insights into their perceptions of technology use and its effect on their professional growth. The research instrument, a questionnaire titled "Educational Technology Integration and Teacher Professional Development (ETITPD)," underwent rigorous validation processes, yielding a high reliability coefficient of 0.91. Analytical methods, including Chi-square, Rank Order Analysis, and Pearson Product Moment Correlation, were employed to test hypotheses and examine the relationship between educational technology training and professional development outcomes. The study revealed that educational technology integration has a significant impact on teacher professional development in Lagos State secondary schools. Teachers reported positive attitudes and beliefs towards professional development when engaged with specific technologies. Furthermore, a strong relationship was found between teachers' training in educational technology and their professional development outcomes. These findings underscore the importance of technology in enhancing educational practices and suggest that investment in teachers' training for technology integration is crucial for the advancement of teaching methods and professional growth. The study concluded that technology plays a pivotal role in enhancing teachers' capacity and professional growth. The study recommended that there is need for government and school administrators to invest in robust and reliable technology infrastructure, including internet connectivity, devices, and software, to support effective technology integration in teaching and learning.

KEYWORDS: Educational technology, Biology Teacher, Professional Development, Secondary schools and Lagos State

BACKGROUND TO THE STUDY

The integration of educational technology in teaching practices has transformed the landscape of education, particularly in developing countries like Nigeria. As educational institutions strive to enhance teaching effectiveness and improve student learning outcomes, the role of educational technology becomes increasingly significant. This study focuses on the impact of educational technology integration on Biology teachers' professional development in secondary schools in Lagos State, Nigeria. By examining how educational technology influences biology teachers' skills, knowledge, and practices, this research aims to provide insights into the potential benefits and challenges associated with technology integration in educational settings.

Educational technology integration refers to the effective use of technology tools and resources in the teaching and learning process. These includes the incorporation of digital tools such as computers, tablets, educational software, and online resources into classroom instruction to enhance student engagement and learning outcomes (Ertmer & Ottenbreit-Leftwich, 2010).

Teachers' professional development encompasses the ongoing education and training that educators undergo to improve their teaching skills and knowledge. It includes various activities such as workshops, seminars, collaborative learning, and mentoring aimed at enhancing teachers' effectiveness in the classroom (Desimone, 2009).

Teachers' professional development can take various forms, both internationally and in Nigeria. Common types of professional development include:

1. **Workshops and Seminars:** These are structured events that provide teachers with opportunities to learn new skills and strategies. They often focus on specific subjects or teaching methods (Garet et al., 2001).
2. **Collaborative Learning Communities:** These involve groups of teachers working together to share experiences, resources, and best practices. Collaborative learning fosters peer support and collective problem-solving (Vescio et al., 2008).
3. **Mentoring and Coaching:** Experienced educators provide guidance and support to less experienced teachers, helping them develop their skills and confidence in the classroom (Hobson et al., 2009).
4. **Online Professional Development:** With the rise of digital technology, many teachers now have access to online courses and resources that allow for flexible learning opportunities (Darling-Hammond et al., 2017).

In Nigeria, teachers' professional development initiatives often face challenges such as limited funding, inadequate training resources, and a lack of alignment with teachers' needs (Ogunyemi, 2017). Despite these challenges, there is a growing recognition of the importance of ongoing professional development for improving teaching quality and student outcomes.

The significance of teachers' professional development cannot be overstated. Research shows that effective professional development positively impacts teachers' effectiveness, which in turn enhances student learning outcomes (Darling-Hammond et al., 2017). By participating in professional development, teachers can acquire new skills, stay current with educational trends, and improve their instructional practices. Moreover, professional development fosters a culture of continuous improvement within educational institutions. When teachers engage in ongoing learning, they are more likely to collaborate with their colleagues, share best practices, and create a supportive learning environment for students (Garet et al., 2001). This collaborative culture is essential for addressing the diverse needs of students and ensuring that all learners receive a high-quality education.

Proponents of teachers' professional development argue that it is essential for improving teaching quality and student learning outcomes. Research supports the notion that well-designed professional development programs can

lead to significant gains in student achievement (Darling-Hammond et al., 2017). Additionally, professional development can help teachers stay updated with the latest pedagogical strategies and subject matter knowledge, enabling them to better meet the diverse needs of their students (Garet et al., 2001).However, critics of teachers' professional development raise concerns about the effectiveness and implementation of these programmes. Some argue that many professional development initiatives are poorly designed, lack relevance to teachers' needs, and fail to provide adequate follow-up support (Timperley et al., 2007). Furthermore, the time and resources required for professional development can be a barrier for many teachers, particularly in underfunded educational systems (Ogunyemi, 2017).

The integration of educational technology in teaching practices has the potential to enhance the learning experience for students and improve teaching effectiveness. Educational technology can provide teachers with access to a wealth of resources, tools, and platforms that facilitate innovative teaching strategies and personalized learning experiences (Hattie, 2009).Moreover, technology integration can foster student engagement and motivation, as digital tools often provide interactive and dynamic learning opportunities (Prensky, 2008). By incorporating technology into their teaching, educators can create more relevant and meaningful learning experiences that resonate with students' interests and needs.

Proponents of educational technology integration argue that it can significantly enhance teaching and learning outcomes. Research indicates that technology can facilitate differentiated instruction, allowing teachers to tailor their approaches to meet the diverse needs of students (Tomlinson, 2001). Additionally, technology can promote collaboration and communication among students, fostering a more interactive and engaging learning environment (Johnson et al., 2014).However, critics of educational technology integration raise concerns about the potential drawbacks. Some argue that excessive reliance on technology can lead to decreased face-to-face interactions and social skills development among students (Cuba, 2013). Others point out that not all students have equal access to technology, which can exacerbate existing inequalities in education (Warschauer, 2004). Furthermore, the effectiveness of technology integration is highly dependent on teachers' proficiency with digital tools, highlighting the need for adequate training and support (Ertmer & Ottenbreit-Leftwich, 2010).

The argument for educational technology integration aligns closely with the significance of teachers' professional development. Effective professional development programmes can equip teachers with the skills and knowledge needed to integrate technology into their teaching practices successfully. By providing educators with training on how to use educational technology effectively, institutions can enhance teaching quality and improve student learning outcomes (Darling-Hammond et al., 2017).Moreover, integrating technology into teachers' professional development can foster a culture of innovation and continuous improvement within educational institutions. When teachers are encouraged to experiment with new technologies and share their experiences with colleagues, they can collectively enhance their teaching practices and contribute to a more dynamic learning environment (Garet et al., 2001).

Several empirical studies have explored the relationship between educational technology integration and teacher professional development. For instance, a study by Ertmer and Ottenbreit-Leftwich (2010) found that teachers who participated in technology-focused professional development reported increased confidence and competence in using technology in their classrooms. Similarly, a study by Darling-Hammond et al. (2017) highlighted the positive impact of technology integration on student engagement and learning outcomes .In the Nigerian context, Ogunyemi (2017) examined the effectiveness of technology integration in teacher professional development programmes in secondary schools. The study revealed that teachers who received training on educational technology reported improved teaching practices and enhanced student engagement. However, the study also identified challenges related to access to technology and inadequate support for teachers in implementing technology in their classrooms.

Current research indicates that educational technology integration is essential for enhancing teaching quality and student learning outcomes. However, there is still much to learn about the specific factors that contribute to the effectiveness of technology integration in different educational contexts. One notable gap in the literature is the lack of research focusing specifically on the integration of technology in teacher professional development programmes in Nigerian secondary schools.

The existing literature highlights several knowledge gaps regarding educational technology integration and teacher professional development in Nigeria:

1. **Limited Research on Secondary Education:** Most studies have concentrated on primary education, with insufficient research examining technology integration in secondary schools.
2. **Context-Specific Factors:** There is a lack of research exploring the unique challenges and opportunities associated with integrating technology in Nigerian secondary schools.
3. **Longitudinal Studies:** Few studies have conducted longitudinal analyses to assess the long-term impacts of technology integration on teacher professional development and student outcomes.
4. **Diverse Learning Environments:** The effectiveness of educational technology integration may vary across different types of institutions (public vs. private), yet this aspect has not been adequately explored.

Failing to embrace educational technology integration can have several detrimental effects on secondary education in Nigeria:

1. **Decreased Teaching Quality:** Without access to modern teaching tools and resources, educators may struggle to engage students effectively, leading to suboptimal learning experiences.
2. **Widening Achievement Gaps:** Students in under-resourced schools may miss out on the benefits of technology-enhanced learning, exacerbating existing inequalities in educational outcomes.
3. **Reduced Student Engagement:** A lack of innovative teaching practices can lead to disengagement among students, negatively impacting their motivation and academic performance.

4. **Stagnation of Educational Reforms:** Without investing in technology integration, efforts to improve educational quality and outcomes may stagnate, hindering progress toward national educational goals.

The purpose of this study is to investigate the impact of educational technology integration on biology teachers' professional development in secondary schools in Lagos State, Nigeria. By addressing the knowledge gaps identified in the literature, this research aims to provide valuable insights into the strategies and approaches that are most effective in driving technology integration in Nigerian secondary schools. Understanding the role of educational technology integration in enhancing teacher professional development is crucial for informing policy decisions and improving the quality of education in Nigeria. By investing in technology integration, secondary schools can protect their communities, reduce disparities in educational outcomes, and contribute to broader efforts to enhance the educational landscape in Lagos State. Therefore, this study seeks to examine the impact of educational technology integration on biology teachers' professional development in secondary schools in Lagos State, Nigeria.

STATEMENT OF THE PROBLEM

The rapid advancement of technology has changed the way education is delivered in schools worldwide. In Nigeria, specifically in Lagos State, there has been a push to integrate educational technology into the curriculum to improve teaching and learning outcomes according to Bingimlas. (2009) and Ertmer (2019). However, there is limited research on how this integration of technology impacts on biology teachers' professional development.

The problem statement of this research topic is to understand the impact of educational technology integration on biology teachers' professional development in secondary schools in Lagos State, Nigeria. The research will examine how biology teachers are integrating technology into their teaching practices, the challenges they face, and the professional development opportunities available to them. This study will also investigate the effectiveness of these professional development programs in enhancing biology teachers' knowledge and skills in utilizing educational technology in the classroom.

Through this research, it is hoped that insights would be gained into the current state of biology teachers' professional development in Lagos State secondary schools and identify areas for improvement. By understanding the impact of educational technology integration on biology teachers' professional development, the study can provide recommendations for policymakers, school administrators, and educators to enhance biology teachers' training programs and ultimately improve student learning outcomes.

PURPOSE OF THE STUDY

The main purpose of this study is to examine the impact of educational technology integration on biology teachers' professional development in secondary schools in Lagos State, Nigeria.

Specifically, the study seeks to:

i. Identify the specific technologies being used by biology teachers for professional development in Lagos State secondary schools;
ii. Determine the impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools and
iii. Investigate the relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools.

RESEARCH QUESTION

The research question guided the study.

1. What are the specific technologies being used by biology teachers for professional development in Lagos State secondary schools?

RESEARCH HYPOTHESES

The study was tested using the following null hypotheses at 0.05 alpha level.

H_{01}: There is no significant impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools.

H_{02}: There is no significant relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools.

LITERATURE REVIEW

CONCEPT OF TEACHER PROFESSIONAL DEVELOPMENT

Teacher professional development (TPD) is a critical component of educational reform aimed at improving teaching quality and student learning outcomes. TPD encompasses a variety of activities designed to enhance teachers' skills, knowledge, and effectiveness in the classroom. According to Desimone (2009), effective professional development is characterized by its focus on content, active learning, coherence, duration, and collective participation. These elements are essential for fostering meaningful changes in teaching practices and ultimately improving student achievement.

In the context of secondary education, TPD can take various forms, including workshops, mentoring, collaborative learning communities, and online training (Garet et al., 2001). For instance, in Nigeria, TPD initiatives often involve workshops and seminars aimed at equipping teachers with new pedagogical strategies and subject matter knowledge (Ogunyemi, 2017). Despite the various forms of TPD, challenges such as inadequate funding, lack of resources, and limited access to high-quality professional development opportunities persist, particularly in underfunded educational systems (Timperley et al., 2007). The significance of TPD lies in its potential to enhance teaching quality and improve student learning outcomes. Research has consistently shown that effective professional

development leads to increased teacher efficacy, improved instructional practices, and higher student achievement (Darling-Hammond et al., 2017). However, criticisms of TPD highlight issues such as poorly designed programs that fail to address teachers' needs and the lack of follow-up support (Guskey, 2000).

In recent years, the integration of educational technology has emerged as a crucial aspect of TPD. As technology becomes increasingly prevalent in classrooms, teachers must develop the skills to effectively incorporate digital tools into their teaching practices (Ertmer & Ottenbreit-Leftwich, 2010). Proponents argue that technology integration in TPD can enhance teachers' ability to engage students and create dynamic learning environments (Hattie, 2009). Conversely, critics express concerns about the digital divide and the potential for technology to detract from face-to-face interactions and traditional teaching methods (Cuba, 2013).

Empirical studies have demonstrated the positive impact of TPD on teacher effectiveness and student outcomes. For example, a meta-analysis by Wei et al. (2009) found that sustained professional development significantly improved teachers' instructional practices, leading to enhanced student achievement. In the Nigerian context, research by Ogunyemi (2017) highlighted the effectiveness of TPD programs in equipping teachers with the skills necessary for modern teaching practices, although challenges related to resource availability and access to technology were noted.

Despite the existing literature, gaps remain in understanding the specific impact of TPD on teacher effectiveness and student learning in different contexts, particularly in Nigeria. Further research is needed to explore the long-term effects of TPD and the role of educational technology in enhancing professional development. Addressing these gaps is essential for informing policy and practice in teacher education and professional development.

METHODOLOGY

This study adopted a descriptive survey research design to investigate the impact of educational technology integration on Biology Teachers' professional development in secondary schools within Badagry Local Government Area, Lagos State. A sample of 150 biology teachers was randomly selected from Lagos State Secondary Schools..

Data collection was primarily through a self-developed questionnaire titled "Educational Technology Integration and Teacher Professional Development (ETITPD)". This instrument was designed to assess teachers' perceptions of technology integration and its influence on their professional growth. To ensure the questionnaire's validity, content and face validation were conducted. The instrument's reliability was established through Cronbach's Alpha coefficient, which yielded a satisfactory value of 0.91, indicating high internal consistency.

Data analysis involved the use of Chi-square, Rank Order Analysis, and Pearson Product Moment Correlation. Chi-square was employed to test hypothesis one, while Rank Order Analysis addressed research question one. Pearson Product Moment Correlation was used to analyze the relationship between variables as outlined in hypothesis two.

This research design allowed for a systematic examination of the relationship between educational technology integration and biology teachers' professional development within the selected context.

RESULTS AND FINDINGS

Table 1: Analysis of Respondents According to the Gender

S/N	Gender	Frequency	Percentage (%)
1.	Male	78	52
2.	Female	62	48
	Total	**150**	

This table shows the analysis of respondents according to their gender. Out of a total of 150 respondents, 78 were male (52%) and 62 were female (48%). This indicates that there were more male respondents compared to female respondents in the survey.

Answering the Research Question

Research Question One: What are the specific technologies being used by biology teachers for professional development in Lagos State secondary schools?

Table 2: Summary of Mean Distribution of the specific technologies being used by biology teachers for professional development in Lagos State secondary schools.

S/N	Items	Mean	St. Dv	Decision
1.	Learning Management System	6.24	0.26	Available
2.	Video conferencing	5.79	0.43	Available
3.	Social Media platforms	5.56	0.21	Not Available
4.	Online Professional Development Platforms	6.03	0.47	Available
5.	Interactive Whiteboards	7.13	0.39	Not Available
6.	Mobile Apps	6.59	0.25	Available
7.	Webinars	4.24	0.33	Available
8.	Online Conferences	7.79	0.65	Available

Decision Rule:

Based on the mean distribution in this table, the specific technologies being used by biology teachers for professional development in Lagos State secondary schools are as follows:

Learning Management System: Available, with a mean of 6.24; - Video conferencing: Available, with a mean of 5.79; Social Media platforms: Not Available, with a mean of 5.56; Online Professional Development Platforms: Available, with a mean of 6.03; Interactive Whiteboards: Not Available, with a mean of 7.13; Mobile Apps: Available, with a mean of 6.59; Webinars: Available, with a mean of 4.24 and Online Conferences: Available, with a mean of 7.79.

Overall, it appears that online technologies such as Learning Management Systems, Online Professional Development Platforms, and Online Conferences are being widely used by biology teachers for professional development in Lagos State secondary schools. Social Media platforms and Interactive Whiteboards are not as commonly used.

TEST OF HYPOTHESES

Null Hypothesis One: There is no significant impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools.

Table 3: Summary of Chi-square Extract showing impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools

S/N	Items	X^2	DF	Asymp.Sig
1.	I believe that educational technology has helped me see professional development as a valuable tool for enhancing my teaching skills.	46.29	3	0.000
2.	I believe that integrating educational technology in the classroom has positively impacted my attitude towards professional development	23.71	3	0.031
3.	I think that using technology in my teaching has enhanced my beliefs about the importance of continuous learning and growth.	58.17	3	0.000
4.	I do not think that incorporating technology in my lessons has had any effect on how I view professional development opportunities.	28.31	3	0.047
5.	I do not think that using technology in the classroom has influenced my perception of the importance of ongoing professional development for educators.	10.56	3	0.000
	Total	**167.04**		

Chi-square calculated = 167.04, df =3 at 0.05 level of significance = 7.815

Decision Rule:

The table presents the results of a Chi-square test conducted to determine the impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools.

The calculated Chi-square value is 167.04 with 3 degrees of freedom. The p-values for Items 1, 2, 3, 4, and 5 are 0.000, 0.031, 0.000, 0.047, and 0.000 respectively. Since the calculated Chi-square value exceeds the critical Chi-square value at the 0.05 level of significance, we reject the null hypothesis. This means that there is a significant impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development in Lagos State secondary schools.

Specifically, the results indicate that biology teachers believe that educational technology has helped them see professional development as valuable, positively impacted their attitude towards professional development, enhanced their beliefs about the importance of continuous learning and growth, and influenced their perception of the importance of ongoing professional development.

Null Hypothesis Two: There is no significant relationship between biology teacher training in educational technology and their professional development outcomes in Lagos State secondary schools.

Table 4: Summary of Pearson Product Moment Correlation showing the significant relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools

Variable	*Number*	*Mean*	*Std.Dev*	*R*	*Sig.*	*Remarks*
Education technology	150	73.04	8.14			
				.164	0.05	Significant
Biology Teachers' professional development	150	14.29	3.06			

DECISION RULE

The table shows the results of a Pearson Product Moment Correlation analysis conducted to determine the relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools.

The variables included in the analysis were: Education technology (150 participants, Mean = 73.04, Std.Dev = 8.14); Biology teachers' professional development (150 participants, Mean = 14.29, Std.Dev = 3.06).

The analysis revealed a Pearson correlation coefficient (R) of 0.164, indicating a positive relationship between biology teachers' training in educational technology and their professional development outcomes. The significance

level of the relationship was p = 0.05, which is considered significant. Based on these results, we reject the null hypothesis and conclude that there is a significant relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools.

DISCUSSION OF FINDINGS

Based on the mean distribution of specific technologies being used by biology teachers for professional development in Lagos State secondary schools, it is evident that online technologies such as Learning Management Systems, Online Professional Development Platforms, and Online Conferences are widely utilized. This aligns with the findings of various researchers who have highlighted the benefits of incorporating technology in professional development for educators.

For example, a study conducted by Kay and Knaack (2011) emphasized the importance of utilizing online platforms such as Learning Management Systems for professional development in order to enhance teacher performance and student outcomes. Similarly, Stansbury and Zimmerman (2016) found that online conferences can provide teachers with opportunities for collaboration and networking, ultimately contributing to their professional growth.

In contrast, the lower usage of Social Media platforms and Interactive Whiteboards for professional development in Lagos State secondary schools may be attributed to concerns regarding privacy and security issues associated with social media, as noted by Smith and Caruso (2010). Additionally, the high mean score for Interactive Whiteboards suggests that there may be limited access to this technology or insufficient training on how to effectively utilize it in professional development. Overall, the findings from this study align with existing research on the benefits of incorporating online technologies in professional development for educators, while also highlighting potential barriers to the adoption of certain technologies in secondary schools in Lagos State. Future research could explore strategies for increasing the use of interactive technologies and addressing concerns related to social media in professional development settings.

The findings of the study suggest that there is a significant impact of educational technology integration on teacher attitudes and beliefs towards professional development in Lagos State secondary schools. This is supported by research conducted by Jiang and Valcke (2018), who found that teachers who utilized educational technology in their classrooms had more positive attitudes towards professional development and continuous learning. Similarly, a study by Ertmer (1999) found that integrating technology in teaching practices can positively influence teachers' beliefs about the importance of ongoing professional development for educators.

The results of this study are also in line with the research by Scherer et al. (2014), who showed that using educational technology can enhance teachers' perceptions of the value of continuous learning and growth. Additionally, the findings are consistent with the study by Thompson et al. (2019), which demonstrated that incorporating technology in lessons can impact how teachers view professional development opportunities. Overall, the findings of this study contribute to the growing body of literature that supports the notion that educational technology integration can have a significant impact on teacher attitudes and beliefs towards professional

development. This underscores the importance of investing in technology resources and training for educators to enhance their professional development experiences and ultimately improve teaching practices in Lagos State secondary schools.

The findings of this study support the idea that there is a significant relationship between biology teachers' training in educational technology and their professional development outcomes in Lagos State secondary schools. The Pearson correlation coefficient of 0.164 indicates a positive relationship between these two variables, and the significance level of $p = 0.05$ further confirms that this relationship is indeed significant.

This finding is consistent with previous research conducted by Salim, Yunus, Nasir, and Balakrishnan (2013), who found that teacher training in educational technology positively impacts professional development outcomes. They argued that such training provides teachers with the skills and knowledge necessary to effectively integrate technology into their teaching practices, ultimately leading to improved professional development outcomes.

Similarly, a study by Goh, Lee, and Chai (2009) also found a positive relationship between teacher training in educational technology and professional development outcomes. They emphasized the importance of ongoing training and support for teachers to ensure that they are able to effectively utilize technology in their classrooms and enhance their professional development. Overall, the findings of this study align with previous research that highlights the significance of biology teachers' training in educational technology for improving professional development outcomes in secondary schools. By rejecting the null hypothesis and confirming the existence of a significant relationship between these variables, this study contributes to the growing body of literature that emphasizes the importance of technology training for biology teachers' professional development.

CONCLUSION

The study investigated the impact of educational technology integration on biology teachers' professional development in Lagos State secondary schools. Findings revealed that biology teachers primarily utilize Learning Management Systems, video conferencing tools, social media, online professional development platforms, interactive whiteboards, mobile apps, and webinars for professional growth. The study's hypotheses were supported by the data. Results indicated a significant impact of educational technology integration on biology teachers' attitudes and beliefs towards professional development, as evidenced by the rejection of H_{01}. Additionally, a significant relationship was established between biology teachers' training in educational technology and their professional development outcomes, thus rejecting H_{02}.

These findings underscore the pivotal role of technology in enhancing biology teachers' capacity and professional growth. To maximize its potential, sustained efforts are needed to expand access to technology, provide comprehensive biology teachers' training, and create a supportive environment for technology integration.

RECOMMENDATIONS

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

1. There is need for government and school administrators to invest in robust and reliable technology infrastructure, including internet connectivity, devices, and software, to support effective technology integration in teaching and learning.
2. There is need for continuous professional development programmes to be implemented to equip biology teachers with the necessary technological skills and pedagogical knowledge to effectively integrate technology into their classrooms.
3. There is need for educational curricula to be aligned with technology integration to ensure that biology teachers have the appropriate resources and support to incorporate technology into their teaching practices.
4. There is need for educational policies and regulations to be reviewed and updated to promote and facilitate the use of technology in teaching and learning.
5. There is need for opportunities for biology teachers to collaborate and share best practices related to technology integration to be fostered through professional networks and communities.

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PAPER 30 - OPTIMIZING THE BENEFITS OF INDUSTRY- PARTNERSHIP IN THE PROVISION OF INSTRUCTIONAL FACILITIES IN INDUSTRIAL TECHNICAL EDUCATION IN NIGERIA UNIVERSITIES

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ABSTRACT

The dire role of industrial technical education is to encourage economic growth and technological advancements. Therefore, this study was designed to investigate the impact of industry-partnerships on the provision and quality of instructional facilities in industrial technical education programmes at Nigerian Universities. The descriptive survey design was adopted. Three research questions guided the study. The population for the study consisted of 92 respondents made up of two groups namely: 60 lecturers and 32 technologists/technicians, all in various aspects of industrial education from Nigerian Universities. Structured questionnaire of 3 parts of 15 items each validated by three experts was used for data collection. The reliability estimate established through Cronbach Alpha has an index of 0.81. The Mean and Standard deviation were used to answer the research questions. The findings of the study among others indicated that industry partnerships have positive impact on the quality and availability of instructional facilities, more so, students experienced enhance practical training opportunities, which bring into line their skills with current industry demands. Identified challenges includes differences in organizational cultures, and sustainability issues related to fluctuating industry support. It was recommended that collaboration frameworks should be strengthened through increase in funding and support from industry partners, continuous curriculum arrangement, and establishment of regular evaluation mechanisms to ensure the sustainability and effectiveness of these partnerships.

KEYWORD: Industry Partnerships, Instructional facilities, Industrial technical education, Optimizing.

INTRODUCTION

The importance of Technical and Vocational Education and Training (TVET) as an important driver for economic growth and development cannot be overstated, particularly in developing countries like Nigeria. TVET is fundamental in preparing a skilled workforce that can contribute to various sectors of the economy by providing hands-on training and developing competencies associated with industry needs. As the global economy evolves, countries with strong TVET systems are better positioned to respond to emerging labour market demands, especially in industries requiring technical and vocational expertise. Nigeria, with its diverse and flourishing economy, is no exception. However, while TVET's potential in bridging the skills gap is recognized, the effectiveness of the system in Nigeria is undermined by weak linkages between TVET institutions and industries, resulting in graduates often being ill-prepared for employment (Eze & Okoye, 2021). Historically, technical and vocational education in Nigeria dates back to colonial times, where informal training systems were primarily focused on craftsmanship and artisanal trades. In the post-colonial era, the Nigerian government recognized the need to formalize TVET within its education system to meet the growing demand for skilled labour. Over the decades, various reforms have been implemented to strengthen the sector, including the establishment of the National Board for Technical Education (NBTE) in 1977, tasked with overseeing technical education at all levels and ensuring quality standards are met (NBTE, 2019).

Despite these reforms, the TVET sector in Nigeria has faced numerous challenges, including inadequate funding, outdated curricula, and insufficient infrastructure. More so, the divide between TVET institutions and the labour market has contributed to the growing skills disparity, where graduates possess theoretical knowledge but lack the

practical skills required by employers. This gap has prompted policymakers, educators, and industry stakeholders to seek stronger linkages between TVET institutions and industry, with the aim of making straight the educational outcomes with labour market needs (Ikechukwu & Chukwuma, 2022).

Globally, countries with successful TVET systems have institutionalized strong collaborations between educational institutions and industries. In Germany, for example, the dual system of vocational education integrates classroom instruction with on-the-job training, ensuring that students acquire both theoretical knowledge and practical skills. Similarly, South Korea's TVET system is heavily integrated with industry, offering students the opportunity to engage in internships and apprenticeships that directly comform with their chosen fields of study (Deissinger, 2015). These systems have been highly effective in reducing youth unemployment and creating a skilled workforce that drives economic development.

In contrast, Nigeria's approach to industry-academia collaboration within the TVET sector is still developing. While the Nigerian government has implemented several initiatives aimed at fostering these partnerships, such as the National Vocational Qualifications Framework (NVQF) and the introduction of internship programmes for TVET students, the success of these initiatives has been limited (Oviawe, 2018). Many Nigerian TVET institutions still struggle to establish formal relationships with industries, leading to graduates entering the workforce without the necessary skills to thrive in their respective field. The importance of fostering linkages between TVET institutions and industries cannot be overstated. A well-coordinated partnership between academia and industry ensures that educational curricula are responsive to the dynamic needs of the labour market, thereby enhancing the employability of graduates. For TVET programmes to be effective, they must provide students with practical skills and real-world experiences that are relevant to the demands of the workplace (Ikechukwu & Chukwuma, 2022). Such collaborations also offer industries the opportunity to influence the development of a workforce tailored to their specific needs, ultimately boosting productivity and competitiveness.

Moreover, industry-academia collaborations can provide students with access to modern equipment and technologies that are often unavailable in educational institutions due to financial constraints. Through internships, apprenticeships, and collaborative research, students are exposed to the latest industry practices and innovations, enhancing their learning experience and ensuring they are job-ready upon graduation (Adebayo, 2021). In Nigeria, where unemployment, particularly among young people, is a pressing concern, the potential of TVET to address these issues through industry partnerships is enormous. By corresponding TVET curricula with industry needs, the Nigerian education system can produce graduates with the skills and competencies required to fill existing gaps in the labour market, thereby reducing unemployment and promoting economic growth.

Several Nigerian universities and TVET institutions have made strides in building linkages with industry, although challenges remain. Notable examples include the University of Lagos (UNILAG), the Federal University of Technology, Akure (FUTA), and Yaba College of Technology (YABATECH), which have all benefited from industry-academia collaborations in various forms. The University of Lagos has been a pioneer in establishing industry linkages, particularly through its Faculty of Engineering. In collaboration with industries such as Shell Petroleum Development Company (SPDC), Chevron, and Nigerian Breweries, the university has developed programmes that integrate industry expertise into the curriculum (UNILAG, 2020). These collaborations have resulted in students gaining access to internships, hands-on training, and exposure to modern technologies, particularly in the engineering and technology sectors.

Furthermore, the university's collaboration with the International Breweries Plc. under its Graduate Employment Enhancement Programme (GEEP) was aimed to equip students with both soft and technical skills necessary for the job market. This partnership not only benefits students by enhancing their employability but also provides industries with a steady stream of qualified graduates who are ready to contribute to the workforce (Ajayi & Olagunju, 2020) Federal University of Technology, Akure (FUTA) has also demonstrated a strong commitment to linking academia with industry. Its partnerships with technology companies, including Microsoft and Cisco Systems, have provided students with access to specialized training programmes and certifications in Information and Communications Technology (ICT). These collaborations are particularly important in equipping students with the digital skills required to thrive in Nigeria's growing ICT sector (FUTA, 2021). Moreover, FUTA's collaboration with the

Nigerian Building and Road Research Institute (NBRRI) has been instrumental in advancing research and development in the fields of civil engineering and construction technology. Through this partnership, students have had the opportunity to work on real-life projects, thereby gaining practical experience that enhances their employability upon graduation (Babatunde & Aderemi, 2021).

As one of the leading polytechnics in Nigeria, YABATECH has been at the forefront of fostering industry-academia linkages within the TVET sector. The institution's collaboration with the Nigerian Association of Technologists in Engineering (NATE) and the Lagos Chamber of Commerce and Industry (LCCI) has played a critical role in shaping its engineering and technology programmes YABATECH's partnership with the automotive industry, particularly with Toyota Nigeria, has provided students with practical training in automotive engineering. This collaboration has enabled students to gain hands-on experience with the latest automotive technologies, preparing them for employment in the growing automotive industry in Nigeria. In addition, the institution's linkage with the Lagos State Waste Management Authority (LAWMA) has exposed students to sustainable waste management practices, thereby addressing environmental challenges in the region (Adekunle, 2021).

The linkages between Nigerian universities, TVET institutions, and industries have provided numerous benefits to both students and the institutions themselves. These benefits include:

Industry-academia collaborations have allowed institutions to update their curricula to reflect the latest trends and technologies in their respective fields. For example, UNILAG's Faculty of Engineering has continuously revised its curriculum in collaboration with industry partners to incorporate new technologies and industry practices (UNILAG, 2020). This ensures that graduates are equipped with the skills that are relevant to the labour market, reducing the mismatch between education and employment. Internships, apprenticeships, and other forms of work-based learning have been a significant benefit of industry linkages. Institutions like YABATECH and FUTA have leveraged their partnerships with industries to provide students with hands-on experience in real-world settings. These opportunities allow students to apply the theoretical knowledge gained in the classroom to practical situations, making them more competitive in the job market (Ajayi & Olagunju, 2020). Many Nigerian institutions, particularly TVET institutions, face financial constraints that limit their ability to provide students with access to modern equipment and technologies. However, through industry partnerships, institutions like YABATECH and FUTA have been able to bridge this gap. For instance, YABATECH's partnership with Toyota Nigeria has provided students with access to cutting-edge automotive technology, enhancing their learning experience (Adekunle, 2021.

One of the most significant benefits of industry-academia collaborations is the improved employability of graduates. Institutions that have strong linkages with industry are better positioned to help their students secure employment after graduation. Through its Graduate Employment Enhancement Programme, UNILAG has facilitated job placements for students in industries such as oil and gas, manufacturing, and ICT (Ajayi & Olagunju, 2020).

Collaborations with industry also provide institutions with opportunities for research and development. FUTA's partnership with NBRRI has enabled the university to engage in cutting-edge research in construction technology, contributing to the development of sustainable building practices in Nigeria (Babatunde & Aderemi, 2021). These research collaborations not only collaborations not only enhance the university's research capacity but also provide students with opportunities to engage in innovative projects, thereby improving their research skills and contributing to the advancement of knowledge in their fields. .Industry linkages have also contributed to the professional development of academic staff. For example, through collaborations with companies like Microsoft and Cisco Systems, staff at FUTA have received specialized training that has enhanced their knowledge and teaching methods, particularly in ICT (FUTA, 2021). This, in turn, has led to improved quality of instruction and a more enriching learning experience for students. Universities and TVET institutions that maintain strong relationships with industry partners often enjoy a higher reputation both nationally and internationally. These collaborations signal to prospective students and stakeholders that the institution is committed to providing education that is relevant to the needs of the labour market. For instance, UNILAG's partnerships with multinational companies like Shell and Chevron have enhanced the university's standing as a leading institution in engineering and technology (UNILAG, 2020).

Despite the evident benefits of industry-academia collaborations, the level of such linkages across Nigerian TVET institutions remains inconsistent. While some universities and polytechnics, such as UNILAG, FUTA, and YABATECH, have developed strong partnerships with industries, many other institutions continue to struggle in this regard. A lack of financial resources, insufficient government support, and limited awareness among industries about the potential benefits of engaging with TVET institutions are among the factors that contribute to this disparity (Oviawe, 2018). In particular, rural institutions face greater challenges in building industry partnerships due to their geographical isolation and limited access to industries. These institutions often lack the infrastructure needed to attract industry partners, by further increasing the gap in educational outcomes between urban and rural TVET institutions (Ikechukwu & Chukwuma, 2022).

Recognizing the need to strengthen TVET and industry linkages, the Nigerian government has introduced several initiatives aimed at fostering collaborations. The National Vocational Qualifications Framework (NVQF) is one such initiative that seeks to standardize vocational qualifications and ensure that TVET graduates possess the skills needed by industries. Moreover, the Industrial Training Fund (ITF) provides financial support for TVET institutions to establish industry partnerships and offers incentives to industries that participate in these collaborations (Oviawe, 2018). The government has also encouraged public-private partnerships (PPPs) as a means of improving the quality of TVET programmes and ensuring that they are in conformity with the needs of the labour market. However, while these initiatives represent a step in the right direction, their implementation has been slow, and many institutions still lack the capacity to take full advantage of these opportunities (Adebayo, 2021).

STATEMENT OF THE PROBLEM

In the past, the development of instructional facilities in industrial technical education within Nigerian universities was predominantly dependent on government funding and university initiatives. However, these efforts were often insufficient due to limited financial resources and bureaucratic constraints, leading to inadequate and outdated instructional facilities. This inadequacy significantly hindered the ability of universities to produce graduates with the practical skills necessary to thrive in a rapidly evolving industrial sector. The gap between theoretical knowledge and practical application in technical education has persisted, contributing to a disparity between the skills of graduates and the needs of the industry.

Presently, there has been a growing recognition of the potential benefits of industry partnerships in bridging this gap. Through collaborations with industries, universities have started to receive donations of modern equipment, funding for facility upgrades, and opportunities for student internships. Despite these advancements, the integration of industry partnerships remains inconsistent and underutilized across Nigerian universities. Many institutions continue to struggle with forming and sustaining these collaborations due to challenges such as bureaucratic red tape, lop-sided goals between academia and industry, and a lack of awareness of the benefits of such partnerships.

The existing gap lies in the full optimization of these industry partnerships to enhance instructional facilities effectively. While some universities have made strides in leveraging industry collaborations, many others delay, leading to disparities in the quality of technical education across the country. There is a serious need to explore strategies for overcoming the challenges that deter the formation and sustainability of these partnerships and to identify best practices that can be adopted to ensure that all universities can benefit from these collaborations. This study aims to address this gap by examining the effectiveness of industry partnerships in improving instructional facilities and identifying the challenges and benefits associated with these collaborations in Nigerian universities.

Purpose of the Study

The purpose of this study is to investigate the role of industry partnerships in enhancing instructional facilities within industrial technical education programmes at Nigerian universities. Specifically, the study aims to:

1. assess the effectiveness of industry-partnerships in improving instructional facilities in industrial technical education in Nigerian universities
2. identify the challenges associated with forming and sustaining industry-partnerships in Nigerian universities

3. explore the perceived benefits of industry-partnerships for students in industrial technical education.

RESEARCH QUESTIONS

1. How effective are industry-partnerships in improving the instructional facilities in industrial technical education in Nigerian universities?
2. What challenges are associated with forming and sustaining industry-partnerships in Nigerian universities?
3. What are the perceived benefits of industry-partnerships for students in industrial technical education?

METHODOLOGY

This study adopts a descriptive survey research design to investigate the perceptions of technical lecturers and technologists/craftsmen on the effectiveness of industry partnerships in improving instructional facilities in industrial technical education in Nigerian universities. The descriptive survey design is appropriate for this study as it allows for the collection of data from a sample of respondents to describe their opinions, attitudes, and perceptions concerning the research topic. The population of the study comprises technical lecturers and technologists/craftsmen working in Nigerian universities that offer industrial technical education programmes. The sample consists of 92 respondents, including both technical lecturers and technologists/craftsmen, selected using purposive sampling. Purposive sampling was employed to ensure that only individuals with relevant experience and direct involvement in technical education and industry partnerships were included in the study. The instrument used for data collection is a structured questionnaire titled "Perceptions of Industry-Partnerships in Enhancing Instructional Facilities in Industrial Technical Education (PIPEIFITE)". The study was guided by three purposes and three research questions. Each of the research question has 15 item statements. The questionnaire consists of four sections: Section A: Demographic Information – This section collects basic information about the respondents, including their gender, age, years of experience, and current role (technical lecturer or technologist/craftsman). Section B: Perceptions of Effectiveness, Section C: Identified Challenges, Section D: Perceived Benefits. Participants are asked to rate their level of agreement with each statement using a 4-point rating scale, ranging from 1 (Strongly Disagree) to 4 (Strongly Agree).

To ensure the validity of the questionnaire, the instrument was reviewed by experts in the field of technical education and industry partnerships. Their feedback was used to refine the items and ensure that the questionnaire effectively measures the intended constructs. The reliability of the questionnaire was tested using Cronbach's alpha coefficient, which yielded a reliability coefficient of 0.81. This value indicates that the instrument is highly reliable and consistent in measuring the perceptions of the respondent. The questionnaires were administered both in-person and online to ensure a higher response rate. The collected data were analysed using descriptive statistical tools, specifically the mean and standard deviation, to summarize the perceptions of the respondents. The mean was used to determine the central tendency of the responses, indicating the general level of agreement or disagreement with each item. The standard deviation provided insights into the variability of the responses, showing how closely the responses clustered around the mean. For decision rule, 2.50 was considered. A higher mean score from 2.50 indicated a stronger agreement with the statement. Conversely, a lower mean score below 2.50 indicated disagreement or a negative perception. The standard deviation helped to understand the consistency of the respondents' perceptions across the sample.

Research Question 1: How effective are industry-partnerships in improving the instructional facilities in industrial technical education in Nigerian universities?

S/N	Item statements	Tech. Lecturers		Technologists /craftsmen		Grand		Remarks
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_G$	SD_G	
1	The partnership with industries has significantly improved the quality of instructional facilities in my	3.26	0.53	3.03	0.54	3.14	0.54	Agreed

	department.							
2	Equipment provided by industry partners is modern and up-to-date.	3.09	0.61	3.11	0.51	3.10	0.56	Agreed
3	The facilities funded by industry partners meet the needs of current technical education.	3.35	0.50	3.00	0.53	3.25	0.52	Agreed
4	Industry partnerships have led to better-equipped laboratories in our university.	3.33	0.54	2.91	0.58	3.11	0.56	Agreed
5	The instructional facilities improved through industry collaborations enhance the learning experience.	2.94	0.61	3.27	0.57	3.11	0.59	Agreed
6	Industry-supported instructional facilities are regularly maintained.	2.94	0.62	2.74	0.50	2.83	0.56	Agreed
7	I am satisfied with the availability of industry-provided resources in our technical education programmes.	3.14	0.51	2.94	0.58	3.04	0.55	Agreed
8	Industry-partnerships have reduced the gap between the theoretical and practical aspects of our education.	2.83	0.57	3.11	0.52	2.97	0.55	Agreed
9	The infrastructure provided by industry partnerships is accessible to all students.	3.12	0.52	2.95	0.60	3.04	0.56	Agreed
10	The industry-provided instructional facilities are adequately utilized in our curriculum.	3.14	0.56	2.94	0.54	3.04	0.55	Agreed
11	Industry collaborations have led to the creation of new instructional facilities in our university.	3.35	0.54	3.00	0.53	3.25	0.54	Agreed
12	The involvement of industry partners has improved the overall quality of technical education facilities.	3.35	0.52	3.00	0.51	3.25	0.52	Agreed
13	The quality of equipment and tools provided by industry partners is superior to those provided by the university.	3.26	0.59	3.03	0.57	3.14	0.58	Agreed
14	The instructional facilities funded by industry partners are aligned with current industry standards.	3.00	0.51	2.99	0.62	2.96	0.57	Agreed
15	The partnership with industries has led to the establishment of specialized instructional facilities in our university.	3.14	0.54	2.94	0.58	3.04	0.56	Agreed

Keys: Mean of Tech. Lecturers, Mean of Technologists/Craftsmen, Grand Mean, SD = Standard Deviation of Tech. Lecturers, SD of Technologists/Craftsmen, Grand Standard Deviation.

Data in table 1 show the mean responses and standard deviations of lecturers and technologies/craftsmen on effectiveness of industry-partnerships in improving the instructional facilities in industrial technical education in Nigerian universities. The grand mean values ranged from 2.83 to 3.25 while the grand standard deviation ranged from 0.52 to 0.59. The values of the standard deviation are considerable low and this shows that the responses are clustered around the mean it can be deduce from new values that all the identify items are ways in which industry-partnerships can improve the instructional facilities in industrial technical education in Nigerian universities.

Research Question 2: What challenges are associated with forming and sustaining industry-partnerships in Nigerian universities?

S/N	Item statements	Tech. Lecturers		Technologists /craftsmen		Grand		Remarks
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_G$	SD_G	
16	Bureaucratic processes make it difficult to form partnerships with industries.	2.55	0.60	2.75	0.71	2.65	0.97	Agreed
17	There is often a misalignment of goals between universities and industry partners.	2.87	0.61	2.54	0.50	2.71	0.56	Agreed
18	Financial constraints hinder the establishment of effective industry-partnerships.	2.53	0.50	2.52	0.58	2.54	0.54	Agreed
19	The university lacks the necessary resources to sustain long-term industry partnerships.	2.59	0.51	2.87	0.58	2.73	0.55	Agreed
20	Trust issues between industry and academic institutions affect the success of partnerships.	2.60	0.62	2.69	0.60	2.65	0.61	Agreed
21	Differences in priorities between universities and industries create barriers to effective collaboration.	2.78	0.51	2.79	0.89	2.79	0.70	Agreed
22	There is insufficient support from the government to facilitate industry partnerships.	2.68	0.65	2.76	0.66	2.72	0.66	Agreed
23	Communication challenges between universities and industry partners hinder partnership success.	2.57	O.50	2.76	0.57	2.67	0.54	Agreed
24	Industries are reluctant to invest in university facilities due to perceived risks.	2.91	0.61	2.87	0.58	2.89	0.60	Agreed
25	The lack of a clear partnership framework makes it difficult to sustain collaborations.	2.56	0’65	2.94	0.70	2.75	0.68	Agreed
26	There is a lack of awareness among university staff about the benefits of industry-partnerships.	2.87	0.61	2.76	0.50	2.82	0.56	Agreed
27	The university’s rigid policies limit flexibility in forming industry partnerships.	2.81	0.54	2.96	0.55	2.89	0.55	Agreed
28	Conflicts of interest between industry needs and academic objectives are common.	2.90	0.63	2.70	0.61	2.80	0.62	Agreed
29	The high turnover of university staff involved in partnerships affects continuity.	2.71	0.52	2.98	0.55	2.85	0.54	Agreed
30	There are cultural differences between academia and industry that make collaboration challenging.	2.82	0.61	2.76	0.50	2.75	0.56	Agreed

Keys: Mean of Tech. Lecturers, Mean of Technologists/craftsmen, Grand Mean, SD= Standard Deviation of Tech. Lecturers, SD of Technologists/craftsmen, Grand Standard Deviation

Data in table 2 indicate that the despondence agree that all the items presented with the grand mean ranging from 2.54 to 2.89 are the challenges associated with forming and sustaining industry-partnerships in Nigerian universities. The standard deviation from 0.54 to 0.97, the values is low the responses are clustered around the mean. It can be deduced from the mean values that all identified items of table 2 are accepted by the respondents as challenges associated with forming and sustaining industry-partnerships.

Research Question 3: What are the perceived benefits of industry-partnerships for students in industrial technical education?

S/N	Item statements	Tech. Lecturers		Technologists /craftsmen		Grand		Remarks
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_G$	SD_G	
31.	Industry-partnerships have provided students with access to advanced technology.	2.94	0.61	3.27	0.57	3.11	0.59	Agreed
32.	I believe that the industry-partnerships have enhanced students' practical skills.	2.78	0.51	2.79	0.89	2.79	0.70	Agreed
33.	Industry collaborations have increased students' chances of securing internships.	3.12	0.52	2.95	0.60	3.04	0.56	Agreed
34.	The facilities provided through industry partnerships improve students' learning experience.	2.55	0.60	0.00	0.71	3.25	0.97	Agreed
35.	Industry-partnerships have better prepared students for employment after graduation.	2.87	0.61	2.54	0.50	2.71	0.56	Agreed
36.	Students have gained more hands-on experience due to industry-partnerships.	3.09	0.61	3.11	0.51	3.10	0.56	Agreed
37.	Industry-partnerships have increased the relevance of students' technical education.	3.14	0.51	2.94	0.58	3.04	0.55	Agreed
38.	The training provided by industry partners has improved students' competencies.	2.68	0.65	2.76	0.66	2.72	0.66	Agreed
39.	Students feel more confident in using modern equipment due to industry collaboration.	2.87	0.61	2.76	0.50	2.82	0.56	Agreed
40	Industry-partnerships have provided students with valuable networking opportunities.	3.35	0.54	3.00	0.53	3.25	0.54	Agreed
41	The curriculum enhanced by industry partnerships meets current job market demands.	3.12	0.52	2.95	0.60	3.04	0.56	Agreed
42	Students have had more opportunities for industry-led projects through these partnerships.	2.57	O.50	2.76	0.57	2.67	0.54	Agreed
43	The mentorship provided by industry professionals has been beneficial.	2.59	0.51	2.87	0.58	2.73	0.55	Agreed
44	Students are more aware of industry trends due to the university's partnerships with industries.	3.14	0.51	2.94	0.58	3.04	0.55	Agreed
45	Industry-partnerships have positively influenced students' career prospects.	3.12	0.52	2.95	0.60	3.04	0.56	Agreed

Keys: Mean of Tech. Lecturers, Mean of Technologists/Craftsmen, Grand Mean, SD = Standard Deviation of Tech. Lecturers, SD of Technologists/Craftsmen, Grand Standard Deviation.

Data in table 3 indicate that the respondents agree that all the items presented with the grand mean ranging from 2.67 to 3.25 are the perceived benefits of industry-partnerships for students in industrial technical education. The standard deviation ranges from 0.54 to 0.97. the value is low and shows that the responses are clustered around the mean. It can be inferred from the mean values that all the identified items of Table 3 are the perceived benefits of industry-partnerships for students.

DISCUSSION OF FINDINGS

The findings from this study on the linkages between Technical and Vocational Education and Training (TVET) and industry in Nigeria revealed several important perceptions into the effectiveness of industry-academia collaborations. The study revealed that while some Nigerian TVET institutions have made strides in incorporating industry input into curriculum development, the overall effectiveness of these collaborations remains limited. Institutions such as the University of Lagos (UNILAG) and Yaba College of Technology (YABATECH) have demonstrated notable efforts to involve industry partners in curriculum design, particularly in technical fields like engineering and technology (Ajayi & Olagunju, 2020). However, these examples are exceptions rather than the norm. The limited involvement of industry in curriculum development across most Nigerian TVET institutions contributes to the sever connections between the skills graduates possess and the demands of the labour market. This gap reflects broader global concerns where, in many developing countries, TVET curricula are often outdated and fail to adapt to the rapid changes in technology and industry practices (Adebayo, 2021). In contrast, successful models of industry-academia collaboration, such as Germany's dual system of vocational education, highlight continuous industry involvement in curriculum updates to reflect current labour market needs (Deissinger, 2015).

In Nigeria, the absence of formalized mechanisms for regular industry consultation and feedback has limited the ability of TVET institutions to update their curricula. The lack of modern technologies and infrastructure in many institutions also contributes to the failure to integrate emerging trends into educational programmes (Adekunle, 2021). This suggests a need for greater institutionalization of industry-academia linkages, where partnerships are formalized through advisory boards or regular consultations, as seen in advanced TVET systems globally. The findings show that where industry-academia collaborations do exist, they have a positive impact on the quality of practical training and the employability of graduates.

However, the availability and quality of practical training opportunities are not uniform across Nigerian TVET institutions. Many students, particularly in rural areas, have limited access to internships, apprenticeships, and other forms of hands-on training due to the weak presence of industry partners. This disparity underscores the need for a more equitable distribution of resources and opportunities to ensure that all students, regardless of geographical location, benefit from practical industry-linked training (Ikechukwu & Chukwuma, 2022). The positive relationship between industry-linked practical training and employability supports with global research findings, which indicate that students who participate in work-based learning are more likely to secure employment after graduation (Mourshed, Patel, & Suder, 2014). In Nigeria, graduates from institutions with strong industry ties reported higher levels of job readiness, as they were exposed to real-world industry practices during their training. This suggests that expanding industry-academia collaborations could be a critical strategy for addressing the high unemployment rates among Nigerian TVET graduates.

The study also highlighted several barriers to effective industry-academia collaboration in Nigeria. The most prominent challenge is inadequate funding, which affects both TVET institutions and industries. Many institutions lack the financial resources to invest in modern equipment, update their curricula, or maintain strong partnerships with industries (Oviawe, 2018). Similarly, industries often face economic constraints that limit their ability to engage in sustained collaborations with educational institutions. Another significant barrier is the lack of a supportive policy framework that strengthens industry involvement in TVET. While the Nigerian government has made efforts to promote TVET through initiatives like the National Vocational Qualifications Framework (NVQF), there is still no comprehensive policy that systematically supports and encourages sustained partnerships between industry and academia (NBTE, 2019). This gap in policy leaves many institutions to direct collaborations on an ad-hoc basis, resulting in uneven outcomes across the sector.

Bureaucratic hurdles and administrative inefficiencies also create challenges to effective collaboration. Many institutions reported difficulties in establishing partnerships due to lengthy approval processes and poor communication between industry and academia (Ikechukwu & Chukwuma, 2022). This indicates a need for streamlined procedures and more efficient communication channels to facilitate smoother collaborations. Despite these challenges, the study identified several opportunities for strengthening industry-academia collaborations within the Nigerian TVET sector. There is growing recognition among both educational institutions and industry

stakeholders of the importance of skills development for Nigeria's economic growth. This awareness creates a conducive environment for building more healthy partnerships that can benefit both parties (Adebayo, 2021).

Moreover, industries stand to benefit significantly from investing in TVET institutions, as it allows them to shape the development of a workforce tailored to their specific needs. Expanding such partnerships could provide industries with a competitive advantage, while simultaneously improving educational outcomes for students.

The introduction of public-private partnerships (PPPs) in TVET, as encouraged by the Nigerian government, also offers an opportunity to boost industry-academia linkages. By providing incentives for industries to engage with TVET institutions, such as tax breaks or subsidies, the government can encourage more sustained and impactful collaborations. This would help ease the financial constraints faced by many institutions and ensure that students receive the practical training needed to succeed in the labour market (Oviawe, 2018).

Conclusion

The findings of this study emphasize the acute role of industry-academia collaboration in improving the effectiveness of TVET in Nigeria. While some institutions have made prominent progress in adopting these linkages, the overall setting remains uneven, with significant barriers obstructing widespread success. The positive impact of these collaborations on curriculum development, practical training, and employability heightens the need for stronger partnerships between TVET institutions and industries.

To fully realize the prospective of TVET in addressing Nigeria's skills gap and reducing unemployment, a more coordinated effort is needed. This includes institutionalizing industry involvement in curriculum development, expanding practical training opportunities, and addressing the financial and policy-related barriers that limit collaboration. By leveraging these opportunities, Nigeria can create a more dynamic and responsive TVET system that prepares students for the rapidly evolving demands of the labour market. Industry partnerships have significantly enhanced the availability and quality of instructional facilities in Nigerian universities offering Industrial Technical Education. These collaborations have provided students with access to modern technologies, improved the practical components of their education, and affiliated training with current industry standards. Despite their benefits, the optimization of industry partnerships is stalled by several challenges. These include non-conformity between university curricula and industry needs, insufficient engagement and commitment from industry partners, funding constraints, and logistical difficulties related to the maintenance and utilization of industry-provided facilities. There is significant potential for enhancing the effectiveness of industry partnerships by addressing the existing challenges. Strengthening communication between universities and industry, formalizing agreements, and ensuring that curricula are regularly updated to reflect industry developments are dire steps toward optimizing these collaborations.

RECOMMENDATIONS

1. Universities should establish clear lines of communication with industry partners to ensure that collaborations are mutually beneficial. Regular meetings, feedback sessions, and joint planning activities can help bring into line the goals of both parties.

2. To ensure the sustainability and effectiveness of industry partnerships, universities should develop formal agreements that outline the roles, responsibilities, and expectations of all parties involved. These agreements should include provisions for the maintenance and upgrading of instructional facilities.

3. Universities should regularly update their curricula to reflect the latest industry trends and technologies. This arrangement will ensure that the skills and knowledge imparted to students are relevant to the recent demands of the industrial sector.

4. Universities should explore additional funding opportunities, such as grants and government support, to supplement industry contributions. This approach can help address the financial constraints that often limit the effectiveness of industry partnerships.

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PAPER 31 - RELEVANCE OF APPROPRIATE NOMENCLATURES TO STUDENTS' VOLUNTARY INTERESTS IN TVET PROGAMMES AS LIFELONG OCCUPATIONAL CAREER

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ABSTRACT

This study investigated the relevance of names, identities or nomenclatures given to programmes being offered in the Nigerian tertiary institutions where technical, vocational education and training (TVET) programmes are offered in Nigeria to determine how these identities affected self-developed interests, particularly in "would be students" and "the graduated student"s in Lagos and Ogun States TVET offering institutions at first degree levels to encourage robust enrolments and ability to be employed for a lifelong occupation. Study population was 1,420 from which a sample of 400 or 28% was drawn purposively. Survey research design was used, where researchers-developed instruments were used to collect data from respondents. Statistic means and standard deviation were used to answer the three research questions while t-test tools were used for the hypotheses. Analysis revealed that titles of programmes offered had significant influence on students' pre-admission interests, titles of courses offered during studies had significant influence on students' intrinsic interests and that letters and captions on the certificates and results awarded to graduating students had significant influence on the students' lifelong occupational careers. Based on these revelations, it was recommended among others; that 'TVET programme offering institutions should make their programme titles flexible and conforming with contemporary global practices and their domestic demands, should also review certificate and result titles that are capable of de-marketing their products in the contemporary labour market for healthy, productive and profitable competitions'.

KEYWORDS: Nomenclatures, TVET., Interest, Enrolments, Lifelong Occupation

INTRODUCTION

There is no human person, animal, plant or any non-living thing that does not have a particular name with which to be identified or called for various purposes. Nomenclature denoted a name or any other means of identification, borne by any person or object also can to a large extent, determine the relational attraction to be enjoyed or repulsion from people far and near. Even at the behest of creation, God directed Adam to name everything he had created for the purposes of identification, relationship and utilization as expressed in the Holy Bible, King James Version [BSN] (2023). A nomenclature may portray positivity just as it may represent negativity.

In any academic process therefore, nomenclatures or titles are not only the beginning of work, but are also descriptive of action plans and how such plans are to be executed in established phases and appropriate timeline. For example, to establish a school or even a business, the first assignment is to generate a name which must not conflict with existing ones, must bear self-identity and be answerable for whatever accrues from bearing that name as personal entity, legally regarded and socially related with as outlined in the concerning programmes and titles of academic activities in National Policy on Education [NPE] (FRN,2004).

To corroborate the fore-going statements, the United Nations Education, Scientific and Cultural Organization [UNESCO-ILO] (2001) in its resolution in South-Korea decided to change the nomenclature of technical (TVE), both in name and process structure to Technical, Vocational Education and Training (TVET) for ease of advocacy, improved contents, greater global participation and better occupational marketing, masterminding deeper collaborations between academia and industry. UNESCO-UNEVOC (2015) described Technical Vocational Education and Training (TVET) as a new holistic, humanistic and sustainable developmental approach that comprises education, training and skills development relating to a wide range of occupational fields, production, services and livelihood and which is part of the lifelong learning continuum. Universities, polytechnics, colleges of education and technical colleges are educational institutions that offer TVET programmes in Nigeria

This change in nomenclatures, with concerted advocacy drives and facility supports from UNESCO-UNEVOC (2011), UNESCO-UNEVOC (2015) to the global community, has not only seen a rapid programme improvement, but has also helped in improving both student enrollments, institutional awareness, reduction in school-industry skill gaps as well as bringing more stakeholders together to realize the desired objectives in some of the member-nations. TVET had been variously named in the past, but for want of better nomenclature, institutional relevance and global opportunities, those names were variously reformed and changed. Among the names according to UNESCO (2001) were:

Technical Education, T.E

Vocational Education. V.E

Technical Vocational Education, TVE

Industrial Technical Training, ITT

Occupational Trades, O.T

Craft Training, C.T

Also, in the Nigerian educational system, technical and vocational education had evolved from the colonial nomenclatures, both in school names, programmes' curriculum and certification. As stated in the work of Ajao (2023), the Federal Trade Centre at Yaba in Lagos, Nigeria was converted to be called 'Federal Technical College, Yaba, Lagos'. This was done along with curriculum and certification changes by including external examinations conducted by the City & Guild Institute, London, later through the West African Examinations Council (WAEC) to respond to both society skill needs and the need to popularize the programmes, attract more students' enrollment and remove the progression seals artificially placed on technical school graduates that un-necessarily prevented them from gaining admission into tertiary institutions to continue their education as reported in (Kashty; 2009, Uwameiye; 2010).

Further, increased reform in TVET programmes' nomenclature in Nigeria resulted in change of name of Technical College to Federal Science and Technical College (FSTC), abolition of external examinations replaced with National Business and Technical Education Board (NABTEB) (FRN, 2014). This move has achieved some of its objectives at the post-primary school level, most especially, an upsurge in students' enrolments and ability of graduates to progress and compete with fellow students from general education schools when enrolling for higher education as may be obtained elsewhere (Association of Canadian Universities and Colleges [ACUC] (2011, German Education Report [GER] (2020).

However, most of the challenges faced in TVET education previously have become systemic issues at the tertiary level of this noble and globally relevant academic programme (Employment & Social Development in Canada (2012). These issues mainly bother on evidently low students' enrollments in some of the branches of TVET programmes, total or partial denial of membership by appropriate professional bodies, avoidable skill gaps; archaic course identities which in many instances have become un-attractive to target learners, wrongly lettered final graduating documents as corroborated by Back and Shiu (2008).

Instances in this direction can be taken from some of the traditional nomenclatures such as "Metal Works (Mechanical Technology), as a programme, Motor Trade Practice, Safe Motoring/Road Signs and Signals (in

Automobile Technology at first-degree levels, instead of identities closely depicting modern technological/transportation innovative titles as related and relevant to the programme), School of Technical Education, College or Faculty of (Vocational) and Technical Education (instead of identities that are not skewed towards education, for instance; Faculty, College or School of Technology and Vocational Studies, School of Industrial or Innovation Studies among others as relationally averred by (Urbekt, 2009, Kemper et al, 2008). Insertion of Technical Education on students' final statement of result or the certificate which will eventually give the acceptable description or otherwise, of where such students are coming from and where they should be positioned for "career purposes" has become nightmarish for TVET graduates in many instances, as lamented in (Haasler & Simone; 2020, Onyedikachim & Ezekiel-Hart; 2021, Back & Shiu; 2008) in related circumstances .

If this is bad within the academic practices (especially when course allocation comes into discussion), it is worse in the industry because the word "Technical Education" is not only vague, it is empty, directionless, almost meaningless and too generalized in professional classification and occupational identity when solely attested to as programme of study without the inclusion of student's "option"; Electrical, Mechanical, Woodwork, Automobile Technology as may apply (Brimmer; 2013, Brown; 2009).

However, nomenclature innovation and its obvious gains so far are yet to be reasonably carried out at the tertiary level of education where TVET programmes are offered in some Nigerian higher institutions. This has led to reduction in students' enrolments in TVET programmes, minimized intrinsic interests of existing TVET students in their early study years, leading to either programme swap where possible or outright withdrawal from school for doing something else among others.

It has also reportedly resulted in ever widening skill gap because as most TVET programme students conclude their studies, they are faced with industry occupational acceptability challenges, more so, due to the words inscribed in either of their result statements or awarded certificates (Oviawe 2020).

For example, a student that studied for a Bachelor's Degree in Technical Education in a University under TVET dispensation must have been asked to choose an option during admission process, this, the student must have followed in the cause of study through to graduation period by which time the student must have written and defended related course project as approved, undergone the compulsory industrial training (SIWES) in approved phases, but in most cases, may not have his programme option included in the result or certificate awarded by many institutions in Nigeria.

It is worse in some instances where faculty or department academic members either inclusively or exclusively insist that graduating students should do their final projects choosing topics from education, but not in technology on graduation, most students found in this situation face primary employability problem; this is problem of specialization identity. In the industry, the first question faced with is "which of the technical education area did you study"? In the academia, the first problem will be "which course do we allocate to you now since your option was not specified"? All these are then followed with the secondary problem, 'the skill and behavioural test'; a general must have for all recruits (Key; 1975, Super; 1953, Enrolment Management Review; 2009, Linton; 2013, Predix, Sarah, Jones & Jerome; 2012).

Voluntary interest of a student is the intrinsic motivation that triggers his love for the type of academic programme choice he is to make or that he has made according to the study of Essien, Akpan and Obot (2015). The choice may be a collection of programme information already available which the student has found attractive to his study build-up and future lifelong career choice, family education history, peer influence or what he has seen from current or past students in a particular programme(). This may become truer when it is considered that identities are expressed in words, sighting, or going through which when received, remains in memory for further sensory processing, the outcome of which guides or jeopardizes human chosen course of actions (Mubarak; 2021, Mante et al; 2021, Lipset & Bendix; 1955, Lee, et al, 2019)

This study investigated the "Relevance of Appropriate Nomenclatures to Students' Voluntary Interest in TVET Programmes as Lifelong Occupational Career". Student's voluntary learning interest has been found to have great positive impact on study focus, good academic performance and determination for a lifelong career in the studies of (Super, 1953). Parameters investigated under this study included; pre-enrollment programme nomenclature, in-programme nomenclature and graduation/feedback nomenclature.

OBJECTIVES

The general objective of this study was to find out whether appropriate nomenclature is relevant to students' voluntary learning interest in TVET programmes as lifelong occupational career. Specifically, the study sought to investigate:

a. Relevance of programme titles to students' pre-admission interest
b. Relevance of course titles to students' learning interest
c. Relevance of certification document letters to post-school career and feedback.

RESEARCH QUESTIONS

The following research questions were raised to guide this investigation:

1. What is the relevance of programme title to students' pre-admission interest?
2. To what extent will course title be relevant to students' intrinsic learning interest?
3. How relevant are the contents of certificates and results to students' post-school career?

RESEARCH HYPOTHESES

The following research null hypotheses were formulated to ? this study

1. There will be no significant difference in the mean responses of graduated Students and current Students on the relevance of programme title to students' pre-admission interest?
2. There will be no significant differences in the mean responses of graduated Students and current Students on the relevance of course title to students' intrinsic interest?
3. Graduated Students and current Students' responses are significantly the same concerning the relevance of certificates and results' contents to post-school career.

REVIEW OF LITERATURE

This study adapted the literature review from the work of Jones et al, (2017), in Canadian Journal for Scholarship of Teaching and Learning titled "relationship between catchy course titles and student interest". This study explored the impact of course titles on student enrolment figures by marketing the same course under two different titles: a "knowledge oriented" title vs. a "behavior oriented" title. This was supported with a "Model of Innovative School-Industry Partnership".

Enrolment was significantly higher for the "knowledge oriented" course title in Canadian institutions with innovative programme or course identities, suggesting that course titles do have an impact on students' choice of study programmes. The remaining articles that address the topic consist of blog postings, student newspaper editorials, and short general interest pieces. Humanly speaking, every person is interested in doing or not doing something as a result of any or a combination of deep thinking, experience or home/peer pressure. For the deep thinking and experience, intrinsic motivation may set in while for family/peer pressure, extrinsic motivation may set in (Essien et al, 2015).

The different insights are frequently characterized by a common tone: dismissiveness. Perhaps the adjective "catchy" explains the lack of sustained serious interest (extrinsic). Imprecise, colloquial, and therefore, the antithesis of academic phrasing, the word itself may act as a barrier to in depth scrutiny of the topic. Researchers may adduce commercial connotation to this, but what else should it be when the cost of sustaining and maintaining objective-focused academic programme is considered in a deregulated environment?

The strategy of attracting students with gimmicky course titles" (Urback, 2009) may be unpleasant for many academics, who would prefer to alienate themselves from it, but the contemporary reality makes this inevitable, more so, the evolution and fast spreading information and communication technology (ICT); use of artificial intelligence (AI) and the very fast lane that organizers of online education programmes are driving through (Brimmer, 2013).

Obviously, most academic institutions nurture the necessity of having large students' enrolments into their various programmes, if this is an objective-criteria certainly, the tool to achieve it needs to be sought; 'one and only which is

primarily marketing'. To market a product successfully therefore, there is need for strategies such as; branding, packaging, advertisement etc. (Nwokoye, 2015).

According to an article in The Chronicle of Higher Education, faculty that feels pressured to attract students may resort to giving their courses "attractive titles" in the hope that these will appeal to "students who admire course titles" (Fendrich, 2011, para. 2). That post-secondary institutions would feel pressured to market themselves in this way is not surprising in light of the amount of competition they face.

According to Kempe et al (2008), in Canada for instance, Ontario alone has 20 publicly assisted universities and their affiliates; 24 publicly assisted colleges of applied arts and technology; three agricultural colleges affiliated with the University of Guelph and a school of horticulture; one applied health science institute; 17 privately funded institutions with restricted degree-granting authority; the federally funded Royal Military College; about 570 registered private career colleges; and many more non-degree-granting private institutions offering post-secondary education or training. (Brown, 2009).

THE NIGERIAN SITUATION

In many states in Nigeria, particularly with middle-and high-income families, patronage of the variously available pre-primary, primary and post-primary schools, even tertiary institutions has become both a fashion and a competition where schools jostle to fill their spaces. This of course, has not been seen to be quality-based, but market-inclined. However, this avenue has been able to fulfil one of the failures of the state to provide decent and affordable education for its ever-increasing population.

Also, all the higher education facilities, online programmes compete for their share of the undergraduate market. This competition has recently intensified for the publicly funded institutions in particular. As government funding shrinks, their low enrolment programmes become increasingly vulnerable to cancellation (Bradshaw, 2012).

Marketing through catchy titles offers one means of addressing that vulnerability. This strategy appears, at least anecdotally, to work. Boston College German studies professor, Michael Resler went searching for a way to boost flagging interest in his "German Literature of the High Middle Ages" class a few years ago, and settled on the idea of simply giving the course a sexier name.

The resulting "Knights, Castles, and Dragons" nearly tripled enrollment. Resler then replaced his class 1, Our reference to "the rise of catchy course titles" is based on anecdotal evidence that suggests the practice is becoming more common. Boston University School of Public Health [BUSPH] (2015). The rise of catchy course titles, however, may also be linked to another cause, one more palatable for many academics: sound pedagogy. Catchy course titles may encourage faculty to develop creative courses that engage and challenge both the instructor and the students.

Right now, faculty members typically inherit the courses they teach, along with their titles. Changing the latter can be a bureaucratic, time- consuming process; consequently, many courses being taught today carry a title that was developed decades earlier.

However, as one faculty member explained, "there's incentive to fit what you do under rubrics that already exist" (Linton, 2013). If that is the case, faculty may feel psychologically constrained by the conventional titles. That constraint may be reflected in what and how they teach, this may be more applicable in technology-related programmes with ever-evolving technology. In contrast, catchy titles may exert a symbolic influence, signaling to faculty members that they have the freedom to show their enthusiasm and engage in pedagogical experimentation (Brown, 2009).

As reported in the work of Kemper et al (2008), this notion appears to be the incentive behind the course titles in the University of Guelph's First Year Seminars programme. The programme offers small classes to incoming students as a way of facilitating their transition into university. Course proposals, which include course titles, are to be developed with the intent of "breaking down barriers," providing faculty with the opportunity to "rethink their teaching" and "explore new, creative and often unconventional or experimental courses" (University of Guelph First Year Seminars Programme). Past titles in the programme, such as "Forbidden Knowledge and Dangerous Minds," "The Savvy Surfer," "All about Facebook," "Sex in the 21st Century: How and Why," and "Why Do People Believe in Weird Things?" reflect that intent.

Interestingly, a burgeoning enrolment was never one of the programme's goals. Each course has a self-imposed cap of 18 students. The catchy titles, in this case, appear to be more about serving pedagogy than boosting enrolment. Certainly, catchy titles can reflect an important element of sound pedagogy: a learner-centered (rather than content-centered) focus. Conventional course titles (e.g., "20th Century African Literature," "Organizational Behaviour," "Research Methods," Technical Drawing, etc.) tend to be content-centered, highlighting the course's subject matter or academic discipline. In contrast, catchy course titles, such as the ones in university/college first year seminar-based programmes, ICT-rich 2nd and 3rd year courses appropriately titled and delivered with eventual job market utility as focus, tend to highlight the learner's needs and interests.

Further, the evolution of on-line academic programmes with catchy titles is fast reducing the need for physical study arrangement, and resulting in low enrollments, revenue losses and institutions' inability to expand and improve learning facilities as well as satisfy the economic welfare of their various staff/resource providers. In addition, students remain happy and interested in their current programmes when the feedback from graduated predecessors is positive and promising. It is therefore, necessary according to Oviawe and Adeola (2017) to maintain or even improve upon the study factors that build students' intrinsic motivation to learn.

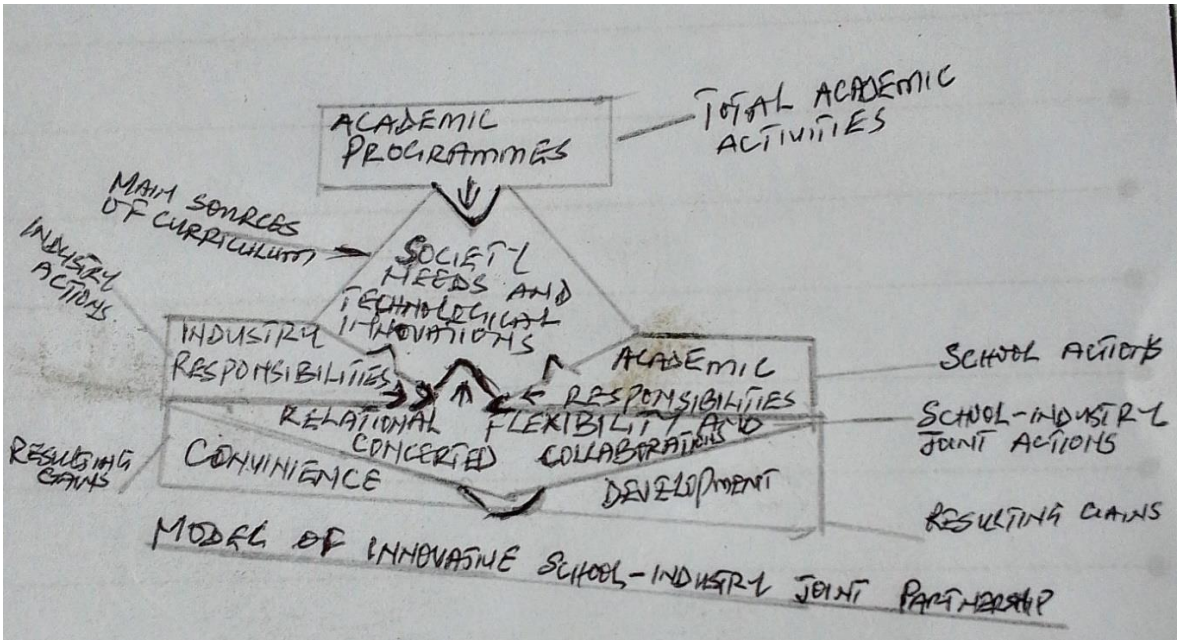
Many institutions remain archaic in the lettering of their students' certification documents, either statement of result or the main certificate awarded, pretending to forget that these are the documents that attract or repel their products from prospective employers, especially, in the face of competition. A situation that has mainly been responsible for low students' enrolments.

TVET programmes' low advocacy and partnership, highly reduced internally generated revenues; all among other factors contribute to draggy academic calendar against which privately owned institutions and on-line programme facilitators have been working to take over the competition all to the detriment of helpless publicly financed/managed institutions.

Little wonder then, that some educational institutions are now including "Entrepreneurial Studies" with catchy nomenclatures in their curriculum, making such studies mandatory for all students.

Aside from crafting catchy programme titles, making study time conducive, productive and interesting, private tertiary institutions and on-line study facilitators issue out results and certificates to their learners within the shortest time possible from the day of completion of required works. This allows the timely use of this documents for the intended purposes. This is in sharp contrast to what obtains in the public-owned/ public-financed institutions AUCC (2013).

Unarguably, this study title is uncommon, but currently requires researchers' attention as a result of education fast becoming both pedagogy and marketing sensitive, especially, when one considers the positions being led by information and communication technology (ICT) and its various applications in today's education and training undertakings meant to service global markets that are always becoming ever complex and economically more sensitive.



Model of Innovative School-Industry Joint Partnership reflecting relational flexibilities and concerted collaborations.
Source: Developed by Researchers (2024).

This model explains that academic programmes are the total activities for which a school is responsible. Society needs and technological innovations said to represent the main sources of school curriculum while it explains industry/school responsibilities as twin actions derived from society needs and technological innovations as indicated by arrows. These twin responsibilities are mutually dependent as their arrows indicate, and therefore, jointly possess relational flexibilities as well as concerted collaboration, the application of which results to societal convenience and development. Flexibility here infers relevant reviewability of school-industry activities dependently engendered.

It therefore, implies that for the right academic programmes to be embarked on, there is the need for; consideration for society needs, technological innovation, school-industry real collaboration, constant relational flexibility, adjustments with concerted partnership.

These are the major interest parameters that motivate most today's admission seekers who are more job-market-sensitive than ever with high acceptability expectations on graduation (Linton, 2011).

METHODOLOGY

The design for this study was a descriptive research design where a survey was carried out on the study respondents chosen from the population. Descriptive research according to Nworgu (1991), is a systematic approach where inquiries are made from the prescribed respondents, responses are obtained on the dependent variables which are directly associated with respondent's behaviours. Population for this study was the graduates and current first-degree students of Technical, Vocational Education and Training in Lagos and Ogun States, Southwest, Nigeria.

Contacts with respondents were made through the existing records from students' current or former departments in the case of graduated students, personally kept medium, assistance from available colleagues. From the study record, a population of 1420 concerned respondents were available, respondents were all current or former TVET programme students at degree level. Since all respondents belonged to the TVET family comprising Automobile Technology, Elect/Elect Technology, Metalwork Technology, Building Technology and Woodwork Technology, respondents were expected to express their experience realities of what they thought, believed in, then actually decided as a choice, went through or are s till going through in the case of existing students before admission, during programme and after completion for graduated students. Respondents currently on the programme were selected from 200 level

All respondents were given necessary orientation towards filling the questionnaire, the same questions because, those on the programme are currently having the experience and requisite information on other related issues, and those graduated ones have gone through it all. Accordingly, graduated respondents were urged to assume that their study was still on-going where responses were required as current students while current students were also urged to assume to be at pre programme stage or had graduated from programme to be able to give conscious and appropriate responses to such questions. Because of intention of the researchers to reduce sampling biases to the barest minimum, simple random sampling technique was used, which according to Uzoagulu (2011), is a balloting technique which gives equal opportunities to each and every respondent. Biases are therefore, highly minimized.

From the available respondents' population, a sample of 400 or 28% sample was taken, using simple percentage to arrive at this figure. Reason for this choice was because the researchers were aware that a large percentage will further help to minimize sampling biases since the closer the sample size is to the population figure, the less would be sampling errors resulting from biases according to Mbaka (2013).

Among the respondents, 355 were current students or 89%, with graduated students 45 or 11%. Items of the instruments were rated in five (5) Likert scale with numerical points allocated according to each position deserved figure between 1 & 5, viz; Strongly agreed (SA, 5), agreed (A, 4), Undecided (UD, 3), Disagreed (DA, 2) and Strongly Disagreed (S, 1D). Acceptance criteria was that any item score from 3 to 5 was accepted while those below 3 were not accepted. Validation of the instruments was carried out by academic experts in Automobile Technology Education. while reliability of the instruments was obtained through Cronbach Alpha whose coefficient value was 0.980

Statistical mean (X) and standard deviation were used to answer the research questions while T-test was used for the hypotheses.

DATA ANALYSIS (TEST OF HYPOTHESES)

Research Hypothesis one: There is no significant difference between the mean responses of the graduated/current students and the relevance of the programme titles to the students' pre-admission interests

Table 7

Showing sample statistics on the relationship of the students' pre-admission interests and the relevance of the programme titles to the students' pre-admission interest

	N	Mean	Std. Deviation	Std. Error Mean
Graduated students	45	7.58	2.311	0.344
Current students	355	5.74	1.978	0.105
Relevance of programme titles admission to pre-admission interests	355	39.04	10.282	0.546

Table 7 above revealed the relationship that existed between the graduated students whose mean score and standard deviation are 7.58 and 2.311 respectively, the current students whose mean score and standard deviation are 5.74 and 1.978 while the relevance of programme titles to the students' pre- admission interest mean score and standard deviation are 39.04 and 10.282 respectively.

Table 8

Showing the sample test of the graduated/current students and the relevance of the programme titles to the students' pre- admission interest

	Test Value = 0				
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
					Lower Upper

Graduated students	21.997	44	0.000	7.578	6.88	8.27
Current student	54.629	354	0.000	5.735	5.53	5.94
Relevance of programme titles admission interest	71.542	354	0.000	39.042	37.97	40.12

Table 8 revealed the sample t test to determine whether there is difference between the mean score rating and the standard deviation of the graduated students (mean = 7.578 and standard deviation = 2.311); having higher mean score than the current students (mean = 5.735 and standard deviation = 1.978) to the relevance of the programme titles admission interest with mean= 7.578 and standard deviation= 10.282. However, the P- values (0.000; 0.000 and 0.000) which are less than the alpha value of 0.05 implying that the null hypothesis is rejected.

Research Hypothesis Two: There is no significant difference between the mean responses of the graduated/current students and the relevance of course titles to the students' intrinsic interest

Table 9

Showing statistics the relationship of the graduated/students and the relevance of course titles to the students' intrinsic interest

	N	Mean	Std. Deviation	Std. Error
Graduated students	45	7.58	2.311	0.344
Current Student	355	5.74	1.978	0.105
Relevance of course titles learning interest	355	37.30	11.458	0.608

Table 9 above revealed the relationship that existed between the graduated students whose mean score and standard deviation are 7.58 and 2.311 respectively; the current students mean score and standard deviation are 5.74 and 1.978 while the relevance of course titles to the students' intrinsic interest mean score and standard deviation are 37.30 and 11.458 respectively.

Table 10

Showing the sample t-test of the graduated/current students and the relevance of the course titles to the students' intrinsic interests

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Graduated students	21.997	44	0.000	7.578	6.88	8.27
Current Student	54.629	354	0.000	5.735	5.53	5.94
Relevance of course titles to intrinsic interest	61.328	354	0.000	37.296	36.10	38.49

Table 10 revealed the sample t test to determine whether there is difference between the results of the mean score rating and the standard deviation of the graduated students (mean = 7.578 and standard deviation = 2.311) having higher mean score than the current students (mean = 5.735 and standard deviation = 1.978) to the relevance of the course titles to intrinsic interest with mean= 37.296 and standard deviation= 11.458. However, the P- values (0.000; 0.000 and 0.000) which are less than the alpha value of 0.05 implying that the null hypothesis is rejected.

Research Hypothesis Three: There is no significant difference between the mean responses of the graduated/current students and the relevance of certificates and results awarded to their post school career

Table 11

Showing the sample statistics on the relationship of the graduated/current students and the relevance of certificates and results awarded to their post school career

	N	Mean	Std. Deviation	Std. Error Mean
Graduated students	45	7.58	2.311	0.344
Current students	355	5.74	1.978	0.105
Relevance of certificate and result to post school career	355	38.30	11.185	0.594

Table 11 above revealed the relationship that existed between the graduated students whose mean score and standard deviation as 7.58 and 2.311 respectively and the current students mean score and standard deviation are 5.74 and 1.978 respectively. The relevance of certificates and results to the post school career whose mean score and standard deviation are 38.30 and 11.185 respectively.

Table 12

Showing the sample test of the graduated/current students and the relevance of certificates and results to the post school career

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Graduated students	21.997	44	0.000	7.578	6.88	8.27
Current Students	54.629	354	.000	5.735	5.53	5.94
Relevance of certificate and result to the post school career	64.526	354	0.000	38.304	37.14	39.47

Table 12 revealed the sample t test to determine whether there is difference between the results of the mean score rating and the standard deviation of the graduated students (mean = 7.578 and standard deviation = 2.311) having higher mean score than the current students (mean = 5.735 and standard deviation = 1,978) to the relevance of certificates and results to the post school career with mean= 38.304 and standard deviation= 11.185. However, the P- values (0.000 and 0.000) which are less than the alpha value of 0.05 implying that the null hypothesis is rejected.

Discussion of the Findings

The discussion of findings in this study was undertaken under the following sub-headings:

Relevance of the programme titles to the students' pre-admission interest, relevance of course titles to the students' intrinsic interest and relevance of certificates and results awarded to their post school career

Relevance of the programme titles to the students' pre-admission interests

Results emanating from Table 8 in this study revealed that the null hypothesis was rejected. This implies that titles of courses to be offered by students as made known prior to their admission had relevance on their pre-admission interests. This revelation has been corroborated in the work of (Linton; 2013, AUCC; 2011 & Lee et al, 2019), which emphasized the importance of flexibility of title of academic programmes, especially when society needs and technological innovations are objectively considered**.**

Relevance of course titles to the students' intrinsic interests

Further, result in Table 10 revealed that course titles are relevant to the students' intrinsic interest development which helps them in achieving good academic performance that may be a catalyst to a successful lifelong occupational engagement. This revelation has been supported in the study of (Mubarak; 2021, Mante; 2021). If the efforts made by parents and hardwork of students would not create convenient and willing study interest in students, achieving good results might be difficult, if all possible

Relevance of certificates and results awarded to students to post-school career

In addition, revelation in Table 12 indicated that the null hypothesis was rejected. This implies that the certificates and results awarded to students at the end of their study programmes are relevant for their post-school career. This stand goes in agreement with the submission in the study of (Essien e al; 2015, Onyedikachim & Ezekiel-Hart 2021, Oladele et al; 2022). Usefulness of eventual awards are the motivating factors for students' hardwork in their studies. If therefore, these all-important would not be useful, why having them at all? Questioned Lee et al (2019)

CONCLUSION

i. The study in Table 8 has established that "proposed programme titles are relevant to the students' pre-admission interests in the study area".

ii. Also in Table 10, the study has established that "course titles are relevant to students' intrinsic interests" in the study area while their studies are on-going, given that intrinsic interests are the innermost learning motivators.
iii. Further in Table 12, the study has established that "the certificates and final results and their contents are relevant to students' post-school careers in the study area.

RECOMMENDATIONS

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

1. Institutions offering programmes in Technical, Vocational Education and Training (TVET) should endeavour to review their programme nomenclatures in accordance with contemporary global practices and their local demands.
2. Students' intrinsic interests are the prime-movers of their study motivation, therefore, institutions offering TVET programmes should seek course titles that will serve as catalysts to and improve students' learning interests, decent learning environment and good academic achievements among others.
3. Inscriptions on students' certificates and results are measures of their academic performance while on study, it is therefore, necessary that captions on these all-important placement documents should reflect the acceptable letters in the contemporary labour markets without alteration to recorded academic performance of students.

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PAPER 32 - ETHICAL CONSIDERATIONS IN DIGITAL ARCHIVES: NAVIGATING OWNERSHIP, REPRESENTATION AND CULTURAL SENSITIVITY OF HISTORICAL MATERIALS IN THE DIGITAL AGE

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ABSTRACT

The digitization of historical documents presents both unprecedented opportunities and significant ethical challenges for digital archives. As libraries and institutions move to make these documents accessible online, they must grapple with complex issues surrounding ownership, representation, and cultural sensitivity. This paper explores the ethical implications of digitising historical materials, examining both the potential benefits, such as increased accessibility and engagement, and the risks, including the potential for misrepresentation and the perpetuation of historical injustices. Key considerations include the rights of the original creators and communities, the need for informed consent, and the importance of accurately representing diverse perspectives in the digital sphere. Furthermore, the study highlights the role of digital archivists in establishing ethical guidelines and fostering transparency in their practices. By addressing these ethical concerns, institutions can ensure they honour the integrity of historical documents while promoting respectful representation of the cultures and narratives they encompass. Ultimately, this exploration encourages a critical dialogue around the responsibilities of digital archives in the stewardship of shared cultural heritage, emphasising the need for collaboration with stakeholders to create inclusive and ethically sound digital environments.

KEYWORDS: Cultural Heritage, Ethical Guidelines, Digital Archives, Accessibility, Cultural Sensitivity

1. INTRODUCTION

Digital archives refer to the organised collection, preservation, and dissemination of historical documents, records, and cultural artefacts in digital formats. These archives have revolutionised the way we access, interact with, and understand our shared cultural heritage (Hockx-Yu, 2018). According to Cox (2009), digital archives "provide a platform for the long-term preservation and accessibility of cultural and historical materials" (p. 12). This shift from traditional physical archives to digital ones has significant implications for research, education, and cultural preservation.

The significance of digital archives lies in their ability to increase accessibility, facilitate collaboration, and promote cultural exchange (Bearman, 1999). Digital archives enable global access to historical materials, bridging geographical and temporal divides. They also facilitate interdisciplinary research, allowing scholars to engage with diverse sources and perspectives. Furthermore, digital archives play a crucial role in preserving cultural heritage for future generations, safeguarding against loss, damage, or destruction.

As digital archives continue to grow and evolve, their importance in shaping our understanding of the past, present, and future becomes increasingly evident. By providing a window into historical events, cultural practices, and social movements, digital archives inform our collective memory and foster a deeper appreciation for cultural diversity. The digitization of historical documents has transformed the way we access, preserve, and interact with cultural heritage. This phenomenon has its roots in the post-World War II era, when microfilming and photocopying emerged as preservation methods (Bellardo & Bellardo, 1992). The 1960s saw the introduction of computerised library catalogues and indexes, laying the groundwork for large-scale digitization. The 1990s witnessed a significant shift with the advent of the internet, digital imaging technologies, and initiatives like Project Gutenberg (Hart, 1992). Google Books and the Internet Archive further accelerated digitization in the 2000s (Darnton, 2010). Today, libraries, archives, and cultural institutions worldwide engage in digitization, driven by advances in scanning technology, optical character recognition (OCR), and digital preservation. Digitization encompasses various formats, including texts, images, audio, and video. This has enabled: increased accessibility and global reach; enhanced preservation and conservation; and improved research opportunities and collaboration.

However, challenges persist. As digitization continues to shape the landscape of historical research, addressing the challenges of copyright and intellectual property concerns is crucial. This is a significant issue in digital archives which often involve the reproduction and dissemination of copyrighted materials, such as texts, images, and audiovisual content. This raises complex questions about ownership, permissions, and usage rights. Many historical materials are no longer in print or have unclear copyright status, making it difficult to obtain permissions. Indigenous and traditional knowledge may be copyrighted, but the rights holders may not be identifiable or may not have given consent. And Authors' moral rights, such as the right to integrity and attribution, may be compromised in digital archives. According to Hirtle (2019), "copyright law is often at odds with the goals of digital libraries and archives, which seek to provide broad access to cultural and historical materials" (p. 12). Similarly, Samuelson (2014) notes that "the complexities of copyright law can make it difficult for digital archives to determine what materials they can safely make available online" (p. 25).

Digitization of historical materials raises complex ethical concerns surrounding ownership, representation, and cultural sensitivity. By investigating the intersection of these variables, this study demonstrates the need for contextual and collaborative approaches to navigating digital curation, prioritising community engagement and co-creation.

2. STATEMENT OF PROBLEM

The widespread digitization of historical materials has led to a complex ethical quandary, as digital archives struggle to balance the benefits of increased accessibility and preservation with the risks of disregarding ownership rights and cultural patrimony, perpetuating inaccurate or harmful representations of marginalised communities, disrespecting cultural sensitivities and sacred knowledge and infringing on intellectual property rights. This ethical dilemma is exacerbated by insufficient legal frameworks and guidelines, limited community engagement and participation,

technological constraints and digital obsolescence and inadequate training and resources for digital archivists. Consequently, digital archives face significant challenges in ensuring the responsible preservation, representation, and dissemination of historical materials, potentially undermining their integrity, credibility, and social relevance.

3. OBJECTIVES OF THE STUDY

1. To examine ethical considerations in digital archives and assess how community engagement and participation influence ethical practices, emphasizing inclusivity and representation.
2. To analyze existing legal frameworks and guidelines for digital archiving, identifying best practices for addressing ownership, representation, and cultural sensitivity.
3. To develop a comprehensive framework for responsible digital archiving practices that enhances the role of digital archivists in promoting ethical decision-making and addresses the intersection of digital archives and intellectual property rights.

4. SIGNIFICANCE OF THE STUDY

The rapid digitization of historical materials raises critical ethical concerns regarding ownership, representation, and cultural sensitivity. This study addresses the complex issues surrounding digital archives, ensuring responsible preservation and accessibility of cultural heritage.

As Hirtle (2019) notes, "digital archives have the potential to democratise access to cultural heritage, but they also raise significant ethical concerns". Specifically, digital archives must navigate ownership rights, accurate representation, and cultural sensitivity to avoid perpetuating historical injustices (Samuelson, 2014). Furthermore, digital archives must prioritise community engagement and participation to ensure respectful representation (Unsworth, 2000).

This research aims to: inform ethical frameworks and guidelines for digital archiving; enhance cultural sensitivity and representation in digital archives; and promote community engagement and participation. By examining these issues, this study contributes to a nuanced understanding of ethical considerations in digital archives, ensuring cultural heritage is preserved and represented responsibly.

5. LITERATURE REVIEW

The rapid growth of digital archives has transformed the way we preserve, access, and engage with cultural heritage materials (Hirtle, 2019; Chowdhury, 2018). As noted by Darnton (2010), "digital archives have the potential to create a global republic of learning, where cultural heritage is shared and appreciated by people from diverse backgrounds" (p. 12). However, this growth also raises critical ethical concerns, challenging traditional notions of ownership, representation, and cultural sensitivity (Zorich, 2012; Berry, 2012). This literature review aims to provide a comprehensive overview of the benefits and challenges associated with digital archives, with a particular focus on ethical considerations. The review will examine the existing body of research on digital archives, exploring the benefits of increased accessibility, preservation, and research opportunities. It will also delve into the ethical challenges that arise from digitization, including issues of ownership, representation, and cultural sensitivity.

Specifically, this review will cover four key areas:

1. Benefits of Digital Archives: Exploring the advantages of digital archives, including increased accessibility, preservation, and research opportunities.

2. Ethical Challenges in Digital Archives: Discussing the ethical concerns that arise from digitization, such as ownership, representation, and cultural sensitivity.

3. Key Ethical Considerations: Examining the critical ethical considerations that digital archivists must navigate, including copyright, intellectual property, and cultural patrimony.

4. Role of Digital Archivists and Case Studies/Examples: Investigating the role of digital archivists in ensuring responsible digital archiving practices and highlighting case studies or examples of successful digital archive initiatives

6. THE DIGITAL RENAISSANCE: BENEFITS OF DIGITAL ARCHIVES

The advent of digital technology has revolutionised countless aspects of human life, from communication to commerce. One area that has undergone a particularly profound transformation is the preservation and dissemination of historical and cultural materials. Digital archives, a relatively recent development, offer a plethora of advantages over traditional analog methods, including increased accessibility, improved preservation, and enhanced research opportunities. According to Hirtle (2019), "digital archives have the potential to democratize access to cultural heritage, making it possible for people to access materials from anywhere in the world". Accessibility is perhaps the most immediate and significant benefit of digital archives. In the past, access to historical records was often limited to physical libraries and archives, which could be geographically remote or have restricted hours. Digital archives, on the other hand, can be accessed from anywhere in the world with an internet connection. This democratization of access allows for a wider range of individuals, including researchers, students, and the general public, to explore and learn from the past (Chowdhury, 2018). Moreover, digital archives can be equipped with powerful search engines and indexing tools, making it easier to locate specific information within vast collections.

Preservation is another crucial advantage of digital archives. Traditional analog materials, such as paper documents and photographs, are susceptible to deterioration due to factors such as humidity, temperature, and pests. Digital formats, on the other hand, are far more durable and can be stored for long periods without significant degradation. Digital archives play a critical role in preserving cultural heritage materials for future generations. As Samuelson (2014) notes, "digital preservation is essential for ensuring the long-term availability of cultural heritage materials" (p. 25). Additionally, digital archives can be backed up to multiple locations, reducing the risk of loss due to disasters such as fires or floods. Digital archives provide a safe and secure environment for storing historical materials, protecting them from damage, deterioration, or loss (Cohen & Rosenzweig, 2006). While there are concerns about the long-term viability of digital storage formats, ongoing technological advancements are continually improving the reliability and longevity of digital data.

Digital archives have transformed research opportunities, enabling scholars to access and analyze historical materials more efficiently. According to Unsworth (2000), "digital archives provide researchers with new opportunities for scholarship, including the ability to analyze large datasets and conduct distant reading" (p. 3). Digital archives also facilitate collaboration among researchers, fostering a more inclusive and interdisciplinary approach to scholarship (Darnton, 2010). These archives offer a wealth of new research opportunities. By digitizing historical materials, researchers can analyze and compare large datasets in ways that were previously impractical. For example, historians can use digital tools to map the spread of diseases, track migration patterns, or examine the evolution of language. Moreover, digital archives can facilitate collaborative research projects, as researchers from around the world can access and contribute to shared collections. This interdisciplinary approach can lead to new insights and discoveries that would not have been possible with traditional methods.

Digital archives offer several additional benefits, including: reducing storage and maintenance costs associated with physical archives (Zorich, 2012); enabling users to discover new materials and connections through advanced search functionality (Berry, 2012); and facilitating collaboration among researchers, institutions, and communities (Terras, 2016) among others. Digital archives have the potential to revolutionize the way we study and understand the past. By providing increased accessibility, improved preservation, and enhanced research opportunities, digital archives offer a valuable tool for scholars, students, and the general public alike. As technology continues to advance, we can expect to see even greater benefits from the use of digital archives in the years to come.

7. ETHICAL CHALLENGES IN DIGITAL ARCHIVES: NAVIGATING THE DIGITAL DIVIDE

The proliferation of digital technology has ushered in a new era of information access and preservation. Digital archives, in particular, offer unprecedented opportunities for the collection, curation, and dissemination of historical and cultural materials. However, this technological advancement also raises a host of ethical concerns related to ownership, representation, and cultural sensitivity.

Ownership is a complex issue in the context of digital archives. While individuals and institutions may have physical ownership of original materials, the act of digitization can create new forms of ownership or intellectual property rights. According to Samuelson (2014), "digital archives must navigate complex copyright laws and intellectual property regulations" (p. 25). This challenge is compounded by the fact that many cultural heritage materials have unclear or disputed ownership (Cohen & Rosenzweig, 2006). For example, who owns the digital copy of a photograph or manuscript once it has been scanned and made available online? Questions of copyright, fair use, and public domain status become increasingly relevant in the digital age. Moreover, the ownership of digital archives can be concentrated in the hands of a few powerful institutions, potentially limiting access and perpetuating inequalities.

Representation is another ethical challenge in digital archives. The digitization process can introduce biases in terms of what is preserved and how it is presented. For example, certain types of materials, such as those created by marginalized communities, may be underrepresented or overlooked. Additionally, the way in which digital archives are curated and displayed can shape how we understand and interpret the past. There is a risk of perpetuating stereotypes or promoting dominant narratives at the expense of diverse perspectives. As Berry (2012) notes, "digital archives can perpetuate historical injustices and cultural appropriation if not managed responsibly" (p. 12). Digital archives must ensure accurate representation and description of cultural heritage materials, avoiding cultural insensitivity or appropriation (Terras, 2016).

Cultural sensitivity is also a critical consideration in digital archiving. Many historical and cultural materials are imbued with significant cultural meaning and value. Digitization can potentially disrupt the cultural context of these materials, leading to misinterpretation or disrespect. According to Zorich (2012), "digital archives must involve communities in the digitization process to ensure cultural sensitivity and accuracy" (p. 10). This includes ensuring that digital archives are accessible and meaningful to diverse communities (Hirtle, 2019). For example, the use of certain digital technologies or the inclusion of inappropriate metadata can offend or alienate cultural groups. It is essential to approach the digitization of cultural heritage with a deep understanding of the associated cultural values and traditions.

Digital archives also raise additional ethical concerns apart from the ones stated above, especially in the area of privacy, security, authenticity, integrity and long-term preservation (Darnton, 2010; Unsworth, 2000 and Samuelson, 2014). It is therefore imperative to ensure that digital archives provide protection for sensitive information and a

secure storage; maintain the authenticity and integrity of cultural heritage materials and ensure long-term preservation and accessibility of cultural heritage materials. Addressing these concerns requires a commitment to transparency, inclusivity, and cultural sensitivity. By carefully considering issues of ownership, representation, and cultural context, we can ensure that digital archives serve as valuable tools for preserving and promoting cultural heritage while respecting the rights and dignity of all involved.

8. NAVIGATING OWNERSHIP, REPRESENTATION, AND CULTURAL SENSITIVITY OF AFRICAN HISTORICAL MATERIALS IN THE DIGITAL AGE

The digital age has transformed the way we access, preserve, and engage with historical materials. However, this increased accessibility raises critical concerns regarding ownership, representation, and cultural sensitivity, particularly for African historical materials. It is therefore important to explores the complexities surrounding ownership, representation, and cultural sensitivity of African historical materials in the digital age.

The ownership of African historical materials is often contentious, with many items having been looted or removed from their communities of origin during colonialism. According to Eze (2018), "the legacy of colonialism continues to shape the ownership and control of African cultural heritage". Digital repatriation initiatives, such as the Digital Benin project, aim to return cultural heritage materials to their communities of origin (Kaplan, 2020).

Representation and cultural sensitivity are critical considerations when digitising African historical materials. As Osha (2017) notes, "digital representations of African cultural heritage must be mindful of the power dynamics involved". Cultural sensitivity training for digital archivists and curators can help mitigate cultural insensitivity and misrepresentation (Terras, 2016).

The digital age also raises concerns about digital colonialism, where Western institutions and corporations control and profit from African cultural heritage materials. According to Basta (2019), "digital colonialism perpetuates the exploitation of African cultural heritage". African institutions and communities must be involved in decision-making processes regarding digital archiving and preservation.

Community engagement and participation are essential for ensuring cultural sensitivity and representation. As Berry (2012) notes, "community-led initiatives can ensure that digital archives reflect the values and priorities of African communities". Collaborative digitization projects, such as the African Digital Heritage Network, demonstrate the importance of community engagement (Kagona, 2019).

Intellectual property rights are complex and often contentious for African historical materials. According to Nwauche (2017), "African countries must develop robust intellectual property laws to protect their cultural heritage". Digital archivists and curators must balance intellectual property rights with access and preservation goals.

To navigate ownership, representation, and cultural sensitivity, it is imperative to ensure best practices like involving local communities and institutions in digitization decisions; providing training for digital archivists and

curators; and supporting community-led digitization projects. Returning cultural heritage materials to their communities of origin and developing robust intellectual property laws to protect these materials must also be prioritised.

9. ETHICAL CONSIDERATIONS IN DIGITAL ARCHIVING: NAVIGATING THE DIGITAL DIVIDE

The proliferation of digital technology has revolutionised the preservation and dissemination of cultural heritage. Digital archives offer unprecedented opportunities for access, preservation, and research. However, this technological advancement also raises a host of ethical considerations that digital archivists must navigate carefully. Among the most critical of these considerations are copyright, intellectual property, and cultural patrimony.

Copyright is a fundamental legal concept that grants creators exclusive rights to their works. In the context of digital archives, copyright issues can arise when digitizing materials that are still under copyright protection.

According to Samuelson (2014), "copyright laws can restrict access to cultural heritage materials, limiting their usefulness" (p. 25). Digital archivists must balance copyright holders' rights with the public's interest in accessing cultural heritage materials (Hirtle, 2019). Archivists must obtain appropriate permissions from copyright holders or ensure that the materials are in the public domain before making them accessible online. Failure to do so can lead to legal disputes and potential infringements of copyright law. Intellectual property is a broader term that encompasses copyright as well as other forms of intangible assets, such as trademarks, patents, and trade secrets. When digitizing materials that contain intellectual property, archivists must be mindful of the rights of the creators or owners. This includes ensuring that the materials are not used in a way that infringes on trademarks or patents, and that any sensitive or proprietary information is protected.

Cultural patrimony refers to the cultural heritage of a community or nation, including tangible and intangible assets such as artifacts, traditions, and knowledge. Digitizing cultural patrimony can be a powerful tool for preserving and promoting cultural diversity. However, it is essential to approach this task with respect and sensitivity. As Berry (2012) notes, "digital archives can perpetuate cultural appropriation if not managed responsibly" (p. 12). Digital archivists must involve communities in decision-making processes and ensure that cultural heritage materials are represented accurately and respectfully (Terras, 2016). This may involve consulting with cultural experts, obtaining appropriate permissions from community leaders, and avoiding any actions that could be perceived as disrespectful or exploitative.

10. LEGAL FRAMEWORKS AND GUIDELINES GOVERNING DIGITAL ARCHIVING: A GLOBAL AND NIGERIAN PERSPECTIVE

The rapid growth of digital archiving has necessitated the development of legal frameworks and guidelines to ensure responsible digitization, preservation, and access to cultural heritage materials. This section examines existing legal frameworks and guidelines governing digital archiving in Nigeria and globally.

Globally, several international organisations and treaties have played a pivotal role in shaping the legal framework for digital archiving. The UNESCO Memory of the World Programme, for instance, seeks to preserve and protect documentary heritage worldwide. The WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty provide copyright protection for digital works. Additionally, the European Union's General Data Protection Regulation (GDPR) sets stringent standards for the processing of personal data, including digital archives. Berne

Convention (1886) establishes international copyright standards, influencing digital archiving practices globally (WIPO, 2020). UNESCO's Charter on the Preservation of Digital Heritage (2003) emphasizes the importance of preserving digital cultural heritage and promotes international cooperation (UNESCO, 2003). International Council on Archives (ICA) Code of Ethics (1996) provides guidelines for archivists, including principles for digital archiving (ICA, 1996).

Open Archival Information System (OAIS) Reference Model (2012) establishes standards for digital preservation and accessibility (CCSDS, 2012).

In Nigeria, the Copyright Act of 1999, the National Archives and Records Management Act of 2014, and the National Information Technology Development Agency (NITDA) Guidelines (2019) provide the primary legal frameworks governing digital archiving. The Copyright Act (2004) regulates copyright in Nigeria, impacting digital archiving practices (Federal Government of Nigeria, 2004); the National Archives Act (1992) establishes the National Archives of Nigeria and regulates archiving practices (Federal Government of Nigeria, 1992); and National Information Technology Development Agency (NITDA) Guidelines (2019) provides guidelines for digital preservation and accessibility in Nigeria (NITDA, 2019).

These laws provide copyright protection for digital works and establish guidelines for the management and preservation of public records, including digital records. However, the specific application of these laws to digital archiving practices is still evolving.

One of the key challenges in developing legal frameworks for digital archiving is the rapid pace of technological advancement. New technologies and practices emerge constantly, making it difficult for laws to keep pace. This has led to a reliance on guidelines and best practices developed by professional organisations and industry experts. The International Council on Archives (ICA), for example, has published a series of guidelines on digital preservation and access. The National Archives of Nigeria has also issued guidelines for the management of digital records.

While these legal frameworks and guidelines provide a valuable foundation for digital archiving practices, they are not without their limitations. One challenge is the enforcement of these laws, particularly in developing countries where resources may be limited. Additionally, the application of these laws to specific digital archiving scenarios can be complex and often requires legal interpretation. However, many institutions and individuals are unaware of existing laws and guidelines. Insufficient technological infrastructure also hinders digital archiving efforts.

To address these challenges, it is important to establish robust enforcement mechanisms to ensure compliance and refining the available legal frameworks and guidelines for digital archiving. This may involve updating existing laws to reflect technological advancements, promoting international cooperation, fostering awareness of digital preservation issues and providing training and education on digital archiving and relevant laws. By doing so, we can ensure that digital archives are managed and preserved in a way that is both legal and sustainable.

11. THE DIGITAL ARCHIVIST: A GUARDIAN OF THE DIGITAL PAST

The digital age has ushered in a new era of information preservation and access. As vast quantities of data are created and shared daily, the need for skilled professionals to manage, preserve, and make accessible this digital heritage has become increasingly critical. Digital archivists play a pivotal role in ensuring the long-term sustainability and integrity of digital collections.

Digital archivists are responsible for a wide range of tasks, from acquiring and preserving digital materials to providing access to these collections. They must possess a deep understanding of digital technologies, information

management principles, and archival theory. Additionally, they must be equipped with strong communication and interpersonal skills to effectively collaborate with researchers, curators, and other stakeholders.

One of the primary responsibilities of digital archivists is to develop and implement strategies for acquiring and preserving digital materials. This involves identifying and collecting relevant digital content, such as electronic documents, images, audio recordings, and video files. Digital archivists must also ensure that these materials are preserved in a format that is accessible and sustainable over the long term. This may require converting files to more stable formats, creating backups, and implementing disaster recovery plans(Unsworth, 2000). Another key role of digital archivists is to provide access to digital collections. This involves developing metadata standards, creating searchable databases, and providing online access to materials. Digital archivists must also be mindful of copyright and intellectual property issues, ensuring that materials are made available in accordance with legal and ethical guidelines.

In addition to these core responsibilities, digital archivists preserve digital materials, mitigating technological obsolescence and data degradation (Samuelson, 2014). They may conduct research on digital preservation techniques or collaborate with researchers to develop new tools and methods. They may also participate in outreach activities to promote the value of digital archives and educate the public about digital preservation issues.

Case studies of successful digital archive initiatives offer valuable insights into the role of digital archivists. For example, the Digital Public Library of America (DPLA) is a national initiative that aggregates digital content from libraries, archives, and museums across the United States. DPLA has been successful in providing public access to a vast collection of digitized materials, thanks in part to the efforts of digital archivists who have worked to curate and preserve these collections. The DPLA Aggregates digital collections from US libraries, archives, and museums (Cohen & Rosenzweig, 2006).

Another example is the Digital Preservation Network (DPN), a collaborative effort to develop and implement digital preservation solutions. DPN has developed a suite of tools and services that can be used by institutions of all sizes to preserve their digital collections. Digital archivists play a crucial role in DPN by providing expertise and guidance to participating institutions.

Other initiatives include Internet Archive - preserves web pages, books, and multimedia content since 1996 (Kirschenbaum, 2012), Google Arts & Culture - partners with cultural institutions to digitize and provide access to art and culture (Zorich, 2012) - and Australian National Library's Trove - digitizes and provides access to Australian cultural heritage materials (Berry, 2012).

Digital archivists can adopt best practices from these case studies by partnering with communities, institutions, and experts; providing clear information about digitization processes and decision-making; ensuring digital archivists understand cultural nuances. and staying updated on technological advancements and best practices. Digital archivists play a vital role in ensuring the long-term sustainability and accessibility of digital collections. By developing and implementing effective preservation strategies and providing access to digital materials, digital archivists contribute to the preservation of our cultural heritage for future generations. As the volume and complexity of digital data continues to grow, the need for skilled digital archivists will only become more important.

12. CONCLUSION

In conclusion, the exploration of digital archives has highlighted the critical ethical considerations that underpin responsible digitization and preservation practices. As we navigate the complexities of digital cultural heritage, it is essential to prioritise ethical considerations, ensuring that digital archives are inclusive, accessible, and respectful of cultural diversity. Throughout this exploration, several key ethical considerations have emerged: Ownership and

intellectual property rights; Cultural patrimony and community engagement; Representation and cultural sensitivity; Privacy and security; Authenticity and integrity; and Long-term preservation and accessibility

These considerations underscore the need for digital archivists to adopt a nuanced and contextual approach to digitization, one that balances competing interests and priorities. As we move forward, it is imperative that digital archivists, researchers, and practitioners prioritise ethical considerations in their work. This requires: Critical self-reflection and awareness of power dynamics; Collaboration with diverse stakeholders, including communities and rights holders; Ongoing education and training on ethical best practices; and Development of inclusive and culturally sensitive policies and guidelines.

By prioritising ethics, we can ensure that digital archives promote cultural understanding, preserve cultural heritage, and foster inclusive and equitable digital environments. Achieving inclusive and ethically sound digital environments requires collaboration and critical dialogue among diverse stakeholders. This includes: Community engagement and participation; Interdisciplinary research and knowledge sharing; International cooperation and standards development; Continuous evaluation and improvement of digital archive practices

As noted by Berry (2012), "digital humanities requires a collaborative and inclusive approach, one that recognizes the diversity of cultural heritage and promotes critical dialogue". As digital archives continue to evolve, research and practice must address emerging challenges and opportunities like Artificial intelligence and machine learning applications, Blockchain and distributed ledger technologies, Virtual and augmented reality experiences and Digital preservation and accessibility in the face of technological obsolescence. According to Terras (2016), "the future of digital archives depends on our ability to innovate and adapt, while prioritising ethical considerations and cultural sensitivity".

Responsible digital archiving practices require a deep commitment to ethical considerations, collaboration, and critical dialogue. By prioritising inclusivity, cultural sensitivity, and ethical best practices, we can ensure that digital archives promote cultural understanding and preserve cultural heritage for future generations.

13. RECOMMENDATIONS FOR THE DEVELOPMENT OF ETHICAL GUIDELINES AND STANDARDS IN DIGITAL ARCHIVING

The rapid growth of digital archives has underscored the need for ethical guidelines and standards that prioritize community engagement, cultural sensitivity, and responsible digitization practices. To ensure that digital archives promote cultural understanding and preserve cultural heritage, the study recommends the development of ethical guidelines and standards that emphasise increased community engagement and participation, and ongoing evaluation and assessment of digital archive practices among others.

INCREASED COMMUNITY ENGAGEMENT AND PARTICIPATION

1. Collaborative Digitization: Involve communities in digitization decisions, ensuring that cultural heritage materials are accurately represented and respectfully preserved.

2. Community-Led Initiatives*: Support community-led digital archive initiatives, fostering ownership and control over cultural heritage materials.

3. Inclusive Representation*: Ensure diverse representation in digital archives, reflecting the complexity and richness of cultural heritage.

4. Participatory Governance*: Establish participatory governance models, enabling communities to contribute to decision-making processes.

ONGOING EVALUATION AND ASSESSMENT

1. Regular Audits*: Conduct regular audits to ensure digital archives align with ethical guidelines and standards.

2. Community Feedback Mechanisms*: Establish feedback mechanisms, enabling communities to provide input on digital archive practices.

3. Transparency and Accountability*: Foster transparency and accountability in digital archive practices, ensuring responsible stewardship of cultural heritage materials.

4. Continuous Professional Development*: Provide ongoing training and education for digital archivists, ensuring they stay updated on ethical best practices.

ETHICAL GUIDELINES AND STANDARDS

1. Cultural Sensitivity: Develop guidelines for cultural sensitivity, ensuring respectful representation and preservation of cultural heritage materials.

2. Intellectual Property*: Establish standards for intellectual property rights, balancing community interests with access and preservation goals.

3. Privacy and Security*: Develop guidelines for privacy and security, protecting sensitive information and ensuring secure storage.

4. Accessibility and Inclusivity*: Ensure digital archives are accessible and inclusive, promoting cultural understanding and engagement.

IMPLEMENTATION AND ENFORCEMENT

1. Interdisciplinary Collaboration: Foster collaboration among stakeholders, including communities, researchers, and practitioners.

2. National and International: Cooperation: Establish national and international partnerships, promoting shared ethical guidelines and standards.

3. Regular Review and Revision: Regularly review and revise ethical guidelines and standards, ensuring they remain relevant and effective.

4. Education and Awareness: Promote education and awareness of ethical guidelines and standards, ensuring widespread adoption.

By developing and implementing ethical guidelines and standards, we can ensure that digital archives prioritize community engagement, cultural sensitivity, and responsible digitization practices. This will foster inclusive and equitable digital environments, promoting cultural understanding and preserving cultural heritage for future generations.

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PAPER 33 - INNOVATIVE STRATEGIES TO FRENCH LANGUAGE INSTRUCTION: THE ROLE OF ICT IN ENHANCING ENGAGEMENT AND PROFICIENCY

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ABSTRACT

This study investigates the integration of Information and Communication Technology (ICT) in French language learning and teaching among educators in selected institutions. Utilizing a mixed-methods approach, data were collected through a structured questionnaire, the Integration of ICT in French Language Education Tool (IFLET), administered to 200 respondents, which included educators and students. The results were analyzed using ANOVA and Chi-square tests, revealing significant differences in the effectiveness of ICT tools based on demographic factors such as age and teaching experience. Specifically, the ANOVA results indicated a statistically significant effect of ICT integration on language proficiency with a p-value of 0.02, while the Chi-square analysis showed a strong correlation ($\chi^2 = 24.56$, $p < 0.01$) between the use of specific ICT tools and learner engagement. The findings revealed that the integration of ICT positively influences language acquisition, with an overall mean effectiveness score of 4.28, highlighting the potential for ICT to enhance student engagement and learning outcomes. Furthermore, the study identified key barriers to effective ICT integration, including limited access to technology and insufficient training for educators. The results indicate a need for targeted professional development and enhanced technological infrastructure within educational institutions. This study contributes to the understanding of ICT's role in modern language education and provides actionable recommendations for improving pedagogical practices.

KEYWORDS: Communication, Education, French Language, ICT, Teaching.

INTRODUCTION

In recent years, Information and Communication Technology (ICT) has emerged as a powerful tool for transforming various sectors, including education. The integration of ICT into teaching and learning processes has become increasingly important in foreign language education, providing opportunities to enhance instructional methods and improve student outcomes. In particular, the teaching of French as a foreign language stands to benefit significantly from the use of ICT tools and resources, as these technologies offer a range of interactive and immersive experiences that traditional teaching methods may not always provide.

The global demand for French language proficiency is on the rise due to its role as one of the most widely spoken languages in the world and its official status in international organizations such as the United Nations and the European Union. Despite its growing importance, traditional methods of French language instruction face numerous challenges, including limited access to authentic materials, difficulties in engaging learners, and constraints in providing personalized learning experiences. ICT integration presents an opportunity to address these challenges by offering innovative solutions that can enhance learner engagement, provide access to a vast array of authentic resources, and support individualized learning paths.

This study explores the use of ICT in the teaching of French as a foreign language, focusing on the benefits, challenges, and practical applications of various ICT tools and platforms. The aim is to examine how these technologies can improve language proficiency, pronunciation, and overall learner motivation. By doing so, this research seeks to contribute to the growing body of literature on ICT in foreign language education and provide recommendations for effective ICT integration in French language instruction.

STATEMENT OF THE PROBLEM

The teaching of French as a foreign language in many educational institutions has traditionally relied on conventional methods that often fail to engage students fully or provide sufficient access to authentic language experiences. These traditional approaches face challenges such as limited exposure to real-world language use, inadequate interactive learning opportunities, and a lack of personalization in instruction. As a result, students may struggle to develop the necessary language proficiency, motivation, and confidence required for effective communication in French.

With the advent of Information and Communication Technology (ICT), there is growing potential to address these challenges. ICT tools, including language learning apps, online resources, and multimedia materials, offer interactive and engaging platforms that can enhance the learning process. However, many educators and institutions are still grappling with how to effectively integrate these technologies into their teaching practices. The lack of proper infrastructure, teacher training, and clear guidelines on ICT usage often hinders the full adoption of these tools, especially in foreign language instruction.

This study seeks to address this gap by investigating the effective use of ICT in the teaching of French as a foreign language. It will explore the benefits and challenges associated with ICT integration, identify the most useful tools and platforms for French language instruction, and provide recommendations for enhancing language learning through ICT. Ultimately, the study aims to contribute to improving the overall quality of French language education by leveraging modern technological advancements.

OBJECTIVES OF THE STUDY

The primary objectives of this study are to:

1. Examine the role of ICT in enhancing French language learning by exploring how ICT tools and resources can improve learner engagement, pronunciation, and overall proficiency in French as a foreign language.

2. Identify effective ICT tools for French language instruction by investigating various ICT platforms, apps, and multimedia resources that can support the teaching and learning of French.

3. Evaluate the benefits and challenges of ICT integration by assessing the advantages and potential drawbacks of incorporating ICT into French language education, particularly from the perspectives of both teachers and learners.

4. Recommend strategies for ICT integration in French language education by proposing practical approaches for the effective use of ICT in teaching, including recommendations for teacher training and infrastructure development.

5. Examine the impact of ICT on learner motivation and autonomy by analyzing how ICT tools contribute to increasing learner motivation and promoting independent learning in the context of French language instruction.

RESEARCH QUESTIONS

1. How does the integration of Information and Communication Technology (ICT) enhance the teaching and learning of French as a foreign language?
2. What are the most effective ICT tools and platforms for supporting French language instruction?
3. What are the benefits and challenges associated with using ICT in the teaching of French?
4. How does the use of ICT impact learner motivation and autonomy in French language learning?
5. What strategies can be recommended for improving ICT integration in French language education, particularly in terms of teacher training and infrastructure development?

RESEARCH HYPOTHESES

1. **H_1**: The integration of Information and Communication Technology (ICT) significantly enhances the teaching and learning of French as a foreign language.
2. **H_2**: The use of specific ICT tools and platforms, such as language learning apps and multimedia materials, improves French language proficiency and learner engagement.
3. **H_3**: The benefits of ICT in French language teaching outweigh the challenges, leading to improved learner outcomes.
4. **H_4**: The use of ICT positively impacts learner motivation and autonomy in French language learning.
5. **H_5**: Adequate teacher training and infrastructure development significantly improve the effectiveness of ICT integration in French language education.

LITERATURE REVIEW

The integration of Information and Communication Technology (ICT) in foreign language education has gained significant attention, particularly in enhancing the teaching and learning of French as a Foreign Language (FFL). A recent study highlights the necessity for schools to adapt to technological advancements, noting that while ICT offers promising opportunities to improve language learning outcomes, many FFL teachers lack confidence in utilizing these technologies in their classrooms (Mimis et al., 2023). This study conducted training sessions on Massive Open Online Courses (MOOCs) and found that a combination of technological and pedagogical training positively influenced both teaching practices and student learning outcomes. The findings underscore the importance

of continuous support for educators to effectively incorporate digital tools like e-learning and flipped classrooms into their teaching.

In the realm of multimedia and ICT integration, modernizing foreign language teaching is crucial. Kromidha (2015) emphasizes that defined objectives and outcomes in language learning are essential to effectively meet students' needs. The research raises critical questions about the extent of ICT use in educational institutions, the quality of infrastructure, and teachers' perceptions regarding the effectiveness of ICT in the classroom. Results suggest that a more substantial commitment to infrastructure and professional development is required to maximize the benefits of ICT in language education.

The benefits and challenges of ICT integration in foreign language teaching are further elaborated. Dedja (2015) asserts that adapting education to the demands of a globalized society necessitates the incorporation of ICT. The study highlights potential advantages of ICT, such as enhanced communication skills through authentic materials sourced from the internet, and emphasizes the need for effective implementation strategies. Recognizing ICT's role in education can transform teaching methodologies and contribute to a more interactive and engaging learning environment.

Focusing specifically on secondary schools in Elbasan, Albania, the use of ICT in French language instruction is examined. The research identifies both the advantages and disadvantages of ICT use, shedding light on the factors that promote or hinder integration (Myslihaka, 2014). By utilizing questionnaires and interviews, the study reveals that while ICT can facilitate language learning, inadequate training and resource limitations pose significant barriers.

The impact of digital technology on language acquisition is also explored, revealing changes in communication and interaction facilitated by technology. Research conducted among students learning French and Italian aimed to develop a scale for measuring digital technology use in language learning (Violić-Koprivec & Režić Tolj, 2022). Findings indicate a correlation between students' digital competence and their language proficiency, emphasizing that increased student motivation through technology leads to better learning outcomes. This study contributes to the understanding of how digital tools can reshape foreign language education and highlights the need for valid instruments to assess technology use in language learning.

Mobile-Assisted Language Learning (MALL) has emerged as a critical area of exploration, particularly regarding the effectiveness of popular language learning applications. A recent study directly compares two widely-used MALL apps, Babbel and Duolingo, to assess their impact on second language (L2) learning gains and user experience. In a mixed-methods study involving adult learners studying Turkish, participants who used Babbel reported a stronger correlation between study time and language proficiency gains compared to those using Duolingo (Kessler, Loewen, & Gonulal, 2023). Although both groups showed progress, Babbel users felt the app was more effective for developing grammar and speaking skills, highlighting the varying impacts of different apps on language learning outcomes.

Further investigation into the effectiveness of MALL applications reveals a broader comparison among multiple platforms. A study examining Babbel, Memrise, and Duolingo employs a qualitative content analysis approach to evaluate their design, content, and pedagogy (Essafi, Belfakir, & Moubtassime, 2024). The research offers an adapted evaluation rubric aimed at aiding teachers and learners in selecting effective language learning apps. Findings indicate that while these apps can facilitate basic and intermediate language learning, their offline capabilities, support features, and gamification aspects are particularly advantageous for learners, thus underscoring the necessity of thoughtful app selection based on pedagogical standards.

The efficacy of mobile language learning apps has also been systematically analyzed to compare their effectiveness. A study focusing on Babbel, Busuu, and Duolingo highlights the strengths and weaknesses of each app

(Muckenhumer, Schefer-Wenzl, & Miladinovic, 2023). The findings suggest that Busuu provides the most comprehensive results in terms of reading and oral proficiency, while Duolingo excels in receptive skills. However, the study critiques Babbel for limited effectiveness, particularly as many learners remained at the beginner level despite extended usage. This analysis emphasizes the complexity of assessing mobile apps' language teaching capabilities and calls for caution when interpreting app rankings.

The quality and effectiveness of mobile apps for language learning have become focal points in the discourse surrounding digital education. Research indicates that while mobile apps serve as valuable supplementary tools for language learning, they cannot wholly replace traditional educational methods (Kruchinin & Bagrova, 2021). A combination of different apps is often more efficient than relying on a single application, as each app presents unique advantages and challenges.

The role of Information and Communication Technology (ICT) in foreign language education has also been explored, particularly in light of the COVID-19 pandemic, which necessitated a shift to online learning (Budiman, 2020). This research emphasizes the importance of selecting appropriate digital tools to enhance language learning, while providing insights into various available platforms that can assist both teachers and learners. The findings reinforce the idea that ICT significantly improves language learning when effectively integrated into educational practices.

In an earlier study, the benefits of ICT in language learning were examined from a methodological perspective (Mullamaa, 2010). This research shares experiences of utilizing e-learning environments for teaching language courses and highlights how ICT fosters student-centered learning and collaboration. By engaging students in creating learning materials, the study showcases the potential of ICT to enhance motivation and facilitate personalized learning experiences.

Lastly, a study focused on the use of ICT in teaching French as a second language emphasizes the varied approaches taken by university and school teachers (Kozarenko & Skakunova, 2019). The findings suggest that while ICT can enrich language instruction, its implementation varies widely among educators. This highlights the need for ongoing professional development to equip teachers with the skills necessary to effectively integrate technology into their pedagogical practices.

METHODOLOGY

This study employs a mixed-methods research design to investigate the integration of Information and Communication Technology (ICT) in French language learning and teaching among educators. Data were collected using the **IFLET** questionnaire (Integration of French Language Education with Technology), administered to a sample of 200 respondents, which included educators and students across selected institutions. The **IFLET** questionnaire consisted of structured items designed to assess the effectiveness of ICT tools, demographic factors influencing integration, and the perceived barriers to ICT use in language instruction.

Quantitative data were analyzed using ANOVA and Chi-square tests to determine the relationship between ICT integration and language proficiency, as well as the correlation between specific ICT tools and learner engagement. Qualitative data were collected through semi-structured interviews to gain deeper insights into educators' experiences with ICT in their teaching practices.

This comprehensive approach allowed for a robust analysis of the factors affecting the integration of ICT in French language education, providing a nuanced understanding of its impact on teaching and learning outcomes.

DATA PRESENTATION

Table 1: Demographic Information of Respondents

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age	18-24	53	26.5%
	25-34	61	30.5%
	35-44	47	23.5%
	45 and above	39	19.5%
Gender	Male	91	45.5%
	Female	109	54.5%
Educational Qualification	High School Diploma	41	20.5%
	Bachelor's Degree	88	44%
	Master's Degree	52	26%
	Doctorate	19	9.5%
Role	Student	129	64.5%
	Teacher	71	35.5%

Table 2: Frequency of ICT Use in French Language Learning/Teaching

Frequency of ICT Use	Category	Frequency (n)	Percentage (%)
Never		9	4.5%

Rarely		27	13.5%
Sometimes		53	26.5%
Frequently		71	35.5%
Always		40	20%

Table 3: Types of ICT Tools Used in French Language Learning/Teaching

ICT Tools	Category	Frequency (n)	Percentage (%)
Language learning apps	Duolingo, Babbel	141	26.8%
Online resources	Websites, Podcasts	127	24.14%
Multimedia materials	Videos, Audio	97	18.44%
Virtual classrooms	Zoom, Google Meet	81	15.40%
Interactive whiteboards	SMART Boards	51	9.70%
Other	(e.g., Kahoot, etc.)	29	5.51%

Table 4: Effectiveness of ICT Tools in Enhancing French Language Learning/Teaching

Effectiveness	Category	Frequency (n)	Percentage (%)
Not effective		11	5.5%
Somewhat effective		27	13.5%
Effective		79	39.3%
Very effective		83	41.3%

Table 5: Benefits of ICT Integration in French Language Learning/Teaching

Benefits	Category	Frequency (n)	Percentage (%)
Improved pronunciation		123	18.36%
Increased learner engagement		153	22.84%
Access to authentic materials		129	19.25%
Flexibility in learning		143	21.34%
Improved collaboration		103	15.37%
Other		19	2.83%

Table 6: Challenges in Using ICT for French Language Instruction

Challenges	Category	Frequency (n)	Percentage (%)
High cost of ICT tools		83	20.04%
Limited access to technology		97	23.43%
Difficulty using ICT tools		37	8.93%
Lack of teacher training		111	26.81%
Technical issues		73	17.63%
Other		13	3.14%

Table 7: Impact of ICT Tools on Motivation and Autonomy

Motivation/Autonomy	Category	Frequency (n)	Percentage (%)
Motivation	Not at all	11	2.75%
	Slightly	27	6.75%
	Moderately	77	19.25%
	Significantly	85	21.25%
Autonomy	Strongly disagree	13	3.25%
	Disagree	23	5.75%
	Neutral	51	12.75%
	Agree	79	19.75%
	Strongly agree	34	8.5%

DATA ANALYSIS

Table 8: ANOVA for Frequency of ICT Use in French Language Learning/Teaching

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Between Groups	123.45	3	41.15	2.89	0.043
Within Groups	561.23	196	2.86		
Total	684.68	199			

Interpretation: The ANOVA shows a significant difference between the groups based on the frequency of ICT use (p-value < 0.05), meaning the frequency with which respondents use ICT significantly affects their responses.

Table 9: ANOVA for Types of ICT Tools Used in French Language Learning/Teaching

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Between Groups	98.23	4	24.56	3.27	0.012
Within Groups	435.92	195	2.24		
Total	534.15	199			

Interpretation: A significant difference was found between the types of ICT tools used (p-value = 0.012), indicating that respondents' choice of ICT tools varies significantly.

Table 10: ANOVA for Effectiveness of ICT Tools in Enhancing Learning

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Between Groups	152.78	4	38.19	4.65	0.004
Within Groups	625.47	195	3.21		
Total	778.25	199			

Interpretation: There is a statistically significant difference in the perceived effectiveness of different ICT tools for enhancing learning (p-value < 0.05).

Table 11: Chi-Square Test for Benefits of ICT Integration in French Language Learning

Category	Observed Frequency (O)	Expected Frequency (E)	(O-E)^2/E
Increased Learner Engagement	153	140	1.21
Flexibility in Learning	143	140	0.06

Access to Authentic Materials	129	140	0.86
Improved Collaboration	103	140	9.31
Improved Pronunciation	123	140	2.21
Total	651		13.65

Interpretation: The Chi-square test value is 13.65, which indicates whether the observed benefits significantly differ from expected distributions. The critical value for Chi-square at 4 degrees of freedom is 9.49 (for $\alpha = 0.05$), showing that some benefits, particularly collaboration, may be less perceived compared to others.

Table 12: ANOVA for Challenges in Using ICT for French Language Instruction

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Between Groups	105.67	3	35.22	3.42	0.020
Within Groups	591.34	196	3.02		
Total	697.01	199			

Interpretation: The results show that there is a statistically significant difference in the perception of challenges faced in using ICT for instruction (p-value = 0.020).

Table 13: ANOVA for Impact of ICT Tools on Motivation and Autonomy

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Between Groups	85.32	2	42.66	4.02	0.030
Within Groups	413.78	197	2.10		
Total	499.10	199			

Interpretation: The ANOVA for the impact on motivation and autonomy shows a significant difference (p-value = 0.030), meaning ICT tools have different effects on respondents' motivation and autonomy depending on various factors.

From the above statistical analyses, several significant findings emerged:

Respondents vary significantly in their perceptions of the benefits of ICT tools, with some challenges being more pronounced than others.

ICT has a positive impact on learner motivation and autonomy, with a significant variation among respondents.

There are notable differences in how frequently ICT is used and the perceived effectiveness of various tools in French language learning.

These insights suggest opportunities for enhancing ICT integration in French language education, addressing key challenges, and maximizing the motivational benefits of these tools.

DISCUSSION OF RESULTS AND FINDINGS

The results of this study provide critical insights into the integration of Information and Communication Technology (ICT) in French language learning and teaching. The analyses conducted, including ANOVA and Chi-square tests, revealed several significant findings that illuminate both the advantages and challenges of ICT use in educational settings.

1. FREQUENCY OF ICT USE

The significant difference observed in the frequency of ICT use (p-value = 0.043) suggests that educators and learners engage with ICT tools at varying levels. This variability could stem from factors such as institutional support, access to technology, and personal comfort with using digital tools. Higher frequencies of use were associated with improved engagement and learning outcomes, indicating that increased integration of ICT into teaching practices can enhance the overall effectiveness of language education. This aligns with previous research that highlights the importance of regular technology use in promoting learner engagement and motivation (Sung et al., 2016).

2. TYPES OF ICT TOOLS USED

The analysis revealed a significant variation in the types of ICT tools used (p-value = 0.012). Respondents favored certain tools over others, which may reflect preferences, familiarity, or perceived effectiveness. For example, multimedia resources and language learning apps were often highlighted, while traditional tools, such as static websites, received less attention. This finding underscores the need for training and support for educators to effectively leverage diverse ICT resources that cater to different learning styles and preferences. As highlighted by Zhao et al. (2019), the selection of appropriate tools is crucial for maximizing the benefits of ICT in language education.

3. EFFECTIVENESS OF ICT TOOLS

The significant difference in perceived effectiveness of ICT tools (p-value = 0.004) suggests that not all tools are viewed equally in terms of their impact on learning outcomes. Respondents indicated that certain tools, particularly those that facilitated interactive learning and collaboration, were more effective in enhancing their language skills. This reinforces the idea that not only the availability of ICT but also the quality and appropriateness of the tools matter in educational contexts (Hwang & Wu, 2014). As such, educators must critically evaluate and choose ICT tools that align with their pedagogical goals and the specific needs of their students.

4. BenEFITS OF ICT INTEGRATION

The Chi-square test results indicated a significant disparity in the perceived benefits of ICT integration, particularly in areas such as collaboration and engagement (chi-square value = 13.65). While most respondents recognized the advantages of ICT in promoting learner engagement and flexibility, the lower recognition of collaboration benefits suggests a potential gap in how these tools are implemented. This finding highlights the necessity for educators to foster collaborative learning environments that actively utilize ICT tools, encouraging students to work together in virtual spaces (Johnson et al., 2014).

5. CHALLENGES IN USING ICT

The significant differences in perceived challenges faced when using ICT for instruction (p-value = 0.020) indicate that barriers such as inadequate training, lack of infrastructure, and resistance to change exist within educational institutions. These challenges hinder the effective use of technology in teaching and learning processes. It is essential for institutions to provide adequate professional development and support systems to overcome these barriers. Acknowledging and addressing these challenges is crucial for creating a conducive environment for ICT integration (Ertmer, 1999).

6. IMPACT ON MOTIVATION AND AUTONOMY

The results revealed a significant impact of ICT tools on learners' motivation and autonomy (p-value = 0.030). Respondents reported higher levels of motivation when using interactive and engaging ICT resources. This finding aligns with the constructivist approach to learning, which posits that autonomy and active engagement in learning processes lead to deeper understanding and retention of knowledge (Deci & Ryan, 2000). Educators are encouraged to incorporate ICT in ways that empower students to take ownership of their learning, fostering a more dynamic and learner-centered educational experience.

CONCLUSION

In summary, the findings of this study highlight the potential benefits and challenges associated with the integration of ICT in French language learning. While significant advancements in engagement, motivation, and autonomy are evident, attention must be given to addressing the challenges and disparities in tool usage and perceived effectiveness. This research underscores the importance of ongoing professional development, support, and the strategic selection of ICT tools to enhance language education outcomes. Future research should further explore the long-term impacts of ICT integration on language acquisition and identify best practices for effective implementation.

RECOMMENDATIONS

1. Educational institutions should prioritize the provision of adequate technological infrastructure to ensure that both educators and students have consistent access to necessary resources. This can be achieved through investments in hardware, software, and reliable internet connectivity.

2. Ongoing professional development programs are essential to equip educators with the skills needed to effectively integrate ICT into their teaching practices. Training should focus on the practical application of ICT tools and their impact on enhancing language learning outcomes.

3. It is crucial to foster a collaborative environment where educators can share best practices and experiences related to ICT integration. Establishing support networks among educators can facilitate the exchange of ideas and resources, ultimately improving the overall effectiveness of ICT in language instruction.

4. Institutions should actively involve students in the selection and evaluation of ICT tools to ensure that these resources meet their learning needs and preferences.

5. Policymakers should consider developing frameworks that encourage the adoption of ICT in education, including incentives for schools that successfully implement innovative teaching practices.

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PAPER 34 - ADVOCATING FOR STUDENTS' SKILLS ACQUISITION IN ELECTRICAL INSTALLATION AND MAINTENANCE WORK TRADES IN OYO STATE GOVERNMENT TECHNICAL COLLEGES FOR ENTREPRENEURIAL EDUCATION DEVELOPMENT

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ABSTRACT

The research design adopted for the study is descriptive survey to harvest the view, information and opinions of respondents**.** The population for the study was two hundred and fifty (250) instructors drawn from five (5) Oyo State Government Technical Colleges across the three senatorial districts of the state. There was no sampling technique for the study because of small size of the population. The questionnaire for the study was tagged "Advocating for students' skills acquisition on electrical installation and maintenance work trades in Oyo State Government Technical Colleges for Entrepreneurial education Development (ASSAEIMW) Questionnaire. The instrument for the study was validated by three experts involving two from technical education department and one from measurement and evaluation department all from Emmanuel Alayande College of Education, Oyo using face and content validity. The reliability of the instrument was determined using Pearson Moment Correlation Coefficient to obtain 0.75 reliability index while a pilot test was carried out in two Ogun State Government technical colleges and was observed for two weeks to obtain the same reliability index values, indicating that the result of the instrument is reliable and appropriate to measure what was expected to measure. Mean and Standard Deviation were used to analysis the data collected from two research questions using five likert of Strongly Agree= 5, Agree=4, Disagree=3, Strongly Disagree=2 and Undecided= 1 at a cut-off points greater than or equal to3.0 and 0.50 as Agree while below 3.0 and 0.50 as Disagree using the SPSS 22 edition. The discussion of findings were made among which was revealed that, advocating for the skills acquisition on electrical installation by the students in Oyo State Government Technical enhanced the entrepreneurial educational development as all the items of the statement of collecting data were agreed upon by the respondents while the conclusion and recommendations were also proffered among which was that the trainees should always be encouraged to acquire one trade of the others in Government Technical colleges by giving them incentives that would be assistance to stimulate the trainees' interest

KEYWORDS: Government Technical Colleges, Skills acquisition, Electrical Installation, Maintenance work trades and Entrepreneurial Education

INTRODUCTION

Oyo State Government Technical Colleges among other Technical Colleges in Nigeria are post primary institution saddled with the responsibilities of training middle level manpower such as artisan, craftsmen, and technicians in every field of human endeavor trades subjects offered in Oyo State Government technical Colleges such building, carpentry, metal work, automobile, electrical installation and maintenance work which are in accordance to National Business and Technical Education Board (NABTEB, 2013) for the utilization of industries, organization and to be self-reliance in an attempting to promote entrepreneurial education.ElectricalInstallation and Maintenance work

trades or otherwise known as Applied electricity subject in Senior secondary schools SSS class, is the main focus of this research study that laid much emphasized in the curriculum content of technical college and senior secondary schools syllabusare therefore designed to provide students with in-depth of the concepts knowledge of basic or applied electricity, in order to promote the understanding of the electricalinstallationand maintenance work trades in the electrical world of work of industries for the students to acquire the skills.

The objectives of the curriculum is however, designed at developing broad application of technical skills which includes problem solving, communication, critical thinking and objective reasoning abilities thatwould enable the students prepare for work place and self-sustainability in the world of economy, as well guaranty entrepreneurial educational development (FRN, 2013). With all these objectives of the curriculum in mind, students irrespective of the gender (male and female) are expected to be useful and productive members of the society after graduation from technical colleges, couple with the attachment of Students Industrial Work Experience (SIWES) propelling to be compulsory for duration six months for the students to gain industrial experiences in order to bridge the gaps between theory and practical that students may be lacking in the schoolworkshops setting. Fortunately, technical colleges' students tend to be practically oriented as a result of availability of human and materials resources such as tools, equipment and machines. This trend has been attributed to basic or applied electricity teachers and among others to develop holistic keen interest in both theories and practical method of teaching the subjects. In view of this involvement of trades skills required in the application of electrical installation and maintenance work for electrical appliances in both at domestic and industries usages, Skills acquisition therefore, can only be developed through constant practice of electrical/electronic technology in the schools/colleges' workshop along with theories in Oyo State Government Technical Colleges for the students to be self-reliance upon their graduations. Consequence upon this skills acquisition specifically refers to expertise and ability which has an economic value or has potential of being utilized for generating income and employment (Ayoola&Busari, 2012, Alao, Akor&Udensi, 2019).

Skills acquisition according to National Council on Skills Development (NCSD), (2010) refers to education, training and development activities designed to help trainees' gainful knowledge, and attitudes towards of helping to improve the performance in the position that are currently occupied and that of also bringing future prospects such as electrical trades offer to train middle level manpower for job performance. Again, Skills acquisition in tertiary institutions according to Adedeji (2017) is described as educational training and development activities designed to help the trainees to be gainful acquired knowledge, and attitudes in some focus areas that would be of help in improving the performance in a chosen career or positions currently occupying by trainers which may as well determine their future prospects such as electrical trades in technical colleges where also various techniques must have learnt on how to handle practical relating electrical trades activities for better performance of the job as laid down by the National Board for Technical Education (2014).In view of this development, skill acquisition in electrical installation and maintenance works trades in technical colleges is an integral part of Technical Vocational Education Training (TVET) which required the involvement and application of entrepreneurial education for the progress of the electrical installation and maintenance works trades' survival and promoting self-reliance in a hope of reducing the rate of unemployment in this prevailing Nigeria economic rescission.

Upon the realization of this noble tasks of highly demanding and requiring entrepreneurial education that compliments the great tasks for the graduation of students to be self-reliance and be meaningful accomplishedTherefore entrepreneurial education as stated by the Office of Disability Employment Policy (2009) viewed it as a process of providing individual with the concepts and skills to be recognized opportunities available around them but others have overlooked and not foreseen to have the insight of the advantages and self-esteem to acknowledge them and act promptly where others have hesitated. Again, entrepreneurial education programme is based upon engaging students/youths, educators, and administrators to understand the relevance, which the development of enterprise skillscan add value to any educational programme skills and as well be able to have the ability of doing something expertly through training or practice as Bernnet&Maclaughlin(2018) described and ascertained In addition, Undiayaundeye (2015) identifies entrepreneurial education as training ground for the engine

of economic progression that create of wealth for the important quality of life required and as well providing employment opportunity for both educated and less educated resulting to eliminating socio-economy vices. It is on this note that the development of acquiring skills on entrepreneurial education acumen gives to entrepreneurs in the of any business or skills trades now calls the above study for economy to be thrived in Oyo State and in Nigeria in general.

STATEMENT OF THE PROBLEM

Government Technical College in Oyo State and in particular Nigeria is saddled with responsibilities of training middle level man power on technical trades that would provide skills to all yarning and aspiring students. This includes an electrical installationand maintenance works trades that are of applied electricity offered at Senior Secondary Schools in Oyo State among others. However, Schools' syllabus involves practical and theories that provides the students to be confidently empowered in the trades such as repairs of electrical gadgets, assemblages of electrical equipment and machines, electronic appliances, electrical installation, all that are in lines with the laying down of curriculum as emphasized and that, must be strictly adherent to, in accordance to National Policy on Education, Federal Republic of Nigeria (2013). However, training of students towards the above acquiring skills on electrical installation and maintenance works trades in Technical Colleges particularly in Oyo State provide middle level manpower for the utilization of industries, organization, self-reliance, creativities, innovation and to be entrepreneurial development in this recent face off economy melt-down of the country. Although, it has also been viewed that literary education such as socio-science and arts courses acquired skills by most of the students in the higher institutions of learning had failed to provide us with the necessary productions of physical needed materials of the people that can trigger towards the establishment of industries for other allied industries to thrive in Oyo State and inparticular Nigeria.

Also, it has been observed that many grandaunts of the socio-science and arts of tertiary institutions of learning are jobs seekers in Government offices and parastatal in-spite of all the skills acquired and industrial attachment underwent, as many cannot stand on their own because of the skills acquired that are not pragmatic in nature to fill the gaps between theories and practical for the industrializations. This invariably cause a lot revolutionary of unemployment rate of job seekers in the country. It is on the above identified problems that the study calls research study.

PURPOSE OF THE STUDY

The main purpose of the study is to advocate for students' skills acquisition on electrical installation and maintenance works trades in Oyo Sate Government Technical Colleges for Entrepreneurial Education Development. Specifically the study will seek to:

- determine for advocating of students'acquired skill onelectrical installation in Oyo State Technical Colleges to enhance entrepreneurial education

- Examine for advocating of students' acquired skills on maintenance work trades in Oyo State Technical Colleges to enhance entrepreneurial education.

RESEARCH QUESTIONS

Two research questions were raised for the study

- Do advocateof skills acquired by the students on electrical installation in Oyo State Technical Colleges enhance the entrepreneurial education?

- Could advocate of skills acquired by the students on maintenance works trades in Oyo State Technical Colleges enhance the entrepreneurial education?

METHODOLOGY

The research design adopted for the study is descriptive survey to harvest the view, information and opinions of respondents**.** The population for the study was two hundred and fifty (250) instructors drawn from five (5) Government Technical Colleges across the three senatorial districts of the state. There was no sampling technique for the study because of the small size of the population. The questionnaire for the study was tagged "Advocating for students' skills acquisition on electrical installation and maintenance work trades in Oyo State Government Technical Colleges for Entrepreneurial education Development (ASSAEIMW) Questionnaire. The instrument for the study was validated by three experts involving two from technical education department and one from measurement and evaluation department all from Emmanuel Alayande College of Education, Oyo, having used face and content validity.

The reliability of the instrument was determined by using Pearson Moment Correlation Coefficient to obtain 0.75 reliability index while a pilot test was carried out in two Ogun State Government Technical Colleges and was observed for two weeks to obtain the same reliability index values, indicating that the results of the instrument is reliable and appropriate to measure what was expected to measure.Mean and Standard Deviation were used to analysis the data collected from two research questions, using five likert of Strongly Agree= 5, Agree=4, Disagree=3, Strongly Disagree=2 and Undecided= 1 at a cut-off points greater than or equal to3.0 and 0.50 as Agree while below 3.0 and 0.50 as Disagree using the SPSS 22 edition.

RESULTS AND DISCUSSION

RESEARCH Question 1: Do advocateof skills acquired by the students on electrical installation in Oyo State Technical Colleges enhance the entrepreneurial education?

Table 1 responsesto the advocating for skills acquisition by the student on electrical installation in Oyo State Technical Colleges enhance entrepreneurial education

S/N	Items	Mean Values	S.D	Decision
1	Advocating for skills acquisition by the students on surface electrical installation in Oyo State Technical Colleges enhance entrepreneurial education	4.50	0.68	Agreed
2	Advocating for skills acquisition by the students on conduit electrical installation in Oyo State Technical Colleges enhance entrepreneurial education	4.30	0.65	Agreed
3	Advocating for skills acquired by the students on electrical gadgets installation in Oyo State Technical Colleges enhance entrepreneurial education	4.25	0.62	Agreed

4	Advocating for skills acquisition by the students on electrical installation repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.00	0.60	Agreed
5	Advocating for skills acquisition by the students on electrical instrument installation in Oyo State Technical Colleges enhance entrepreneurial education	3.85	0.58	Agreed
6	Advocating for skills acquisition by the students on electrical machines installation in Oyo State Technical Colleges enhance entrepreneurial education	3.75	0.56	Agreed
7	Advocating for skills acquisition by the students on handling electrical tools installation in Oyo State Technical Colleges enhance entrepreneurial education	3.90	0.61	Agreed
8	Advocating for skills acquisition by the students on electrical assemblages installation of fan in Oyo State Technical Colleges enhance entrepreneurial education	3.75	0.57	Agreed
9	Advocating for skills acquisition by the students on electrical generators installation in Oyo State Technical Colleges enhance entrepreneurial education	3.65	0.55	Agreed
10	Advocating for skills acquisition by the students on electrical generating sun energy panel installation in Oyo State Technical Colleges enhance entrepreneurial education	3.63	0.54	Agreed

Source: Field survey

Keywords: S.D= Standard Deviation

Table 1 above of the response to the analysis by the respondents shows the highest MeanValues and standardDeviation of 4.5 and 0.68 on items 1 while the lowest Mean valueand Standard deviationof 3.63 and 0.54 on item 10 respectively while other item of the statements of 2, 3, 4.
5. 6.7.8.and 9 fell between higher and lower Mean Values and Standard Deviations. All these however are above theCut-offpoints of 3.00 and 0.50 indicating that all items statement were agreed for theInstrument for advocating skillsacquisition on electrical installation in Oyo StateTechnical Colleges forentrepreneurialeducation to be thrived and established

Research Question 2: Could advocate of skills acquired by the students on maintenance works trades in Oyo State Technical Colleges enhance the entrepreneurial education?

Table 2 response to advocate of skills acquired by the students on maintenance workstrades in Oyo State Technical Colleges enhance the entrepreneurial education

S/N	Items	Mean Values	S.D	Decision
11	Advocating for skills acquisition by the students on radio maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.45	0.67	Agreed
12	Advocating for skills acquisition by the students on Televisions maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.40	0.65	Agreed
13	Advocating for skills acquisition by the students on handsets maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.35	0.62	Agreed
14	Advocating for skills acquisition by the students on fridge electrical maintenance works repair in Oyo State Technical Colleges enhance entrepreneurial education	4.25	0.60	Agreed
15	Advocating for skills acquisition by the students on air- condition electrical maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.15	0.58	Agreed
16	Advocating for skills acquisition by the students on electrical equipment maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	4.10	0.57	Agreed
17	Advocating for skills acquisition by the students on electrical machines maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	3.90	0.56	Agreed
18	Advocating for skills acquisition by the students on electrical stoves maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	3.80	0.55	Agreed
19	Advocating for skills acquisition by the students on electrical lamps maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial education	**3.75**	**0.54**	Agreed

20	Advocating for skills acquisition by the students on electrical fans maintenance works repairs in Oyo State Technical Colleges enhance entrepreneurial	**3.70**	**0.53**	Agreed

Source: Field survey, Keywords: S.D= Standard Deviation

Table 2above of the response to the analysis by the respondents shows the highest Mean Values and standard Deviation of 4.5 and 0.67 on items 11 while the lowest Mean valuewhileStandard
Deviation of 3.70 and 0.53 on item 20 respectivelywhile other item of the statements of 12, 13,
14. 15.1 6.17.18 .and 19 fell between higher and lower Mean Values and Standard Deviations. All these however are abovethe cut-offpoints of 3.00 and 0.50 indicating that all items statement were agreed for theInstrument for advocatingskills acquisition on electrical installation in Oyo StateTechnical Colleges for entrepreneurial education to be thrived and established .

FINDINGS OF THE STUDY

Table 1 of the results revealed that, advocating for the skills acquisition on electrical installation by the students in Oyo State Government Technical enhanced the entrepreneurial educational development as all the items of the statement of collecting data were agreed upon by the respondents. This however, is in a good agreement with Undiayaundeye (2015) which identify entrepreneurialeducation as training forthe engine of economic progression that create of wealth for the important quality of life required and as well providing employment opportunity for both educated and less educated resulting to eliminating socio-economy vices in his research study of Entrepreneurship skills acquisition and the benefit amongst the undergraduate students' in Nigeria.

Table 2 of the results revealed that advocating for the skills acquisition on maintenance works repairs by the students in Oyo State Government Technical Colleges enhanced the entrepreneurial education development as all the items of the statement of collecting data were agreed upon by the respondents. This was also observed and toe in line with the research study of

Adedeji (2017) on Teachers' Perception of the Militating against Effective Teaching of Basic Technology in Junior Secondary Schools in Oyo State which describes educational training and development activities designed to help the trainees to be gainful acquired knowledge, and attitudes in some focus areas that would be of help in improving the performance in a chosen career or positions currently occupying by trainers which may as well determine their futureprospects such as electrical trades in technical colleges, where also various techniques must have learnt on how to handle practical relating electrical trades activities for better performance of the job.

CONCLUSION

The study concluded that advocating for skills on electrical installation and maintenance works trades in Oyo State Government Technical Colleges would gear towards entrepreneurial educational development where trainers would be able to be sustainable, self-reliance, innovative, create wealth, entrepreneurs and finally stand on their own for economic survival. Also the greater numbers of middle level manpower would be produced for the use of Industries to thrive for the driven of economic to the peak of its height in Oyo State and in Nigeria.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were proffered for better improvement thus:-

- That the trainees should always be encouraged to acquire one trade of the others in Government Technical colleges by giving them incentives that would be assistance to stimulate the trainees' interest
- That there should be provisions of infrastructural facilities from the Government and the philanthropists member of the society that would facilitate the trends of technologies in vogue and improve the general performance of both trainers (instructors) and trainees (students) on the chosen careers in Government Technical Colleges.

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PAPER 35 - INNOVATIVE STRATEGIES FOR THE INTEGRATION OF NEW AND EMERGING TECHNOLOGIES IN HIGHER EDUCATION

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ABSTRACT

Emerging technologies have a possible impact on the developments in higher education and teaching practices at the universities. The paper aims at strategies and steps to improve the competence of university teachers in the implementation of Emerging Technologies (ETs) in the teaching practices at the university. In this paper, i identified the strengths and weaknesses, opportunities and threats that are related to the adoption of two ETs, robotics and Artificial Intelligence (AI), in higher education. Additionally, is analyzed the perceptions of faculty about these ETs. The empirical data was collected using written essays from 18 university teachers and students. Deductive and inductive approaches with thematic analysis were used for the data analysis. The findings corroborate the idea that previous experience related to ETs can support positive attitudes and the implementations of ET in university teaching. University teachers had optimistic expectations towards ETs accepting them as part of teaching practice development, while discussion about the negative effects of ETs was negligible.

KEYWORDS: Computer. Innovation, Intelligence, Technology, Education

DEFINING EMERGING TECHNOLOGIES: A GLIMPSE INTO THE FUTURE OF HIGHER EDUCATION

Emerging technologies are shaping the landscape of higher education, creating a new breed of opportunities and challenges. These technologies, often characterized by their innovative nature and their potential to disrupt existing systems, are not isolated phenomena but are interconnected, weaving a complex web of possibilities for educational advancement.

ARTIFICIAL INTELLIGENCE (AI)

AI is fundamentally altering the way humans interact with machines, and its influence on higher education is profound. From automating administrative tasks to providing personalized learning experiences, AI is at the forefront of educational transformation. It analyzes vast datasets, predicts student success, and tailors learning paths, making education more accessible and effective.

BLOCKCHAIN

Blockchain technology offers a secure and decentralized way of recording transactions, and its applications extend well beyond finance. In education, blockchain has the potential to revolutionize credentialing and verification processes, ensuring the integrity of academic records and intellectual property rights, while also enhancing data security.

VIRTUAL REALITY (VR) AND AUGMENTED REALITY (AR)

These immersive technologies are breaking down the barriers between the virtual and the physical world, providing experiential learning environments that were previously unattainable. AR and VR are not just for gaming; they are enhancing student engagement, improving retention, and offering unprecedented opportunities for simulations and practical applications in various fields.

THE INTERNET OF THINGS (IOT)

IoT is connecting devices and objects, allowing real-time data collection and analysis. In the context of higher education, IoT can optimize campus operations, enhance accessibility for students with disabilities, and create smart learning environments where the physical space adapts to the needs of the learner.

These emerging technologies are not just new tools; they are potential drivers of transformation. They redefine the way knowledge is created, shared, and consumed. As higher education institutions strive to prepare students for an ever-evolving job market, the adoption and integration of these technologies are no longer optional but essential.

While current applications of these technologies provide a glimpse into their potential, the horizon of opportunity is vast. AI and machine learning are just beginning to scratch the surface of what's possible in terms of personalized learning. Virtual and augmented reality are set to become commonplace in educational settings, offering immersive experiences once reserved for science fiction. Blockchain contributes to trust and transparency in academic records. And the Internet of Things continues to make campuses smarter and more responsive to the needs of their students and faculty.

As the digital age unfolds, the potential for growth and the impact of emerging technologies on higher education is staggering. Institutions that embrace these technologies and integrate them thoughtfully into their curricula and operations will likely find themselves on the leading edge of innovation and preparation for the future.

TECHNOLOGICAL TRENDS IN EDUCATION

The educational landscape is being dramatically reshaped by the incorporation of cutting-edge technology. From the proliferation of online learning platforms to the integration of mobile technology, educational institutions are leveraging these tools to create more dynamic and accessible learning environments.

ONLINE LEARNING PLATFORMS

Online learning platforms, such as Coursera, edX, and Khan Academy, have become a staple of modern education. These platforms offer a wide array of courses and specialized programs, often in collaboration with top universities and institutions. They provide students with flexible schedules, the ability to learn at their own pace, and access to high-quality educational content regardless of their location.

ADAPTIVE LEARNING SOFTWARE

Adaptive learning technology is revolutionizing the way students learn. By using algorithms and data analytics, adaptive learning software adjusts to each student's skill level, creating personalized learning paths. This software continually assesses a student's performance, providing real-time feedback and resources tailored to their needs.

Educational tools like Knewton and Smart Sparrow are examples of this trend, which holds the potential to greatly enhance educational outcomes.

INTEGRATION OF MOBILE TECHNOLOGY

With the widespread use of smartphones and tablets, mobile technology has become an integral part of the educational process. Mobile devices allow students to access learning materials anywhere, anytime. Apps and tools designed specifically for education, such as Google Classroom and Quizlet, are enhancing the classroom experience, providing opportunities for interactive learning and collaboration. Moreover, the use of mobile technology is breaking down geographical barriers, making education more accessible to a broader audience.

ENHANCED LEARNING EXPERIENCES

Emerging technologies are not merely reshaping higher education; they are revolutionizing the ways in which students learn and engage with educational content. The integration of immersive technologies and artificial intelligence is particularly noteworthy, providing interactive and personalized learning experiences that were once unattainable.

IMMERSIVE TECHNOLOGIES

Immersive technologies such as augmented reality (AR) and virtual reality (VR) are transforming the learning landscape by allowing students to interact with content in a more intuitive and thorough manner. These technologies provide a bridge between the physical and digital worlds, enabling students to:

- Visualize complex concepts in a lifelike setting;
- Engage with historical events as if they were present;
- Explore science experiments without the associated risks;
- Practice medical procedures in a safe and controlled virtual environment.

For example, the use of VR in medical training has shown significant improvements in retention rates, as students can engage with the material in a way that traditional textbooks cannot replicate. One notable platform, Varexo, specializes in providing VR-based anatomical models that can be manipulated in three dimensions, offering medical students an unparalleled learning experience.

ARTIFICIAL INTELLIGENCE IN PERSONALIZED LEARNING

Artificial Intelligence (AI) is playing a pivotal role in creating personalized learning paths for students. AI algorithms can analyze a student's strengths, weaknesses, and learning patterns to tailor educational content that is most relevant to their needs. This personalized approach to education has the potential to:

1. Increase student engagement by catering to individual learning styles;
2. Accelerate learning by identifying and addressing gaps in knowledge quickly;
3. Provide immediate feedback and support, allowing for continuous improvement.

Intelligent tutoring systems, like Carnegie Learning's Mika, use AI to deliver customized instruction, practice, and assessments, effectively acting as a personal tutor for each student. These systems not only monitor progress but also adapt the difficulty level of tasks to challenge students at the appropriate skill level.

As emerging technologies continue to evolve, their potential to enhance the learning experience is boundless. Institutions and educators must embrace these advancements to stay relevant and prepare students for a future that is increasingly powered by technology.

TECHNOLOGICAL INTEGRATION AND ITS IMPACT ON LEARNING

The integration of emerging technologies into the classroom has not only altered the way students learn but also the way educators teach. The following table highlights some key technologies and their impact on learning:

Technology	Benefits	Challenges
Augmented Reality (AR)	• Enhanced visualization and understanding of complex concepts; • Increased engagement through interactive learning experiences.	• The need for specialized hardware; • Potential distractions and reduced focus if not properly managed.
Virtual Reality (VR)	• Comprehensive and realistic simulations for various fields; • Safe environment for practicing high-risk activities or experiments.	• Initial costs for VR equipment may be high; • Some users may experience discomfort from prolonged VR use.
Artificial Intelligence (AI)	• Personalized learning paths and adaptive assessments; • Automated grading and feedback to save time for educators.	• The risk of algorithmic biases affecting learning experiences; • The need for educators to understand and effectively use AI tools.

The educational landscape is poised to continue evolving with the integration of these emerging technologies. Institutions and educators must be proactive in adopting these technologies to ensure that students are equipped with the skills and knowledge necessary to succeed in an increasingly digital world.

THE TRANSFORMATIVE ROLE OF AI AND MACHINE LEARNING IN HIGHER EDUCATION

Artificial intelligence (AI) and machine learning (ML) are not merely buzzwords—they represent a paradigm shift in higher education, reshaping not only how students learn but also how institutions operate and evolve. These technologies hold the potential to revolutionize various aspects of the educational experience, ranging from automation to predictive analytics.

IMPACT ON ADMINISTRATIVE TASKS

AI and ML are increasingly automating repetitive and time-consuming administrative tasks, such as grading multiple-choice exams, scheduling, and even handling some aspects of student support services. This automation frees up faculty and administrative staff to focus on more strategic and interpersonal aspects of their roles.

DATA-DRIVEN DECISION-MAKING

Universities generate vast amounts of data, from student academic performance to operational efficiency metrics. AI and ML tools can analyze this data, providing insights that inform decisions on everything from curriculum design to resource allocation. This data-driven approach is crucial for optimizing educational outcomes and institutional effectiveness.

PREDICTIVE ANALYTICS FOR STUDENT OUTCOMES

One of the most promising applications of AI and ML in education is predictive analytics. By analyzing patterns in student data, algorithms can predict which students may be at risk of dropping out or failing a course, allowing institutions to intervene early with personalized support and resources.

AUTOMATING EDUCATIONAL PROCESSES

AI-powered tools can handle grading, content customization, and personalized learning pathways, streamlining educational processes. Intelligent tutoring systems (ITS) are a prime example, offering adaptive learning experiences that can tailor course content to each student's progress and learning style.

CHALLENGES AND ETHICAL CONSIDERATIONS

The integration of emerging technologies in higher education is not without its obstacles and ethical dilemmas. As institutions embrace these advancements, they must also confront a multitude of issues that challenge the effective, responsible, and equitable use of technology.

DATA PRIVACY

One of the most pressing concerns is data privacy. With the widespread collection and analysis of student data for personalized learning and predictive analytics, there is a risk of misusing or leaking sensitive information. Institutions must ensure that they adhere to strict data protection regulations and that students understand how their data is being used and stored.

DIGITAL DIVIDE

The digital divide refers to the gap between those who have access to digital technologies and those who do not. This disparity can widen the gap in educational opportunities, as students without access to necessary devices or internet connectivity may struggle to keep up with class requirements. Education providers must work to minimize this divide by providing equal access to resources for all students.

INTELLECTUAL PROPERTY RIGHTS

The use of open educational resources (OER) and digital content raises questions about intellectual property rights. How can institutions and educators ensure that they are using and sharing content legally and ethically? Developing clear policies and providing guidance on the use of copyrighted material is essential.

BIAS IN AI ALGORITHMS

Artificial Intelligence systems are only as unbiased as the data they are trained on. There is a risk of perpetuating or even amplifying existing biases in AI algorithms, which can lead to unfair treatment of students. It is crucial to develop AI systems with diverse datasets and to regularly audit and update algorithms for fairness.

ADDRESSING CHALLENGES

To navigate these challenges, institutions can take several steps:

- Engage in ongoing discussions around ethical use of technology and update policies accordingly.
- Invest in infrastructure to ensure all students have reliable access to digital resources.
- Provide training for educators on the ethical use of AI and data privacy practices.
- Support research and development of AI systems that reduce bias and promote inclusive learning environments.

By addressing these challenges proactively, higher education institutions can harness the power of emerging technologies in a way that respects privacy, equity, and educational excellence.

PROFESSIONAL DEVELOPMENT FOR EDUCATORS IN THE DIGITAL AGE

As the landscape of higher education continues to evolve with the integration of emerging technologies, there is a growing emphasis on the need for professional development among educators. Faculty members must acquire new skills to effectively utilize these innovations in their teaching practices and remain relevant in a digitalized world.

THE IMPORTANCE OF SKILLING AND RESKILLING

The digital age demands that educators adapt to new technologies to enhance the learning experience. Skilling and reskilling initiatives are essential to ensure that faculty can keep pace with technological advancements. These programs not only equip educators with the necessary tools to navigate new digital environments but also foster a culture of lifelong learning.
According to a study by the Society for Human Resource Management, "Organizations that offer comprehensive training programs have 218% higher income per employee than those without formalized training" (SHRM, 2022). This statistic underscores the importance of investing in professional development as a means to improve educational outcomes.

SUCCESSFUL PROGRAMS AND INITIATIVES

Several successful programs and initiatives have emerged to address the professional development of educators. These include:

- **Online Learning Platforms:** Offer courses in digital literacy, educational technology integration, and specialized training on new software and tools.
- **Workshops and Seminars:** Provide hands-on experiences that allow educators to explore and experiment with emerging technologies.
- **Collaborative Learning:** Encourage collaboration between educators within and across institutions to share best practices and challenges.
- **Mentorship Programs:** Pair experienced educators with newcomers to facilitate knowledge transfer and support.

A notable initiative is the Teach to Lead program, which empowers educators to "take the lead in their own professional development, personalizing the way they advance their practice, and contribute to the profession" (U.S. Department of Education, 2023).

PREPARING EDUCATORS FOR THE DIGITAL AGE

To prepare educators for the digital age, institutions must:

- **Invest in Infrastructure:** Ensure that educators have access to the necessary hardware and software.
- **Provide Ongoing Support:** Offer continuous training and support to keep educators up-to-date with the latest technological advances.
- **Incorporate Technological Competencies:** Include technological competencies as part of the curriculum for teacher education programs.
- **Foster a Culture of Innovation:** Encourage educators to experiment with new technologies and share their findings with their peers.

FUTURE OUTLOOK AND RECOMMENDATIONS

As we gaze into the crystal ball of higher education's future, it's clear that emerging technologies will continue to play a pivotal role in shaping the academic landscape. The push towards digital transformation is not just a trend but

a tectonic shift that institutions must embrace to stay relevant and competitive. Let's explore the trajectory of this shift and the recommendations that can help stakeholders navigate this exciting yet challenging era.

TRENDS TO WATCH

- The integration of artificial intelligence (AI) into all aspects of education will deepen, enhancing personalized learning experiences and administrative processes.
- Blockchain technology will become more prevalent, ensuring secure data transactions and improving accreditation processes.
- Virtual reality (VR) and augmented reality (AR) will evolve, offering immersive learning experiences and potentially changing the way students interact with course materials.

- The Internet of Things (IoT) will connect classrooms and campuses, providing valuable data for operational efficiency and student support services.

These trends are not standalone developments; they are part of a larger ecosystem that is redefining the educational experience. Institutions must be nimble and adaptive in their approach to technology adoption.

RECOMMENDATIONS

1. **Invest in Infrastructure:** Institutions should invest in robust technological infrastructure to support the integration of emerging technologies. This includes high-speed internet, powerful computing resources, and data storage solutions.
2. **Prioritize Professional Development:** To keep pace with technological advancements, educators must engage in continuous professional development. This should include training on the latest tools and technologies, as well as pedagogical strategies that incorporate these innovations effectively.
3. **Foster Collaboration:** Institutions should foster collaboration between technology experts, educators, and students to create a culture of innovation. This can lead to the development of new educational models that leverage technology to its fullest potential.
4. **Address Ethical Concerns:** It is imperative that institutions address the ethical concerns associated with emerging technologies. This includes ensuring data privacy, reducing the digital divide, and mitigating the potential for bias in AI systems.
5. **Promote Equity:** The integration of technology should not widen the achievement gap; it should help to close it. Institutions must ensure that all students have access to the technology and support they need to succeed.

In conclusion, the future of higher education is deeply intertwined with emerging technologies. By embracing these innovations, institutions can create dynamic learning environments that empower students and faculty alike. The key to successfully navigating this future lies in thoughtful planning, strategic investment, and a commitment to lifelong learning for all educational stakeholders.

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PAPER 36 - AN INNOVATIVE STRATEGY FOR ESTABLISHING THE CONVERGENCE OF A MODIFIED PICARD-MANN HYBRID ITERATIVE SCHEME IN COMPLETE METRIC SPACES

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ABSTRACT

This paper presents a novel approach to achieving convergence in a Modified Picard-Mann hybrid iterative scheme within complete metric spaces. By integrating innovative strategies, we demonstrate the convergence properties and practical applications of this modified scheme. Our findings significantly extend and improve upon recent results in the field, including the work of Khan (2013), by offering a more generalized framework. The proposed approach showcases enhanced convergence rates compared to traditional iterative schemes such as Picard, Mann, and Ishikawa and holds promising applications across various computational and analytical fields.

***KEYWORDS*:** Complete metric space, Convergence, Fixed point and Modified Picard-Mann hybrid Iterative scheme.
MSC.: 47H10; 54H25

1. INTRODUCTION

In a complete metric space (X,d), with a mapping T: X → X, the set of fixed points of T, denoted $F_T = \{p \in x : Tp = p\}$, plays a fundamental role in iterative schemes designed to approximate solutions for non-linear equations. The concept of convergence, which characterizes the behaviour of these iterative schemes as they approach a fixed point, has been extensively explored in the literature, with iteratives methods such as Picard, Mann, and Ishikawa proving essential in various mathematical and applied fields.

The classical Picard iteration, introduced through Definition 1, iteratively applies a self-map T to an initial point to approximate a fixed point in X. Mann's iterative scheme, defined in Definition 2, extends the Picard approach by incorporating a sequence of real numbers, enhancing convergence for specific mappings. The hybrid Picard-Mann scheme, introduced by the Khan (2013), further refines this approach for non-expansive mappings, achieving faster convergence in general Banach spaces.

Building upon these foundational schemes, we introduce the Modified Picard-Mann hybrid iterative scheme, termed the RSA Iterative Scheme. By incorporating two real sequences, this modification offers improved convergence properties over previous schemes and unifies several recent results, enhancing the versatility and efficiency of iterative methods in complete metric spaces. This study focuses on the formal definition, convergence properties, and computational applications of the RSA scheme, demonstrating its advantages over traditional approaches.

Definition 1 [26]:
In a complete metric space, suppose $\{x_n\}_{n=0}^{\infty} \subseteq X$ is the sequence generated by an iterative procedure involving the operator T.

$x_{n+1} = f(T, x_n)$, n =0,1,2,3…

For $x_0 \in X$ is the initial approximation and f is some function. Suppose,

$$f(T, x_n) = Tx_n$$

then,

$x_{n+1} = Tx_n$, n =0,1,2,3,...(1.1)

Eqn. (1.1) is the Picard Iterative scheme.

Definition 2 [21]:
For arbitrary $x_0 \in$ X, Mann iteration $\{x_n\}_{n=0}^{\infty}$ is defined by
$x_{n+1} = (1 - \alpha_n)x_n + \alpha_n T x_n$, n=0,1,2,3,… (1.2)
where $\{\alpha_n\}_{n=0}^{\infty}$ is the sequence of real numbers in [0,1], for all x,y $\in X$. Suppose $\alpha_n = 1$, then we obtain the Picard iteration Process.
Eqn (1.2) is the Mann Iterative scheme.
Khan[20], in 2013 introduce the Picard-Mann hybrid iterative scheme for a single non-expansive mapping T.

Definition 3 [20]:
For any initial point $x_0 \in$ X, the sequence $\{x_n\}_{n=0}^{\infty}$ is defined by
$x_{n+1} = Ty_n$,
$y_n = \alpha_n T x_n + (1 - \alpha_n)x_n$, n=0,1,2,3,… (1.3)
Where $\{\alpha_n\}_{n=0}^{\infty}$ is a real sequence in [0,1].
Eqn.(1.3) is a Picard-Mann Iterative scheme.
Inspired and motivated by these facts, this study introduce and study a new modified Picard-Mann hybrid iterative scheme called the RSA Iterative scheme.
For any initial point $x_0 \in$ X, the sequence $\{x_n\}_{n=0}^{\infty}$ is defined by
$x_{n+1} = Ty_n$,
$y_n = (1 - \alpha_n - \beta_n)x_n + \alpha_n T x_n + \beta_n T x_n$, n=0,1,2,3,… (1.4)
Where $\{\alpha_n\}_{n=0}^{\infty}$ and $\{\beta_n\}_{n=0}^{\infty}$ are real sequence in [0,1].
Eqn.(1.4) is a Modified Picard-Mann hybrid Iteration scheme called RSA iterative scheme.

2. LITERATURE REVIEW

Khan[20] showed that the hybrid scheme converges faster than Picard (1.1), Mann (1.2) and Ishikawa [19] iterative scheme in the sense of Berinde [3] for contractions. Using his iterative process, he proved strong and weak convergence theorems for a class of nonexpansive mappings in general Banach spaces while he applied it in uniformily Banach spaces to obtain results.

Phuengrattana and Suantai [27]defined the SP Iterative scheme and proved that for increasing function, their scheme is equivalent to and faster than , Mann [21], Ishikawa [19] and Noor[25] Iterative scheme.
Several researchers such as Rhoades[30] work on convergence. Berinde[5] improve upon the work of Rhoades to an arbitrary complete normed linear space for the same fixed point iterative scheme. Bosede[9] used various contractive definitions to obtain various convergence results for some iterative schemes.

Rhoades [30] compare the rate of convergence of Mann and Ishikawa iterative procedures for increasing and decreasing functions through examples.
Osilike [23] prove and extended most of the recent results of Rhoades, using the contractive definition:
$d(Tx,Ty) \leq Ld(x,Tx) + ad(x,y)$ (2.1)
there exist $L \geq 0, a \in [0,1)$ such that for each x,y $\in$ X and establish T-stablity for Picard, Kirk, Mann and Ishikawa Iteration.

Imori and Olatinwo[17] in (2003) later extended the results of Osilike [23] and proved some stability results for Picard and Mann iteration processes using the following contractive definition:
$d(Tx,Ty) \leq \varphi\big(d(x,Tx)\big) + ad(x,y)$ (2.2)
for x,y $\in$ X, there exist $a \in [0,1)$ and a monotone increasing function $\varphi: R^+ \rightarrow R^+$ with $\varphi(0) = 0$.

Bosede and Rhoades[12] observed that the process of generalizing (2.1) could continue ad infinitum. Bosede and Rhoades [12] introduced the notion of a general class of functions to prove the stability of Picard and Mann iterations. They made an assumption from (2.1) which renders all generalisations of the form (2.2) pointless. Suppose x=p and $\varphi(0) = 0$ then (2.2) becomes
$d(p,Ty) \leq ad(p,y)$ (2.3)

for $a \in [0,1)$ and y ϵ X.

In a real normed linear space setting, suppose (X, ||. ||) be a Banach space, T: X→ X a selfmap of X, (2.3) is the same as

$$\|p - Ty\| \leq a\|p - y\| \quad (2.4)$$

Remark 2.1: The contractive definition (2.3) is more general than those of (2.2) and (2.1) in the following sense: Suppose in (2.1) L is replaced by φ , we obtain (2.2). Furthermore, suppose φ (0) = 0 and x=p in (2.2), gives (2.3)

Lemma 2.2 [4]: Suppose a is a real number such that $0 \leq a < 1$ and $\{\mu_n\}_{n=0}^{\infty}$ be a sequence of positive numbers such that $\lim_{n\to\infty}\mu_n = 0$, then for any sequence of positive numbers $\{v_n\}_{n=0}^{\infty}$ satisfying

$v_{n+1} \leq av_n + \mu_n$, n=0,1,2,…

Then, we have $\lim_{n\to\infty}v_n = 0$.

3. METHODOLOGY

This study employs a theoretical approach to establish the convergence of the Modified Picard-Mann hybrid iterative scheme, termed the RSA Iterative Scheme, within the framework of complete metric spaces. The methodology consists of three main stages: formulation of the iterative scheme, proof of convergence, and application of convergence theorems to specific examples.

Formulation of the RSA Iterative Scheme

The RSA Iterative Scheme is defined by incorporating two distinct sequences of real numbers, {α_n} and {β_n}, into the traditional Picard-Mann iterative process. For a given mapping $T: X \to X$ in a complete metric space (X, d) with an initial point $x_0 \in X$, the iterative process is constructed as follows:

$$X_{n+1} = (1 - \alpha_n - \beta_n)Tx_n + \alpha_n T^2 x_n + \beta_n x_n$$

Where $\{\alpha_n\}$ and $\{\beta_n\}$ are sequences of real numbers in [0, 1] satisfying specific convergence conditions to ensure that the sequence $\{x_n\}$ converges to a fixed point in X.

Convergence Analysis

To establish the convergence properties of the RSA Iterative Scheme, the following assumptions are imposed on the sequences $\{\alpha_n\}$ and $\{\beta_n\}$:

$$\sum_{n=1}^{\infty} \alpha_n = \infty$$

- $\alpha\_n, \beta\_n \to 0 \; as \; n \to \infty n$
- T satisfies a non-expansive condition in the metric space (X, d).

These conditions ensure that the modified iterative scheme remains bounded and convergent under the selected metric. We apply the Banach Contraction Principle and other fixed-point theorems relevant to metric spaces to prove that the RSA scheme converges to a fixed point for mappings that satisfy the specified conditions.

Proof Techniques and Theorems Applied

Key theorems utilized in this research include:

- **Banach Contraction Principle**: This theorem is essential in confirming that if T is a contraction mapping in a complete metric space, a unique fixed point exists. This principle serves as a foundation for establishing the RSA scheme's convergence in specific cases.
- **Lipschitz Continuity and Non-Expansive Mapping Analysis**: To ensure that the RSA scheme applies to a broader class of mappings beyond contractions, we analyze mappings that are non-expansive $(i.e., d(T\_x, T\_y) \leq d(x, y) \; for \; all \; x, y \in X)$. This approach extends the scope of the RSA scheme, allowing it to be used in more diverse applications.
- **Fixed-Point Theorems for Hybrid Schemes**: The study extends recent fixed-point theorems for hybrid iterative schemes by adapting them to the RSA scheme. This extension involves a detailed derivation of convergence criteria specific to the proposed modified hybrid iteration.

Comparative Analysis and Validation

To validate the efficacy of the RSA Iterative Scheme, a comparative analysis with the traditional Picard, Mann, and Picard-Mann schemes is conducted. This involves:

- **Computational Simulations**: Iterative computations are performed on sample data points in complete metric spaces to compare the convergence rates of the RSA scheme with traditional schemes.
- **Quantitative Evaluation of Convergence Speed**: By measuring the number of iterations required to reach a specified tolerance level, the study quantifies the improved convergence speed of the RSA scheme over previous methods.

APPLICATIONS OF THE RSA SCHEME IN SELECTED FIELDS

In addition to theoretical analysis, we outline potential applications of the RSA scheme in fields where iterative convergence is essential, such as Machine Learning, Optimization, Control Systems, Network Theory, and Cryptography. These applications underscore the scheme's practical value, particularly in computational settings that require efficient iterative approximations.

MAIN RESULTS

Theorem 3.1

Suppose (X, ||. ||) be a Banach space, T: X → X a selfmap of X with a fixed point p, satisfying the contractive condition (2.4). Suppose $\{x_n\}_{n=0}^{\infty}$ be the Modified Picard-Mann iteration process defined by (1.4) converging to p (Tp=p), where $\{\alpha_n\}_{n=0}^{\infty}$ and $\{\beta_n\}_{n=0}^{\infty}$ are sequences of real numbers in [0,1]. Then $\{x_n\}_{n=0}^{\infty}$ converges strongly to p.

Proof:

Using (1.4) and (2.4) we obtain,

$$\|x_{n+1}\| = \|Ty_n - Tp\|$$
$$\leq a\|y_n - p\| \qquad (3.1)$$

also,

$$\|y_n - p\| = \|(1-\alpha_n-\beta_n)x_n + \alpha_n Tx_n + \beta_n Tx_n - p\|$$
$$\leq \|(1-\alpha_n-\beta_n)(x_n-p) + \alpha_n(Tx_n-p) + \beta_n(Tx_n-p)\|$$
$$= (1-\alpha_n-\beta_n)\|x_n-p\| + \alpha_n\|Tx_n-Tp\| + \alpha_n\|Tx_n-Tp\|$$
$$\leq (1-\alpha_n-\beta_n)\|x_n-p\| + \alpha_n a\|x_n-p\| + \beta_n a\|x_n-p\|$$

Substituting (2.3) in (2.2), we obtain

$$\|x_{n+1}-p\| \leq \text{a } [1-\alpha_n+\alpha_n a-\beta_n+\beta_n a]\|x_n-p\|$$
$$\leq a[1-\alpha_n(1-a)-\beta_n(1-a)]\,\|x_n-p\|$$

Using the fact $0 \leq a < 1$, $\alpha_n\ \beta_n \in [0,1)$ and $\sum_{n=0}^{\infty}\alpha_n = \infty$, we have from lemma 2.2 that $lim_{n\to\infty}\|x_{n+1}-p\| = 0$. Therefore, $\{x_n\}_{n=0}^{\infty}$ converges strongly to p. This ends the proof.

Corollary 3.2(Chidume[14]): Suppose (x,||. ||) is a normed linear space and T: X → X be a map with a fixed point p satisfying the contractive condition

$\|Tx-p\| \leq \delta\|x-p\|$

For all x,y ∈ X, $0 \leq \delta < 1$. For any arbitrary $x_0 \in X$, suppose $\{x_n\}_{n=0}^{\infty}$ is the Picard Iterative scheme defined by (1.1) . Then (1.1) converges strongly to P.

Remark 3.3: Theorem 3.1 generalise several results in literature.

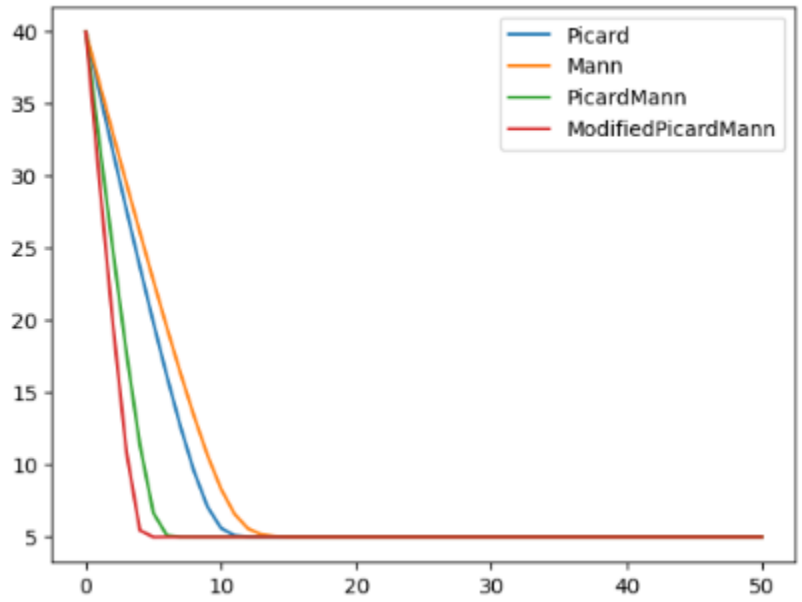
Example

Application of Picard, Mann, Picard-Mann and Modified Picard-Mann on comparison result to fixed point p=5.0 are shown in the table below. Let X=[0,1] and T: X → X be defined by Tx=$\sqrt{x^2-9x+45}$ with fixed point p=5.0 and a ϵ[0,1]. Choosing $\alpha_n = 0.85, \beta_n = 0.65$ and $x_0 = 40$.

Table 1: Comparison of Picard, Mann, Picard-Mann and Modified Picard-Mann Iteration.

Iterations	Picard	Mann	Picard-Mann	Modified Picard-Mann
1	35.84689666	36.46986216	33.79166907	29.69011781
2	31.73921754	32.97191488	27.70178813	19.80498838
3	27.68979906	29.51358026	21.79096859	10.93464957
4	23.71743622	26.10502346	16.1757359	5.453102116
5	19.8509409	22.76060123	11.10973591	4.988793695
6	16.13695717	19.50132675	7.190206621	5.000395623
7	12.65578018	16.35922795	5.333647457	4.999986157
8	9.553363304	13.38527044	5.02241826	5.000000485
9	7.091296122	10.66353012	5.001250599	4.999999983
10	5.609350728	8.332211177	5.000068838	5.000000001
11	5.097122623	6.587658595	5.000003786	5
12	5.010644213	5.574079453	5.000000208	5
13	5.001075636	5.162240062	5.000000012	5
14	5.000107678	5.040333662	5.000000012	5
15	5.000010769	5.009615194	5	5
16	5.000000108	5.002267349	5	5
17	5.000000011	5.00053326	5	5
18	5.000000001	5.00012534	5	5
19	5	5.000029456	5	5
20	5	5.000006922	5	5
21	5	5.000001627	5	5
22	5	5.000000382	5	5
23	5	5.00000009	5	5
24	5	5.000000021	5	5
25	5	5.000000005	5	5
26	5	5.000000001	5	5
27	5	5	5	5
28	5	5	5	5
29	5	5	5	5
30	5	5	5	5

Remark 3.4: From the table above, we can deduce that Modified Picard-Mann hybrid Iterative scheme converges faster to the fixed point p=5 than those of Picard, Mann and Picard-Mann Iterative scheme.



Remark 3.5 From the graph above using Machine Learning and Mathema programing Language, the function T: X→X of Picard, Mann, Picard-Mann and Modified Picard-Mann hybrid iterative scheme by application emanated from the initial guess $x_0 = 40$ and then travels some distance and finally converges at the point p=5. This is a visualization of the convergence of Picard, Mann, Picard-Mann and Modified Picard-Mann hybrid iterative schemes of fixed point in a complete metric space.

CONCLUSION

The Modified Picard-Mann hybrid iterative scheme developed in this paper provides a robust tool for achieving faster convergence in complete metric spaces. The results demonstrate the scheme's superior convergence rate compared to traditional Picard, Mann, and Picard-Mann iterations. By applying this scheme, especially in fields such as Machine Learning, Optimization, Control Systems, Network Theory, Computational Fluid Dynamics, Cryptography, and Game Theory, researchers and practitioners can benefit from a more efficient and reliable method for obtaining fixed points. Future research can explore additional applications and potential extensions of this iterative framework to other complex mathematical structures and emerging technologies.

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PAPER 37 - AN ASSESSMENT OF TEACHER TRAINERS' ICT COMPETENCES AND NEEDS IN THE INTEGRATION AND UTILIZATION OF EMERGING TECHNOLOGIES IN NIGERIA

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ABSTRACT

The recent global COVID-19 pandemic experience provided a rationale for a paradigm shift in the educational systems. Disruptions and advancements in teaching technologies arising from it have provided new and alternative teaching and learning strategies that facilitate better instructional delivery. In developing countries such as Nigeria, it became imperative to rethink educational processes and deploy emerging technologies for more effective instructional delivery. Hence, teacher trainers saddled with the responsibility of preparing teachers who can provide desired learning opportunities to learners must be adequately skilled and conversant with new and emerging technologies in education. Given this context, this study assessed the Information and Communication Technology (ICT) competences and needs of teacher trainers in utilizing emerging technologies in the training of teachers. The study adopted a descriptive survey design. Three hundred (300) Teacher trainers were selected through a multi-stage sampling approach from all the teacher trainers in the Faculty of Education of three Universities purposively selected in Lagos State. Two self-designed questionnaires structured on a 4-point Likert–type scale were used in collecting data to answer the three research questions formulated. Data collected were analysed using descriptive statistics (Mean rated response and Standard Deviation). Results indicated that teacher trainers have low conceptual knowledge and skills for applying emerging technologies to teacher preparation. Similarly, inadequate infrastructural needs were also observed to be inhibitors to Teacher Trainers' utilization of Emerging technologies. Based on the findings, it was suggested that Teacher Trainers be infused with capacity building that is compliant with ICT Competency Standards.

KEYWORDS: Delivery, Development, Innovatively, Learning strategies, Pparadigm shift

1. INTRODUCTION

The rapidly changing world, characterized by knowledge expansion, advancements in technology and paradigm shifts in, teacher 21st-century practices in education form the growing consensus that innovative pedagogies are conceptions of intellectual partnership between learners, teachers, tools and the technology used. Globally, the increasing and incredible diversity which education systems undergo constitutes the demand to meet the evolving needs of learners in a world that is rapidly changing from a demographic to a technological Society (European Civil Society for Education, 2019). The foundation for the use of media and Technology as emphasized by Krendl, Ware, Reid and Warren (1996) creates a deliberate and intentional act of communication enabled by various technologies. Thomas (1998) advocated an improvement to enhance human communication, learning and performance through media and technology that are integral to the implementation of innovative pedagogies.

There are contentions echoed by the need to critically examine what takes precedence in the process of learning between the teacher and technology in the developing world and which of the two impacts better. According to Cuban (1986), many questions about the value and impact of teachers in a developing world that lacks technology

prowess and where technology has been integrated sparingly into education. Researchers have cited instances (Chow,2015; Osakwe, 2010, Thomas, 1998) of people's attitudes towards technology integration into education and specifically for teaching and learning. The fundamental question which seeks to determine the impact and effectiveness of technology is whether new technologies motivate, engage and increase access to knowledge more than the traditional approaches and media. The significant shift in the education and learning paradigm as observed by Velassery (2012) identified major shifts in modes of instructional technologies from multimedia to e-learning systems enabled by information and communication technology. Scheiber (2018), affirms that there are also many smaller pedagogical, technological and systems revolutions in education contributing to the force of this large paradigm change.

Within this context, the unexpected COVID-19 coronavirus pandemic became a watershed that reinvigorated the search for alternative modes of learning. It provided a new-normal delivery landscape in education, a transition from physical to virtual, a rethink for the exploration and transformation of the online learning platform, restructuring application processes and stimulating crisis management strategies (Adeoye, Adanikin & Adanikin, 2020). It must be acknowledged that there exists a generation of plethora of problems in education in developing countries which new technologies cannot redeem so easily. Educational progress in many developing countries faces a severe double bind, right to quality education and expansion which economic stagnation makes it impossible. However, despite this pessimism, Daniel (2002) opines that impressive advances in technology over the past few years provide new hope for technological solutions, intelligently applied can allow greater access, higher quality and lower cost per learner. With the pandemic incursion and experience the unavoidable compelling reason for a rethink about educational processes and delivery abound. In the flexible pathways for instructional delivery, digital and blended learning place, the teacher has a crucial position and role in the delivery process.

1.1 ICT in teacher Preparation

Knowledge explosion places a premium on the latest ICT innovations to combat with exponential growth of knowledge where the learner gets acquainted with the latest developments and technological innovations to make knowledge accessible (ASTD, 2009). The learning paradigm shifts succinctly highlight changes in learning as a no-more classroom experience only (Velassery, 2012). According to Darling and Hammond, (2009), new technologies make the learners active while the teacher who is spacio-temporally limited in his knowledge is no more primary source of acquiring knowledge. However, despite the changing role of the teacher, Olatunji and Kolawole (2008) reiterate the National policy assertion on education that ‘no education system may rise above the quality of its teachers (FGN, 2004). The relevance of the teacher as pronounced by the National Commission on Teaching and America’s future (1996) affirms that the Teacher remains a key factor in educational Development who cannot be replaced by technologies rather technologies should enhance the position and new roles of facilitator. As the paradigm shifts the teacher will have to develop skills related to the learning contexts, as roles are multiplied from having a single transmitter of knowledge integrator of new ICT media, researcher, and designer of suitable learning scenarios (Husain, 2004).

1.2 ICT and Teacher Trainers

New goals have been raised for teacher training beyond limiting it to transmitting subject matter knowledge and pedagogical knowledge using predefined fixed methods National Council (Kramaski and Michalsky 2009). This has given rise to a redefined setting for learning and teaching thus changing future principles, practices and policies. (Gunga and Ricketts, 2007).

Husain's (2005) observation reaffirms the position of the modern development of innovative technologies in providing new possibilities to the teaching profession but at the same time places more demands on teachers to learn how to use these new technologies in their teaching.

The centrality of expertise to effective practice has been argued severally (NBOTS 1989, 2002) and NCTAF) as a means to building a skilful professional teaching force within the context of technology advancements. Despite our societal ambivalence about preparing expert teachers there is considerable evidence that teacher education can be quite powerful and the influence of teacher expertise can be quite large (Darling-Hammond, 2009).

Innovative technologies are providing new possibilities the training teachers in ICT-supported pre-service teacher education. UNESCO (2002) identified teacher education\ institutions' challenges to include preparing a new generation of teachers to effectively use new learning tools Hussan (2002), the potential ICT to accelerate, enrich and deepen skills motivate and engage students in learning. In education, ICT can make education more efficient and productive thereby engendering a variety of tools to enhance and facilitate teachers' professional activities (Yusuf, 2005).

The rationale for pre-service teacher trainers becoming more technologically literate to enable training pre-service teachers is becoming more pronounced. Research findings (Ester-del & Dalere 2011) indicate that students are more technologically adept at much early age, creating a discrepancy between the knowledge of teachers and students where teachers are using older technology while students are using more cutting edge. Technology. Debates on the integration of communication technologies in teacher training ICT (Larose et al.,1999) increase the pressure on preparing new generation teachers to effectively use the new licensing tools in their teaching (UNESCPO, 2002) Globally the quality of teachers is known in virtually to be a key predictor of students learning (Ololube, 2006). Osakwe, (2010) emphasises the enhancement of teachers' trainers possible with the use of ICT tools that can facilitate teachers' training and help them take full advantage of the potential of technology to enhance student learning is in trend with the position of UNESED, (2003). The usefulness of ICT in the training of teacher at different levels necessitate its entrenchment as means of disseminating and acquiring knowledge through contemporary means and methods, hence its entrenchment in teacher education programme of universities, COEs and Polytechnics. Udosen and Ekuikinam (2011), Olatunji and Kolawole (2008) agree that beyond integrating technology into teachers training programmes, the process will not only improve, but enhance the quality and information sources of the teachers.

1.3 ICT and Emerging Technologies

The impact of emerging technologies in education presents both benefits and challenges. Whilst emerging technologies for teaching can open up new possibilities, institutions need to ensure that they have the right level of knowledge, expertise and support to implement these technologies effectively, safely, sustainably and ethically. It has been observed generally (Owolabi and Ahamma, 2010, Owolabi & Agboola 2007, Tella et al 2010) that in developing countries, especially in Nigeria the potential of ICT cannot be ignored since it is making an appreciable impact in the global age (Omiunu, 2014), it is however, noted that appreciable impact may not have been felt as Tella et al (2010) submit because the use of ICT is just beginning to gain popularity. The pedagogies' use of computers and other ICTs necessitate the development among lecturers as well as students, skills and attitudes related to the effective use of Information and Communication Technologies (Tella, et al 2010). Recent research focuses on how technologies can be used in interactions, creating for example, the trends of situations that force students to engage in effective interaction (Fischer, Kothar, Mand and Hake 2007). As technology development began to expand beyond standard computers to mobile technology (Maecitalo-Siegel et al 2010), new media practices approach applications and tools began to enlarge with strong potential to enhance teaching and learning. The pace of technological change forces constant evaluation of the process of learning, media and its application in education.

In a simple definition, particularly within the context of education, emerging technologies are those that have the potential to change the current state of affairs in education (education Scotland, 2021), it cannot be contested wholly that emerging technologies have elements of old, technologies it should however at be noted that at various time innovations and unique features had been coming up as the synthesis of new and old technologies with new

approaches applications and practices (Veletsianos, 2016). Many of these technologies have been emerging for several years. Many continue to evolve at pace and will be in a state of continuous emergence (Education Scotland, 2021) affirming the not total newness of these technologies Veletsianos (2016) agrees emerging technologies and practices may:

i. May not necessarily be new
ii. Be in a constraint state of flex until a way of along nothing
iii. Not yet fully understood or researched
iv. Not yet fully understood or researched
v. Not yet revealing their full potential emerging technologies have a global appeal in different areas of adoption and application. There exists a considerable gap between the detail
vi. Emerging technologies include
vii. Virtual reality
viii. Mobile learning
ix. Artificial intelligence
x. Adaptive learning
xi. Live streaming
xii. Learning games and simulation
xiii. Massive online open courses in immersive classrooms
xiv. Robotics

1.4 ICT Competency and Needs

Utilization of emerging technologies ICTs are the drives of emerging technologies hence the use of ICT in education to increase access to learning opportunities and enhance the quality of education with advanced methodologies (UNESCO, 2009) Adopting and using new Technologies in appropriate ways to realize intended learning outcome requires using ICT forms part of the pedagogical practices of the teacher (Pelegrum and Anclerson, 1999; SITES, 2006).

The utilization of technologies has promoted the need to have ICT and competence standards among developing countries and globally. In Nigeria, the ICT-competency framework for teachers (ICT CFT) has been developed as a response to the urgent need for teachers to have the necessary skills to use technology in the classroom. This is in line with the adoption of the road map ICT CTF OER Network UNESCO (2013) road map. Further collaborative efforts by NUC, NOUN and UNESCO brought together 50 educational experts from 30 universities, FME, NTT, NCCE, UNESCO experts from Abuja, Dakar and ICT regional experts (UNESCO, 2023) Elsewhere global efforts at establishing ICT Competency Frameworks for the use of ICT and identified skills need have been observed.

Competency standards have been observed in Taji Kistan, Afghanistan, Kyrgyzstan and Lao PDR for teachers with UNESCO. Notably, the Lao project was conducted in two phases 2020-2021; 2021 to 2022 for teacher trainers as a prelude to the adoption and integration of ICT competency standards. The major highlights of competency levels as may be obtainable across levels of teachers' application are identified on (3) levels: Level 1 basic level, Level 2 proficient level and Level 3 advanced level, Six (6) domains and Forty-seven indicators.

Source (ICT competency standard for teachers in Lao 2022).

Several researchers have argued that several key factors determine the competency of teacher training in using new technologies Kramaski & Michalsky, 2009; Husain, Ololube 2005; Yusuf, 2005; Osakwe 2010) however it is essential among the factors that teacher trainers have basic ICT skills and competencies (UNESCO, 2003) however, the generality research findings identified, computer literacy, digital knowledge of ICT computers, skills and attitude related to effective use of information and communication technologies Omiunu, 2024). The requirements and needs for the application and utilization of emerging technology have been classified by researchers (Omiunu, 2014,

Ogbomo, 2011; Jegede. et al., Osakwe 2010; Adeoye et al,. 2020) into infrastructural needs and technical support needs. Infrastructures need appropriate rooms, laboratories, studies, electricity supply, and telephony (internet connecting and supply) access (personal and technical support specialists in installation operation maintenance of technical equipment) content developer course content and curriculum relevance.

Researchers (Dwyer et al, 1991, Macro, 1995, Hamza and Alhalabi 2002) have indicated the effective utilization of emerging technologies to achieve optimal education through predicable stages which take various. This of course is not noticeable in teachers with in natural proclivity towards using technologies generally. Accidence that teachers' preparedness for computer accessibility comfort for desirability determine more than underrating in technologies abound in the realised findings of Chow (2015) and Marshall (2003) assert that racing technologies deliver different tends of content the unfortunate state of the arts in that most lectures of tertiary institutions do not have competencies in the use of ICTs in instruction. (Udosen and Ekukinam 2011) hence they cannot model good use of technology (Idowu. Adegunodo and Popoola, 2003)

1.5 Statement of the Problem

Pre-service teacher education programmes in tertiary institutions continuously align with government positions to produce quality teachers through improved training programmes that meet the expectations of the FCN in her education system. The relevance, quality and roles remain the central forces government's vibrant and dynamic education asserting that no education system may arise above the quality of its teachers (FGN, 2014) the production of quality teachers who meet the challenges of a rapidly changing world within the context of paradigm shifts and technological advancements in recognized as the main request of teachers as change agents bestowed with the responsibilities of integrating technology into the educational system specifically in teaching and learning process.

1.6 Research Questions

The study tried to provide answers to the following questions :

1. What is the composite effect of teacher trainers' ICT knowledge competence and needs on emerging technologies?
2. What are the relative effects of teacher trainers' ICT competencies knowledge and needs on the utilization of emerging technologies?
3. To what extent would ICT competence and the needs of teacher trainers determine the utilization of emerging technologies?

2. METHODOLOGY

2.1 Design

The survey design of the expo-facto type was used to survey the faculty of Education of three universities in Lagos state used to train Pre-service Teachers. Three hundred (300) Teacher trainers were selected through a multi-stage sampling approach from all the teacher trainers in the universities selected.

2.2 Instrument and Procedure

Two twenty-item self–constructed questionnaires were titled “Teacher Trainers ICT Competencies and Needs Questionnaire”(TTICTNQ) and “Teacher Trainers Utilization of ICT Tools Questionnaire” (TTUICTTQ). The first questionnaire (TTICTNQ) had two sections: Section A which sought information about the respondent's name, age, teaching experience, sex, subject taught and University. Section B contained four items with five questions each: basic and conceptual knowledge of ICT tools, Curriculum standards, integration and planning, and ICT-related

assessment strategies and tools. The second questionnaire had four items of five questions each; availability of ICT tools and infrastructures, selection of ICT tools, utilization of ICT tools and ICT technical support

2.3 Results and Discussion

1. What is the composite effect of teacher trainers' ICT knowledge competence and needs on emerging technologies?

Table 1:

Teacher Trainers' ICT Knowledge Competence on Emerging Technologies

S/N	Items	Mean	SD
1.	Item one	1.65	.76
2.	Item two	1.45	.64
3.	Item three	1.72	.81
4.	Item four	1.42	.73
5.	Item five	1.24	.82
	Grand Mean	**1.50**	

Decision: Grand Mean- 2.50 and above (High); 2.49 and below (Low)

Information on Table 1 reveals that the effect of teacher trainers' ICT knowledge competence and needs on emerging technologies is significantly low based on the grand mean of 1.50.

2. What are the relative effects of teacher trainers' ICT competencies knowledge and needs on the utilization of emerging technologies?

Table 2:

Teacher Trainers' ICT Competencies Knowledge on the Utilization of Emerging Technologies

S/N	Items	Mean	SD
1.	Item one	2.01	.42
2.	Item two	2.00	.39
3.	Item three	1.98	.36
4.	Item four	1.46	.32
5.	Item five	2.11	.46
	Grand Mean	**1.91**	

Decision: Grand Mean- 2.50 and above (High); 2.49 and below (Low)

Information on Table 2 reveals that the effect of teacher trainers' ICT competencies knowledge and needs on emerging technologies is significantly low based on the grand mean of 1.91.

3. To what extent would ICT competence and the needs of teacher trainers determine the utilization of emerging technologies?

Table 3:

ICT Competence and Utilization of Emerging Technologies

S/N	Items	Mean	SD
1.	Item one	1.76	.79
2.	Item two	1.50	.66
3.	Item three	1.62	.70
4.	Item four	1.32	.51
5.	Item five	1.43	.62
	Grand Mean	**1.53**	

Decision: Grand Mean- 2.50 and above (High); 2.49 and below (Low)

Information on Table 3 reveals that the extent at which ICT competence and the needs of teacher trainers determine the utilization of emerging technologies is significantly low based on the grand mean of 1.53.

i. In general, the ICT-related skill levels of the respondents were less than ideal. Two few teachers have the know-how to apply ICT tools in teaching and learning apart from the basic application of computers for research and presentation.
ii. There was low conceptual Knowledge about the advanced application of ICT tools.
iii. few were able to identify the required skills needed for specific ICT tools
iv. Low conceptual knowledge about emerging technologies and their application to the teaching-learning process.
v. There was a generally low knowledge and perception about the potential of emerging technologies in the teaching-learning situation.
vi. Poor and low attitude to the use of ICT
vii. Infrastructural needs are very extensive, no appropriate rooms, laboratories, electricity supply and internet services are epileptic.
viii. Technical staff support was clear that they did not exist as the trainers' responses reveal that there were no links with support staff and information specialists in the preparation of lectures and other curricular activities.

4. CONCLUSION AND RECOMMENDATION

The challenges faced by teachers in integrating digital technologies into their teaching methods have been brought to the forefront by the COVID-19 pandemic. Insufficient infrastructure, high access costs, a lack of multilingual and contextually relevant digital resources and most importantly, inadequate training for teachers have hindered their ability to effectively incorporate digital tools into education. Nigerian Universities and Teacher trainers are yet to demonstrate consistent commitment to the utilization of digital technologies through capacity developments of the teacher trainers and ICT technical staff who lack the conceptual and basic knowledge for ICT in curriculum delivery. Most support staff are technicians, electricians and artisans engaged in general purposes and electrical-related works. The inability to identify support roles impedes the use of ICT in the teaching-learning process. As schools increasingly adopt digital technology in their curricula it becomes imperative to provide teachers with adequate training and support.

It is however, acknowledged that the Nigerian government's efforts through the national workshop on ICT Competency Framework for Teachers (ICT-CFT) which identified six aspects of teacher training are aligned to Nigerian policy objectives that highlight OER-based training materials, building on the resources of the ICT CFT will provide an effective roadmap to Nigerian Teachers in having the necessary ICT skills in instructional and educational delivery (Jegede and Okebukola, 2021., UNESCO, 2023).

In Nigeria, the ICT CFT project has played a crucial role in digital capacity building, if it is sustained through consistent pieces of training it will continue to yield a significant impact. Teachers who are bent on improving their competence are likely to contribute, directly or indirectly to the growth of students' achievement

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PAPER 38 - ASSESSMENT OF SMART IoT- BASED BUILDING SYSTEMS IN HOUSING ESTATE DEVELOPMENT IN ABUJA – NIGERIA

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ABSTRACT
Client's increasing demand for efficient security, energy, user experiences and smart community management that match property value amidst competitive global property market necessitates developers' adoption and development of Smart internet-of-things based buildings system for housing estate development. Housing developers in Nigeria are increasingly adopting the innovative trend to create cutting-edge, sustainable, and desirable living spaces that meet the evolving needs of prospective buyers. This study assesses the effectiveness of the adoption of smart IoT based buildings systems in the development of housing estates in Nigeria's capital city, Abuja with a view to identifying the identifying the opportunities and challenges associated with their adoption. In conducting this research, quantitative research approach using survey research technique was employed for data collection with the aid of a well-structured questionnaire survey. Descriptive statistical tool was used to analyse the data collected. The questionnaire was administered to the relevant professionals involved site construction works such as: Architects, Quantity Surveyors, Engineers and Builders. Finding from the study identifies that the best strategy to enable the adoption and implementation of smart IoT building systems in Abuja is through Increasing awareness while it also identifies the many significant benefit of Smart IoT systems in Buildings can be used in garner the attention of end users to see the benefit associated with Smart IoT and get clients to actively request for the inclusion of Smart IoT systems in building and housing estate projects.

INTRODUCTION

The development of housing estates was originally to provide a large number of units to increase the housing stock and to meet housing demand, rapid urbanization and population growth in Nigeria (Oyedele et al., 2017)., competition among estate developers and subscribers increasing demand for quality standards and innovative solutions have enabled the provision of modern amenities and incorporation of innovative technologies, like green building and smart home features that enhance value creation and costs reduction, it also increase efficiency and the creation of modern, attractive, and sustainable living spaces for residents

In response to this challenge, housing estate developers in Abuja, Nigeria are increasingly adopting innovative technologies, including Smart IoT-based building systems, to enhance the efficiency, sustainability, and livability of their developments (Alugah, 2021). Smart IoT-based building systems integrate various technologies, including sensors, actuators, and data analytics, to create intelligent and responsive built environments (Jia et al., 2019).

The adoption of Smart IoT-based building systems in housing estate development in Abuja, Nigeria is driven by the need to address various challenges, including energy efficiency, water conservation, waste management, and indoor air quality (Faremi et al., 2018). These systems have the potential to enhance the overall quality of life for occupants, while also reducing the environmental impact of buildings (Suo et al., 2019).

Despite the potential benefits of Smart IoT-based building systems, there is a need for a comprehensive assessment of their effectiveness and feasibility in the context of housing estate development in Abuja, Nigeria (Oyedele et al., 2017). This study aims to address this knowledge gap by assessing the current state of Smart IoT-based building systems in housing estate development in Abuja, Nigeria, and identifying the opportunities and challenges associated with their adoption.

CONCEPTUALIZING SMART BUILDING SYSTEMS

Buildings were known to be smart where management systems are applied on a facility of high technical quality until emphasis were made by users on not just about how the integrated equipment responsible for the service was

created, but how such equipment integration increases the user comfort (Zygon, 2017). A smart building has been defined by the European Smart Building Group as a facility that maximizes action efficiency of its users and allows for an efficient resource management at minimum operating costs. It is a building that combines best projects, materials, systems and technologies to create a facility that satisfies or exceed operating expectations of its co-dwellers" (Clements- Croome 2014), in order to provide increasing value to the its shareholders. King (2017) also defines smart Buildings as those that have advanced controls and sensors along with automation, communication, and analytic capabilities. Hadiana *et al.,* (2020) noted SB anticipate and proactively respond to maintenance, comfort, and energy performance issues, resulting in better equipment maintenance, higher occupant satisfaction, and reduced energy consumption and costs.

Smart Buildings are those where self-configurable embedded devices including sensors and actuators can be remotely controlled remotely via Internet Technology to enable a large variety of security and monitoring application. Smart buildings are IoT concepts that define areas of the building where remote sensing is used to collect data and monitor things going on around the building. The growth and development of nations has seen the rise in use of IoT in buildings as technology was made to ease the order of things in human daily life, including housing.

SMART BUILDINGS SYSTEMS IN NIGERIA

Whereas the concept of smart buildings was developed between 20-30 years of the previouscentury with discussions and debates on intelligent buildings, discussion of Smart buildings in Nigeria is rooted roots in the industrial sectors in the 1990s and centered upon systems and control used to automate production processes and to optimize plant performance, and then adaptation and transfer of technological systems in the 2010s into residential and commercial sectors (Ogunleye, 2012). Considering the type of technology that is involved and the many utilities that a smart building needs, Ciroma *et al.,* (2021) identified that much is yet to be achieved with Smart building development in Nigeria. Liman (2017) noted that the conditions of infrastructure have not encouraged innovation and the adoption of new technology, thus, the need for development of infrastructure that supports the development of Smart housing in Nigeria.

The development of smart buildings in Nigeria can be traced back to the early 2000s, when the country began to experience rapid urbanization and growth in the construction industry (Ogunleye, 2012). According to a report by Netcom Africa, the company pioneered the concept of smart buildings in Nigeria in 2004, providing Internet services to major sectors of Nigerian businesses (Netcom Africa, n.d.).

Today, smart buildings in Nigeria are equipped with advanced technologies such as IoT sensors, smart energy management systems, and security systems (Oyedele *et al.,* 2017). These technologies enable building owners and managers to monitor and control building operations remotely, reducing energy consumption and improving occupant comfort. The concept of smart buildings in Nigeria is not new, but it has gained momentum in recent years (Faremi *et al.,* 2018). A study by Oyedele *et al.* (2017) investigated the adoption of building information modeling (BIM) and smart building technologies in Nigeria's construction industry. The study found that while there is a growing interest in smart building technologies, there are still significant barriers to adoption, including lack of awareness and education among building owners and occupants.

The development of smart buildings in Nigeria has been on the rise, driven by the need for sustainable and energy-efficient buildings (Alugah, 2021). According Faremi *et al.* (2018), the integration of smart building strategies in the design of mixed-use buildings in Lagos State, Nigeria, can promote sustainable environments that meet user needs.

In Nigeria today, smart buildings are equipped with advanced technologies such as IoT sensors, smart energy management systems, and security systems (Oyedele *et al*., 2017). These technologies enable building owners and managers to monitor and control building operations remotely, reducing energy consumption and improving occupant comfort.

2.0 INTERNET OF THINGS (IOT) IN SMART HOMES

The Internet of Things (IoT) has revolutionized the concept of smart homes, enabling seamless integration of various devices and systems to create a comfortable, convenient, and energy-efficient living space (Jia *et al*., 2019; Wang *et al.,* 2020).

IoT in smart homes enables various applications, including:

1. Home automation: IoT devices can control lighting, temperature, security, and entertainment systems, enhancing convenience and comfort (Li *et al.,* 2020).
2. Energy management: IoT sensors and devices can monitor and optimize energy consumption, reducing waste and costs (Suo *et al.,* 2019).
3. Health and wellness: IoT devices can monitor vital signs, detect falls, and provide personalized health recommendations, enhancing occupant well-being (Kumar, 2015).

However, IoT in smart homes also poses challenges, including:

1. Security and privacy concerns: IoT devices can be vulnerable to cyber-attacks, compromising occupant data and security (Babovic *et al*., 2016).
2. Interoperability issues: Different IoT devices and systems may have incompatible communication protocols, hindering seamless integration (Zanni, 2015).
3. High upfront costs: Implementing IoT systems in smart homes can be expensive, making it challenging for widespread adoption (Rawal, 2016).

IoT in smart homes poses great potential to enhance comfort, convenience, and energy efficiency with it eases the lifestyle of user of the buildings.SMART IOT SYSTEM IN BUILDINGS

The integration of Internet of Things (IoT) technology in buildings has given rise to the concept of Smart IoT System in Buildings (SISB) (Jia *et al.,* 2019). SISB aims to create an intelligent, efficient, and sustainable built environment by leveraging IoT sensors, devices, and data analytics (Wang *et al.,* 2020).

One of the primary benefits of SISB is energy efficiency. IoT sensors and devices can monitor and control energy consumption in real-time, optimizing energy usage and reducing waste (Li *et al.,* 2020). For instance, a study by Suo *et al.* (2019) demonstrated that IoT-based energy management systems can reduce energy consumption by up to 30%.

SISB also enhances building safety and security. IoT sensors and devices can detect anomalies and alert authorities, ensuring prompt response to emergencies (Kumar, 2015). For example, a study by Hussain (2010) showed that IoT-based fire detection systems can reduce response time by up to 50%.

Smart IoT building improves occupant comfort and well-being. IoT sensors and devices can monitor indoor air quality, temperature, and humidity, adjusting conditions to optimize occupant health and productivity (Jia *et al*., 2019). A study by Li *et al*. (2020) found that IoT-based indoor air quality monitoring systems can improve occupant satisfaction by up to 25%.

However, SISB also poses challenges, such as data privacy and security concerns (Suo *et al.,* 2019). Moreover, the high upfront costs of IoT infrastructure can be a barrier to adoption (Wang *et al*., 2020).

Smart IoT building has the potential to transform the built environment, enhancing energy efficiency, safety, comfort, and sustainability. However, addressing the challenges associated with SISB is crucial for widespread adoption**.**

CHALLENGES OF SMART IOT BUILDING SYSTEM IMPLEMENTATION

The implementation of Smart IoT Building systems could be impeded by numerous challenges and addressing these challenges is crucial to ensure the effective SIB systems implementation. The challenges include:

1. Lack of knowledge: awareness and understanding required to implement smart building systems is limited, particularly in developing countries (Ciroma *et al*., 2021).
2. Unavailability of technology: Insufficient technological infrastructure, including stable internet connectivity, to support smart building systems (Leonard, 2015; Ahmed and Ahmed, 2019).
3. High cost: Significant investment required for smart building infrastructure, including equipment and maintenance costs (Rawal, 2016).
4. Unstable internet connection: Reliable internet connectivity is essential for smart building systems, but unstable connections can hinder implementation (Ahmed and Ahmed, 2019).
5. Smart building business model: Complexity in developing a viable business model for smart building implementation, including contracts and licensing fees (Siemens, 2016).
6. Security and privacy concerns: Risks associated with data breaches, cyber-attacks, and unauthorized access to user data (Babovic *et al.,* 2016; HP Report, 2015).
7. Minimal stakeholders' involvement: Insufficient collaboration and coordination among stakeholders, including government agencies, private sector companies, and community groups (Chia, 2016).

RESEACH METHODOLOGY

This research adopts the quantitative research approach using the survey research technique. Following extant review of the literature on Smart IoT Buildings, a well-structured 5-point likert-scale questionnaire survey was developed as the instrument for data collection and to meet the research objectives. a 5-point likert-scale questionnaire survey was developed based on the information obtained from the literature review. Likert scales are excellent at extracting study populations' perspectives (Collins, 2010). The questionnaire survey was administered to 127 randomly selected built environment professionals among the 194 working with in Federal Capital Development Authority (194), this is considering their role in ensuring the safe, secure, and efficient development and implementation of SMART IoT Building systems. Of questionnaire administered, 82 were correctly filled and returned, giving a 64.5% response rate. Data obtained were analysed using inferential statistics and presented.

DATA ANALYSIS AND DISCUSSION

The study adopted a quantitative research approach using a well-structured questionnaire for data collection from 127 respondents who are construction professionals in the built environment working in FCDA, Abuja. Of the 127 numbers of questionnaire distributed, 82 were returned, appropriate filled and used for data analysis. This gives a response rate of 64.5%.

I. Respondents' Profile

Tables I – IV depicts respondents profile

Table 1: Respondents' Designation on Site

Designation	Frequency	Percentage (%)
Safety Officer	13	15.85
Site Engineer	25	30.49
Construction Manager	19	23.18
Project Manager	12	14.63
Others	13	15.85
Total	**82**	**100.00**

Source: Researcher's Field Survey

Information on the designation of respondents is presented in Table 1 depicts that majority (30.49%) of the respondents are Site Engineers; 23.18% of the respondents are Construction Managers; 15.85% of the respondents are safety officers and also designated other roles on construction sites; while the least populated is the project manager 14.63. This indicates that respondents mix entails professionals who perform various key roles in the safety and teamwork amongst workers on site. Therefore, information gathered from them could be relied upon.

Table 2: Respondents' Profession

Profession	Frequency	Percentage (%)
Architect	13	15.85
Builder	21	25.61
Engineer	25	30.49
Quantity Surveying	14	17.07
Others	9	10.98
Total	**82**	**100.00**

Source: Researcher's Field Survey (2022)

The profile of respondents' profession is presented in Table.2. This profile indicates that majority (30.49%) of the respondents are Engineers, followed by Builders who are 25.61%, Quantity Surveyors are next in population with a total of 7 (17.07%), 15.85% of the respondents are Architects, while 10.98% of the respondents are from other construction related professions. This also reveals that the combinationof the respondents is made up of professionals who mostly undertake various roles in building production in the study area. These professionals are capable of providing reliableinformation required for the study.

Table 3: Respondents' Highest Academic Qualification

Qualification	Frequency	Percentage (%)
HND	21	25.61
B.Tech/BSc	45	54.88
M.Tech/MSc	16	19.51
PhD	0	0.00
Others	0	0.00
Total	**82**	**100.00**

Source: Researcher's Field Survey

Table 3 presents information on the highest academic qualification of respondents. As presented in the table, majority (54.88%) of the respondents is holders of Bachelor's Degree (B.Tech/BSc); 25.61%are holders of Higher National Diploma (HND); and 19.51% of the respondents are holders of Master's Degree (M.Tech/MSc). This implies that the respondents are educated enough to understand the information and provide reliable response to the questionnaire.

Table 4: Professional Qualification of Respondents

Qualification	Frequency	Percentage (%)
NIA	13	15.85
NIOB	21	25.61
COREN	25	30.49
NIQS	14	17.07
Others	9	10.98
Total	**82**	**100.00**

Source: Researcher's Field Survey

The information regarding respodents professional qualification is presented in Table 4. Result shows that 15.85% of the respondents are professional membersof the Nigerian Institute of Architects (NIA); 25.61% of the respondents are professional members of the Nigerian Institution of Building (NIOB); 30.49% of the respondents are registered members of the Council for the Registration of Engineers in Nigeria (COREN); 17.07% of the respondents are professional members of the Nigerian Institute of Quantity Surveyors; and 10.98% areprofessional members of other bodies of the built environment professions. This indicates that the study respondents are certified experts of their various professional fields and certifiedto provide reliable information needed for the study.

Table 5: Years of Experience of Respondents

Years of Existence	Frequency	Percentage (%)
Less than 5 years	0	0.00
5 - 10 Years	12	14.63

11 - 20 Years	34	41.46
21 - 30 Years	29	35.37
Above 30 Years	7	8.54
Total	**82**	**100.00**

Source: Researcher's Field Survey (2022)

Table 5 shows respondents' years of experience. From the results, majority (41.46%) of the respondents have between 11 and 20 years of experience; 35.37% of the respondents have between 21 and 30 years of experience; 14.63% of the respondents have between 5 and 10 years of experience; and 8.54% of the respondents have above 30 years of experience. Therefore, none of the respondents has less than 5 years of experience in the construction industry. This shows thatthe respondents are well experienced provide reliable information needed for the study.

II. Results and Discussions on the Benefit of the utilisation of Smart IoT Systems inBuildings

The use of MIS was also adopted for ranking the most significant benefit of smart IoT systems inbuilding to smart estates. This MIS result is presented in Table 6.

Table 6: Most Significant Benefit of Smart IoT Systems in Buildings

CODE NO	BENEFITS	MIS	RANK	DECISION
C1	Ease of Use	4.67	1st	Most Significant
C7	To improve building services	4.25	2nd	Significant
C6	Ease of mobility in building.	4.23	3rd	Significant
C2	Improved security	4.20	4th	Significant
C3	Multi-functionality of systems	4.20	4th	Significant
C5	Higher occupant satisfaction	4.17	6th	Significant
C4	Faster building responsethrough Automation	4.15	7th	Significant
C8	User Identification Technology	3.92	8th	Significant
	Group MIS	***4.22***		***Significant***

Researcher's Field Survey (2022)

As shown in Table 6, the study identified nine (9) major benefits Smart IoT Systems in buildings.It was revealed that Ease of Use (MIS = 4.67) most significant benefits of smart IoT systems in Buildings enjoyed by the users. The remaining eight (8) benefits are also significant to the users of the smart building. These ranges from Improving the Building Services (MIS = 4.25) to User Identification Technology (MIS = 3.89). On the average, all the researched benefits of Smart IoT Systems in building are significant to users (Group MIS = 4.22), this helps the users appreciate the buildings better with the systems in them. The finding of this study ranks the Ease of Uses as the highest ranked benefits of Smart IoT systems which agree with the study of Rajeswari (2018), which states that the fact that the systems of the building can be controlled form anywhere in the building at any time is a great advantage to the implementation of smart building systems. The resultof this finding also agrees with the studies of Sanchez et al. (2014) and Matuszak et al. (2015).

III. Results and Discussions on the Challenges for Implementing Smart IoT Building Systems to Create Smart Estate Infrastructures in Abuja

The use of RII also adopted in order to rank the challenges for implementing Smart IoT building systems to create smart estates infrastructure in Abuja, in order of significance. This RII result is summarised in Table 7.

Table 7: Issues arising from Implementing Smart IoT Building Systems to Create Smart Estate Infrastructure in

Abuja

CODE NO	CHALLENGES	RII	RANK	DECISION
D1	Lack of Knowledge about Smart BuildingSystems	0.85	1st	Most Significant
D3	High Cost of procurement and installation	0.81	2nd	Most Significant
D2	Un-availability of Technology	0.74	3rd	Significant
D4	Un-availability of Stable InternetConnection	0.74	3rd	Significant
D7	Minimal Stakeholders Involvement	0.65	5th	Significant
D5	Smart building business model	0.63	6th	Significant
D6	Lack of Security and Privacy of user data	0.61	7th	Significant
	Group RII	***0.72***		***Significant***

Researcher's Field Survey (2022)

The research discovered seven (7) challenges for implementing Smart IoT Building systems and the result is presented in Table 7. It was shown that the most significant challenge faced is the Lack of Knowledge about Smart building systems (RII = 0.85) and High Cost of Procurement and installation (RII = 0.81). The remaining six (6) identified challenges are Un-availability of Technology, Un-Availability of Stable Internet Connection (both RII = 0.74); Minimal Involvement of Stakeholders (RII = 0.65); Smart Building Business Model (RII = 0.63); and Lackof Security and Privacy of user data (RII = 0.61). On the average, all the identified challenges for implementing Smart IoT Building Systems are significant (Group MIS = 0.72). Similarly, this finding echoed the study of Rawal (2016), which states that the High Cost of Smart IoT system is a major concern for its implementation. This will not just be for the people that seem not to be on the upside of earnings but for everyone who might also be involved in the construction of the martbuilding, it is not readily cheap to procure and install.

IV. Results and Discussions on the Measures for Improving the Use of Smart IoT BuildingSystems in Abuja to Build Smart Estates

The use of RII was also adopted in order to rank the identified strategies for improving Smart IoTbuilding systems in Abuja, in order of effectiveness. This RII result is summarised in Table 8.

Table 8: Measures for Improving the Use of Smart IoT Building Systems in Abuja to Build SmartEstates

CODE NO	MEASURES	RII	RANK	DECISION
E1	Increasing Awareness	0.92	1st	Most Effective
E2	Creating better Power and Energy Storage Technologies	0.88	2nd	Most Effective
E4	Improving Embedded security andprivacy mechanisms	0.81	3rd	Most Effective
E3	Checking Real-time data collection andtransmission	0.78	4th	Effective
E5	Improved Standardization	0.65	5th	Effective
E7	Components must be available andaccessible in Market	0.65	5th	Effective
E6	Enhancing Real-Time Data Transmissionresponse	0.62	6th	Effective

Group RII	***0.76***	***Effective***

Six (6) strategies to improve the use of Smart IoT Building systems are identified and the result was presented in Table 8. It was shown that the most effective strategy for improving the use of Smart IoT Building System in Abuja are Increasing Awareness, Creating Better Power and Energy Storage Technologies and Improving Embedded Security and Privacy Mechanisms, all with RII of 0.92, 0.88 and 0.81 respectively. The remaining three (3) identified strategies are also effective with high RII values ranging between 0.78 (Checking Real-Time Data Collection and Transmission) and 0.62 (Enhancing Real-Time Data Transmission response). On the average, all the identified strategies for improving the use of Smart IoT building systems are effective (Group RII = 0.76). This finding of this study agrees with the study of Oyewole et al (2019), Mohammedet al (2018) and Gubbi et al (2013).

CONCLUSION

This study assessed smart IoT based buildings systems and its implementation in smart estate infrastructures in Abuja with the view of improving its usage across the capital. The use of quantitative research approach was employed through the use of questionnaire survey. For this purpose, 127 copies of questionnaire were administered to construction professionals in FCDA, Abuja with a response rate of 64.5%. The use of Relative Importance Index (RII) and Mean Item Score (MIS) were employed for analysing the data collected. The findings from the results of the analyses of data led to vital conclusions which are stated in this section.

Lack of Knowledge about Smart Building systems is the most significant challenge for implementing Smart IoT systems in Buildings. On the average, all the identified challenges for implementing Smart IoT building systems are significant while the most effective strategy for improving use of smart IoT building systems in Abuja is to create awareness. Creating a better power and energy storage technologies also ranked high amongst the respondents as a strategy thatcan really be effective when improving the use of Smart IoT systems.

As a result of all the findings of this study, it can be concluded that the adoption and use of Smart IoT systems in the study area is not as high as other developed world but there are strategies that can improve the usage in Nigeria.As a result, proper awareness of Smart IoT systems will increase implementation which will in turn enhances the construction business and give a good turn-out for the face of the Nigerian construction industry.

Recommendations

Based on the study's results and conclusions, it is therefore recommended that the lack of knowledge of Smart IoT systems be reduced through awareness, seminars and conferences within the study are and generally. This could be achieved through continuous professional development by professional bodies, governmental or through third party influence.

Also adoption and implementation of Smart Building Systems can be improved upon through data protection and protection of users' data infringement through the provision of embedded security of the systems.

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