# DIGITAL LEARNING SKILL NEEDS OF NIGERIAN UNIVERSITY STUDENTS AND OPTIMIZATION OF AI WRITING ASSISTANCE APPS FOR ENHANCED LEARNING: A STUDY OF THE UNIVERSITY OF NIGERIA

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## Abstract

*With an emphasis on the University of Nigeria, this study examined the digital learning requirements of Nigerian university students for optimization of AI writing support apps to improve academic learning. The increasing digitization of education and the increasing dependence of students on technology for academic purposes have brought attention to the necessity of students possessing requisite digital skills. However, many university students in Nigeria encounter difficulties optimising digital resources for learning. This study uses an online survey with Google forms to gauge students' use of AI writing assistance tools. According to the findings, there is a big disconnect between students' perceptions of their own digital literacy and their real aptitude for using these resources to succeed academically. The study further highlighted the potential of these tools to improve students' writing skills, critical thinking, and overall learning experience. Based on the findings, the study recommended integrating comprehensive digital literacy training into the university curriculum, with an emphasis on the practical use of AI writing applications. Such initiatives could help students harness the full potential of digital tools, fostering a more effective and engaging learning environment. The study concluded that optimizing AI writing assistance apps through digital learning skills development is essential for enhancing learning outcomes and preparing students for the demands of the digital age.*

**Keywords**: Digital Literacy; digital learning skills needs; AI Writing Assistance Apps; Learning Optimization, Nigerian Universities

## Introduction

In today's digital world, university students can hardly learn and carry out their academic researches without huge dependence on the AI assisted writing apps. This fact is almost undisputable given recent experiences as students marry chatGPT for their academic studies and writing. While this is a global trend that has been argued to have aided students across the globe in their learning and research, experience has shown that these students use these apps wrongly. This wrong use of these AI Apps has further eroded scholarship quality and integrity of the research in terms of plagiarism and originality of research outputs.

Thus, to be part of the streams of global students who use AI writing assistance app, the university of Nigeria students need to poses requisite digital learning skills as technology has completely changed learning landscape by opening up new avenues for learning and teaching. While Nigerian universities are working to incorporate digital tools into their curricula to improve the quality of education they offer, students' levels of digital literacy vary greatly, which frequently affects their engagement and performance in the classroom. One example of this digital learning tool is the artificial intelligence (AI) for writing and study.

Artificial intelligence refers to the ability of technology to simulate human intelligence processes. As a process, Artificial Intelligence (AI) allows computers to carry out a wide range of sophisticated tasks, including as seeing, comprehending, and translating spoken and written language, analyzing data, making suggestions, and more (Craig, Loskowski & Tucci, 2024).

Artificial intelligence (AI) is has brought changes in several industries, including education. Like in many other nations, Nigeria is fast tracking the integration of AI into its educational systems to improve learning outcomes. With Artificial Intelligence (AI), learning and writing have been improved as features that can enhance grammar, coherence, and overall writing quality are available in AI writing assistance apps. The emergence of artificial intelligence (AI) offers promising prospects to improve learning outcomes and experiences.

Artificial intelligence (AI) is a set of technologies that can improve educational outcomes. These technologies include machine learning, natural language processing, and data analytics. They are changing how students learn, teachers teach, and educational institutions run. Personalized learning is one of the most important uses of AI in education. With the use of AI-driven platforms, learning experiences may be customized to meet the needs of each individual student, resulting in a more successful educational path. Adaptive learning technologies are utilized by DreamBox Learning and Smart Sparrow, among other platforms, to modify content in real-time according to student performance. According to research, individualized learning can greatly raise student achievement and engagement (Pane et al., 2015). Such adaptive technologies can identify gaps in knowledge and suggest resources, enabling students to learn at their own pace.

In the words of Sule (2024), in Nigeria, where the education sector faces numerous challenges, such as inadequate infrastructure, lack of qualified teachers, and inconsistent access to learning resources, AI has the potential to bridge significant gaps. By integrating AI into education, Nigeria can enhance teaching, improve learning outcomes, and provide students with personalized educational experiences. However, successful integration requires careful planning, infrastructure investment, and policy support. AI comes with numerous opportunities for the educational system in Nigeria. It could help students create personalized learning outcomes. The Integration of AI can provide students with individualized learning paths based on their abilities, learning styles, and progress. This is particularly important in Nigeria, where classrooms are often overcrowded, and teachers may struggle to cater to each student's unique needs. AI-powered platforms, such as intelligent tutoring systems, can adapt content, provide real-time feedback, and suggest additional learning materials to enhance student comprehension. AI can enable the creation of advanced e-learning platforms that simulate classroom experiences. For students in remote or underserved areas, this can provide access to quality education even with few qualified teachers. AI can facilitate virtual classrooms, interactive discussions, and automated assessments, allowing students to learn from anywhere.

These functions clearly call attention to AI in assisting students' in writing. With AI, instant comments and suggestions are provided by tools like Grammarly, ProWritingAid, and ChatGPT, which assist students in improving their writing abilities. These programs use natural language processing to evaluate text and provide enhancements for clarity, grammar, and style. According to a Watanabe and Yoon (2021) study, students' writing confidence and skills increased dramatically when they used AI writing tools. These tools help students feel less anxious about writing assignments by providing them with real-time support, which motivates

them to participate more actively in the writing process. AI can also help with concept generation and argument structure, which makes it a useful tool for learners of all skill levels.

The benefits of integrating AI technologies into education are manifold: first, it enhanced learning outcomes as it facilitates personalized learning experiences that cater to diverse learning styles and needs, resulting in improved academic performance (Luckin et al., 2016). Secondly, it increases engagement hence interactive AI tools make learning more engaging and enjoyable, promoting active participation among students (Johnson et al., 2019). Thirdly, AI writing assistants provide instant feedback, allowing students to learn from their mistakes in real-time and improve their writing skills more effectively (Baker & Inventado, 2014), fourthly, AI makes education more accessible to students with disabilities by providing tailored resources and support, enhancing their learning experiences (Almalki, 2021).

Notwithstanding the benefits, there are concerns about the growing use of AI technologies in education as students often lack the necessary digital skills to leverage these tools effectively (Akinola et al., 2021). By digital skills, we mean the various competencies, including information literacy, technical proficiency, collaboration, and critical thinking which are the critical resources for the optimization of AI. According to Hague and Payton (2010), these skills are essential for students to navigate modern educational landscapes effectively. The ability to find, evaluate, and use information critically is fundamental in enhancing learning outcomes. The digital skills needs of Nigerian university students are crucial for enhancing their learning experiences and academic success. Extant literature has it that in the University of Nigeria, many students lack the necessary digital skills to effectively use AI writing tools, which can enhance their academic performance. This assertion is not in tandem with everyday life style of Nigerian youths most of whom are in the university and can actually pass for active internet users. Thus, saying that they lack the necessary digital skills for effective usage of AI writing tools, propels this study that seeks answers to the below listed research questions that are drafted to guide the study.

i. What are the key AI writing Assistance tools the Nigerian students can leverage on for enhanced learning?
ii. What digital skills do students at the University of Nigeria possess?
iii. What specific skills are necessary for effective use of AI writing assistance apps?
iv. What barriers do students face in developing these skills?

## Objectives of the Study

In relation with the questions, the study's specific objectives are to:

a. highlight the key AI writing Assistance tools the Nigerian students can leverage on for enhanced learning;
b. assess the current digital learning skills of students at the University of Nigeria;
c. identify the digital skills needed to utilize AI writing assistance effectively; and
d. explore challenges faced by students in acquiring these skills;

## Review of Relevant Literature

### Concept of Digital Learning Skills

Digital learning skills are increasingly vital for university students in navigating academic challenges and leveraging technology to enhance learning outcomes. With the advent of AI writing assistance applications, understanding the digital skills needs of Nigerian university students is critical for effective integration into their academic practices. Digital literacy encompasses a range of skills required to effectively utilize digital tools, particularly in an academic setting. According to Ng (2012), digital literacy includes the ability to find, evaluate, and communicate information in various formats using digital technologies. This skill set is essential for students in Nigeria, where access to educational resources often relies on digital platforms.

Digital learning skills are a broad category of abilities needed to use technology for learning in an efficient manner. The growing integration of digital tools and resources in educational settings necessitates that instructors and students alike grasp the concept of digital learning abilities. Digital learning skills refer to the ability to use digital technologies to access, evaluate, create, and communicate information. According to Jisc (2015), these skills can be categorized into three main areas: technical skills, which involve using digital devices and applications; information skills, which pertain to locating and evaluating information; and communication skills, which include collaborating and sharing information online.

Digital learning skills are essential for academic success and personal development in the digital age. Ng (2012) emphasizes that possessing these skills enables learners to adapt to rapidly changing technological landscapes, fostering lifelong learning. In a similar vein, Hague and Payton (2010) assert that digital skills are not just about technical proficiency; they also involve critical thinking and problem-solving abilities that enhance learning experiences. The components of Digital Learning Skills include:

**Technical Proficiency**: This encompasses basic computer skills, familiarity with software applications, and the ability to troubleshoot technical issues. According to Beetham and Sharpe (2013), foundational technical skills are crucial for engaging with more complex digital tools.

**Information Literacy**: Information literacy is the ability to locate, evaluate, and use information effectively. According to Mackey and Jacobson (2011), digital learners must develop critical thinking skills to discern credible sources in an information-rich environment.

**Communication and Collaboration**: Digital learning skills also include the ability to communicate effectively using digital platforms. Anderson and McCormick (2018) highlight the importance of collaboration tools, such as discussion forums and collaborative documents, in enhancing student interaction and engagement.

**Digital Citizenship**: Understanding ethical and responsible use of technology is a vital component. Ribble (2015) outlines the nine elements of digital citizenship, including digital etiquette and online safety, which are essential for responsible participation in digital environments.

Despite the importance of digital learning skills, many learners face challenges in acquiring these competencies. A study by Zheng et al. (2016) found that a lack of access to technology and inadequate training opportunities hinder students' ability to develop necessary skills. Additionally, the rapid pace of technological advancement can overwhelm learners, leading to a skills gap (Hague & Payton, 2010). Digital learning skills are essential for navigating the modern educational landscape, encompassing technical proficiency, information literacy, communication, and digital citizenship. While challenges exist in developing these skills, targeted strategies in curriculum design, educator training, and collaborative learning can significantly enhance students' digital competencies.

**AI Writing Assistance Tools for enhanced learning**

Artificial intelligence (AI) writing support systems are becoming common in both professional and educational settings, helping users write better and more efficiently. These tools use artificial intelligence to offer comments on writing overall effectiveness, as well as on grammar, style, and coherence. It is vital to comprehend the abilities, advantages, and constraints of these instruments to ensure their seamless incorporation into composition procedures (Zawacki-Ricter, 2019).

AI writing assistance apps evaluates content and offer ideas for improvement with Natural language processing (NLP) techniques. These tools can help with a variety of writing tasks, including as content creation, stylistic improvement, and grammar correction (Sari et al., 2020). Well-known examples are Grammarly, ProWritingAid, and Microsoft Editor, each of which has special functionality catered to various writing requirements. In terms of benefits of AI writing tools, researches have shown that AI writing tools significantly improve the quality of writing by identifying errors that writers might overlook. For instance, a study by Mullen et al. (2020) indicated that students using AI tools demonstrated marked improvements in their writing scores compared to those who did not. Following the enhanced writing quality is immediate feedback. Indeed, **o**ne of the primary advantages of AI writing tools is their ability to provide instant feedback. As noted by Cheng et al. (2021), this immediacy allows writers to make corrections in real time, fostering a more iterative writing process and promoting better learning outcomes. Accessibility and Support is another core feature of AI writing assistance tool. AI writing tools democratize access to writing assistance, particularly for non-native speakers and individuals with learning disabilities. According to Ghasemi et al. (2021), these tools can level the playing field by offering support that may not be readily available in traditional educational settings. AI writing assistance tools also make for productivity enhancement. It is believed that by automating routine editing tasks, AI writing tools enable writers to focus on content creation rather than mechanics.

Integrating AI writing assistance tools into educational settings can enhance the learning experience for students. Educators can leverage these tools to foster a more engaging and supportive writing environment. However, it is essential to balance their use with traditional writing instruction to ensure that students develop comprehensive writing skills (Kirkland & Sweeney, 2020).

## Challenges in Digital Skill Acquisition

Digital literacy is crucial for students in the 21st century, as it encompasses the skills needed to effectively navigate, evaluate, and create information using digital technologies. In Nigerian universities, however, the development of digital literacy is often hindered by various barriers. This section explores these barriers, focusing on resource limitations, training gaps, and other challenges faced by students and faculty in Nigerian higher education institutions.

Barriers to Digital Literacy in Nigerian Universities in terms of resource limitations include inadequate infrastructure and technology access as well as funding constraints. According to Owolabi & Ogunkola (2020), a significant barrier to digital literacy in Nigerian universities is the lack of adequate infrastructure, such as computers, reliable internet access, and up-to-date software. Owolabi and Ogunkola (2020) conducted a study across several universities in southwestern Nigeria and found that only 35% of students had regular access to computers, while internet connectivity was described as unreliable and slow. This lack of resources limits students' ability to engage in digital learning and practice essential digital skills. Adetimirin (2019) highlighted the issue of insufficient funding as a major obstacle to improving digital literacy. The study showed that limited financial resources prevent universities from acquiring necessary technological tools and implementing comprehensive digital literacy programs. The author argued that without increased funding, universities would continue to struggle to provide students with the digital resources needed for effective learning.

There is also training gaps which Anunobi & Ogbo, (2019) called Lack of Digital Skills Training for Students (Anunobi & Ogbo, 2019). Anunobi and Ogbo (2019), in their study found that many Nigerian universities do not offer structured digital literacy training programs for students. This lack of training means that students often enter higher education without the digital skills needed to succeed academically. The researchers recommended integrating digital literacy courses into the university curriculum to ensure that all students receive adequate training. Osuji (2020) explored the barriers to digital literacy among faculty members in Nigerian universities and revealed that many lecturers lack the necessary digital skills to effectively use technology in teaching. This gap is due to inadequate professional development opportunities and a lack of incentives for faculty to improve their digital competencies. As a result, faculty members are often unable to provide effective digital literacy instruction to their students.

There are also the cultural and attitudinal barriers to Digital Skill Acquisition. In this regard, Ibrahim et al., (2021) identified Resistance to Change. In their study, they found that resistance to change among both students and faculty members is a significant barrier to digital literacy. The researchers noted that some faculty members prefer traditional teaching methods and are reluctant to adopt digital tools. Additionally, students often view digital literacy as an optional skill rather than a necessity, which affects their motivation to engage in digital learning. In the same vein, Agbo (2019) discussed the impact of the digital divide on digital literacy in Nigerian universities, noting that students from lower socioeconomic backgrounds are less likely to have prior exposure to digital tools. This lack of exposure creates a gap in digital skills between students from different socioeconomic backgrounds, which can affect academic performance and future career opportunities.

In terms of Policy and Administrative Challenges, Oye et al., (2020), identified Lack of Strategic Planning. Oye et al. (2020) identified the absence of clear policies and strategic planning as a barrier to digital literacy development in Nigerian universities. Many institutions

lack comprehensive digital literacy policies that outline the objectives, resources, and evaluation methods needed to enhance digital skills. This lack of direction makes it difficult for universities to implement effective digital literacy programs. Nwosu and Chukwudi (2018) pointed out that bureaucratic inefficiencies within university administrations often delay the implementation of digital literacy initiatives. Challenges such as lengthy approval processes for funding and procurement of digital tools hinder timely access to resources and training.

The reviewed literature reveals multiple barriers to digital literacy in Nigerian universities, including resource limitations, training gaps, and cultural resistance. Resource constraints, such as inadequate technology infrastructure and insufficient funding, significantly hinder students' and faculty's ability to engage in digital learning. Additionally, the lack of structured training programs for both students and faculty exacerbates the problem, leaving many without the skills necessary to utilize digital tools effectively. Cultural and attitudinal barriers also play a role, as resistance to change and a lack of perceived importance of digital literacy impede progress. Addressing these issues requires a multi-faceted approach, including increased funding, comprehensive training programs, and strategic policy implementation.

**Theoretical framework of analysis - Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM) is a good theory for a study on the requirements of Nigerian university students in terms of digital learning capabilities and the optimization of AI writing aid apps for improved learning. Examining how students view and utilize technology in learning environments is made easier with the help of this idea. The Technology Acceptance Model (TAM) is a theoretical framework that describes how people come to accept and use technology. It was created by Davis in 1989. The model centers on two main elements:

1. **Perceived Usefulness (PU):** The degree to which a person believes that using a particular technology will enhance their performance.
2. **Perceived Ease of Use (PEOU):** The degree to which a person believes that using the technology will be free of effort.

**Application of Technology Acceptance Model (TAM) to the Study**

1. **Understanding Digital Learning Skills Needs:**

✓ TAM can be used to assess the students' perceptions of the usefulness and ease of use of digital learning tools, including AI writing assistance apps.

✓ It helps identify the digital skills gaps among students and how these gaps affect their willingness and ability to engage with digital learning tools effectively.

2. **Optimization of AI Writing Assistance Apps:**

➢ By applying TAM, the study can explore the factors that influence students' acceptance and effective use of AI writing assistance apps.

➢ The model can guide the optimization process by highlighting aspects of the apps that need improvement to enhance perceived usefulness and ease of use, such as interface design, functionality, and alignment with academic needs.

3. **Enhanced Learning Outcomes:**

❖ TAM provides insights into how digital learning tools and AI writing apps can be better integrated into the learning process to improve academic performance.

- ❖ The study can use the model to propose strategies that enhance student engagement and learning outcomes through the effective use of digital tools.

**Complementary Theories to Technology Acceptance Model (TAM)**
To enrich the study, TAM can be combined with other theories such as:

- **Self-Regulated Learning Theory:** To examine how digital learning skills and AI tools contribute to students' ability to manage their learning processes.
- **Diffusion of Innovations Theory:** To understand how digital tools and AI applications spread among students and are adopted within educational institutions.

With TAM, the study systematically investigated the factors that influence the acceptance and use of digital learning tools and propose strategies for optimizing AI writing assistance apps to meet the educational needs of Nigerian university students.

## Methodology

This study utilized the survey research design to elicit data from a targeted population through online survey powered by Google form. The students of the faculty of the social sciences, of the University of Nigeria, Nsukka constituted the population of the study. Out of about 4896 of them 257 of them were randomly sampled. This number was generated electronically as number of response gotten from the online survey. Data were presented in tables that display its percentile representations for easy comprehensibility and consequently analyzed with STATA.

## Data Presentation

Data for the study are presented hereunder:

**Research question One:** What are the key AI writing Assistance tools the Nigerian students can leverage on for enhanced learning?

Below are the top AI tools that have significantly enhanced students' productivity and overall learning experience.

1. **Open AI Playground: A Powerhouse for Content Creation:** Open AI Playground is a dynamic platform that uses artificial intelligence (AI) to help in content development. Whether you need help with a research paper for your history class, a computer science assignment requiring code, or a creative writing assignment for your literature course, it's like having a personal assistant that can create content from beginning. The tool's adaptability to several information kinds accounts for its versatility, which makes it a great resource for students studying a wide range of subjects. However, Open AI Playground has advantages that go beyond content production. Writer's block, that annoying state in which you're gazing at a blank computer and unable to put your thoughts into words, is one of the most frequent problems that students encounter. In these kinds of situations, Open AI Playground comes to the rescue. It can assist you in organizing and structuring your ideas and provide you a place to start when writing. You can overcome writer's block and jumpstart your writing process by making initial drafts, offering suggestions, and sketching the structure. In essence, Open AI Playground is more than just a tool; it's a companion for students in their academic journey.

It not only simplifies the content creation process but also empowers students to express their ideas more effectively and efficiently.

2. **Chat GPT-3/GPT-4: Your Personal AI Tutor:** Artificial intelligence chatbots, such as GPT-3 and GPT-4, are particularly complex and have the potential to completely transform the way students study and work.. OpenAI's Chat GPT-3 and GPT-4 are two of the most sophisticated chatbots on the market right now. They are extremely flexible learning tools since they are made to comprehend and react to different instructions. These chatbots potentially revolutionize the way that research papers are written. They can produce original material, offer perspectives on a range of subjects, and even assist with the organization of your work. However, Chat GPT-3 and GPT-4 can do more than just write. They can also respond to intricate queries on a wide range of subjects. These chatbots can offer thorough and educational answers, whether you are wanting to learn more about a new subject out of curiosity or trying to grasp a challenging concept for your assignment. They are even able to converse back and forth, making the learning process more dynamic. These chatbots provide an additional degree of support for students who are interested in coding. They are an invaluable resource for both novice and expert programmers since they can assist with writing code in several different programming languages. Chat GPT-3 and GPT-4 can help you if you're trying to learn a new programming language or debug a piece of code.

3. **QuillBot: Your Personal Writing Assistant:** Originality and clarity are crucial in the field of academic writing. However, it can occasionally be difficult to find the perfect words. Quillbot steps in at this point. Quillbot is a tool for paraphrasing that helps students create interesting and original content. It's like to having a personal writing assistant. Quillbot's capacity for contextual text understanding is one of its best qualities. Quillbot use cutting-edge AI to understand the text, in contrast to basic thesaurus tools that merely change words. Because of this, it can produce paraphrases that preserve the original meaning while utilizing new terms. Students who wish to avoid plagiarism or convey an idea in a novel and original way will find this function to be of great use. However, Quillbot's powers go beyond simple utterances. Additionally, it can paraphrase whole paragraphs. When you're attempting to rework a portion of your essay or report to make it more interesting or to eliminate redundancy, this can be a huge help. Simply copy and paste your paragraph into Quillbot, and it will swiftly produce a new version with alternative wording and structure while preserving the original idea. Apart from its ability to paraphrase, Quillbot provides additional functionalities that can improve your writing. For example, it can assist you with vocabulary growth, grammar correction, and tone adjustments, allowing you to write in a more formal or informal style depending on the situation.
4. **Grammarly: A Lifesaver for Student Writers:** Imagine having a personal writing assistant that improves your work and checks it for plagiarism in addition to correcting your language. For students, Grammarly provides precisely that. In the enormous ocean of academic writing, it's like a lifesaver. Regardless of the tone or style they're going for, Grammarly is meant to assist students in producing writing that is free of errors. Grammarly can help you with both informal email writing and academic research paper writing. It carefully examines your writing for any grammatical faults, punctuation errors, or awkward wording and offers immediate ideas for corrections. That is not all, though. Additionally, Grammarly has an integrated plagiarism checker. To make sure your original work is free of inadvertent

plagiarism, it compares it to billions of published works and online sites. This feature is particularly useful when writing academic papers or reports with crucial citations. Additionally, Grammarly's text enhancement tool aids pupils in improving their writing. It makes your writing easier to read, offers synonyms for overused terms, and even sheds light on the tone and style of your work. This manner, you can make sure that your writing is impactful and interesting in addition to being error-free. Essentially, Grammarly is a tool for more than just correcting grammar. It is an all-inclusive writing tool that helps pupils communicate their thoughts succinctly and successfully. Thus, Grammarly can assist you in improving your writing abilities regardless of your level of experience.

5. **Otter.ai: Your Personal Lecture Transcriber:** Otter.ai is a cutting-edge tool that may act as your personal scribe by transcribing voice notes and lectures. It records spoken words and turns them into written text so that you don't miss any crucial information from your study sessions or lectures. This means that instead of dividing your concentration between listening and taking notes, you may give your whole attention to taking in the material, participating in conversations, and developing your comprehension. Otter.ai offers advantages than transcribing alone. It's a flexible tool that works well with many different programs, which increases its usefulness for educational objectives. Otter.ai can record and transcribe everything, whether you use Teams for online classes, Zoom for group study sessions, or Google Meet for project group conversations. It's similar to having a personal assistant that assiduously takes notes during every academic session. Otter.ai is essentially more than simply a transcribing tool. It's completely changing the way that students attend lectures and study in the academic world. It frees students from the strain of taking notes, allowing them to concentrate on what really counts: understanding and learning. Otter.ai is a resource that you ought to think about if you're a student trying to improve your academic performance.
6. **Google Bard:** Google Bard is a sophisticated chatbot powered by artificial intelligence (AI) that can comprehend and reply to challenging questions. Google Bard can offer precise and comprehensive responses for queries pertaining to historical events or difficult scientific concepts. This function is very helpful for students who require prompt responses when studying or completing homework. Still, that's not all. Planning your day is another area where Google Bard shines. If you have trouble scheduling your time between homework, classes, and extracurricular events, Google Bard can help. Google Bard can help you stay on top of your tasks by identifying your priorities and schedule and suggesting an effective daily plan. Furthermore, Google Bard is an effective tool for finding information. Finding accurate and relevant information can be like trying to find a needle in a haystack in this day of information overload. Google Bard makes this procedure easier. It can save you a great deal of time and work by sorting through enormous volumes of data to get the information you need. Google Bard is essentially a holistic tool that improves productivity, encourages efficient time management, and facilitates learning—it's more than just an AI chatbot. For students trying to manage their personal lives and academic obligations, Google Bard can be a game-changer.
7. **Slidesgo: Revolutionizing Student Presentations with AI:** An AI-powered tool called Slidesgo is revolutionizing the way students make presentations. With its extensive collection of Google Slides and PowerPoint templates, it offers pupils an abundance of creative alternatives. Students can concentrate more on the topic of their presentations and save time by doing this. The tool's goal is to improve the visual appeal and decrease monotony of

presentations. With the range of layouts, color schemes, and design options available, students can tailor their presentations to their preferences. This diversity guarantees that every presentation is distinct and captivating, drawing in the audience and facilitating a more palatable assimilation of the material. To further streamline the design process, Slidesgo's AI capabilities can recommend templates depending on the content of the presentation. Students who wish to make visually attractive presentations but may not have a background in design will find this option especially helpful. In conclusion, Slidesgo is an excellent tool for students that make it quicker and easier to create interesting, eye-catching presentations.

8. **Fotor: Your Digital Canvas for Artistic Exploration:** Creativity reigns supreme in the fields of art and design. However, obstacles can occasionally arise for even the most inventive minds. Fotor steps in at this point. For students studying design or art, Fotor is an inventive artificial intelligence application that creates artwork in response to text questions. Imagine having a technology that allowed you to create art with your words. That is exactly what you get when you use Fotor. Just provide a text prompt, and Fotor will evaluate it using its sophisticated AI algorithms to create a one-of-a-kind artwork. Anything from a straightforward sketch to an intricate computer painting may be this. Your creativity is the only thing limiting the options. However, Fotor is more than just an artistic tool. It serves as a forum for research and education as well. You can use Fotor as a student studying art or design to investigate novel concepts, styles, and methods. You can test out various prompts to observe how the AI processes them. This might open your eyes to new ideas and motivate you to think creatively when producing your own work. Furthermore, Fotor can be a useful resource for comprehending the nexus between technology and art. With AI becoming more prevalent in many industries, including design and art, having first-hand experience with a tool like Fotor can help you stand out from the competition. In summary, Fotor is a collaborator on your artistic endeavor, not merely an AI tool. It's a platform for learning, creating, and exploring. Fotor can help you stretch the limits of your creativity and elevate your art, whether you're working on a class project, developing your portfolio, or trying out new ideas.
9. **Mendeley:** Mendeley is a reference management software and academic social network that helps researchers and students organize their research, collaborate with others, and discover the latest findings in their field. It offers features such as Reference Management. Mendeley allows users to import, organize, and manage references and PDFs in a personal library. Users can create folders to categorize their references based on projects or topics; Citation Generation: The software can generate citations and bibliographies in various citation styles (such as APA, MLA, Chicago, etc.) with just a few clicks, streamlining the process of writing academic papers. Collaboration: Mendeley enables users to collaborate with others by sharing references and notes, creating groups for specific research projects, and engaging in discussions; Research Discovery: Users can discover new research articles, follow authors, and find relevant literature in their field through Mendeley’s recommendation engine and research catalog; Cross-Platform Accessibility: Mendeley is available as a desktop application, web-based tool, and mobile app, allowing users to access their library and notes from various devices; and integration: Mendeley integrates with word processors like Microsoft Word and LibreOffice, making it easier to insert citations and manage references directly within documents.

10. **Smart Noter AI:** Smart Noter AI is an artificial intelligence tool designed to assist with note-taking and content summarization. It leverages natural language processing (NLP) to understand the context of spoken or written information, allowing it to generate concise and accurate summaries or notes from lectures, meetings, or documents. Smart Noter AI can automatically capture key points, main ideas, and important details, making it especially useful for students, professionals, or anyone looking to streamline their note-taking process. Some features might include: Real-time Transcription: It can transcribe spoken words into text as you speak or during live lectures; Summarization: It condenses long texts, articles, or meetings into easy-to-understand summaries, focusing on key information; Organization: It helps organize notes by creating categories or tags based on content, making it easier to retrieve information later; Integration with Other Tools: Smart Noter AI might integrate with platforms like Google Docs, Microsoft OneNote, or Evernote, allowing for smooth workflows across multiple devices and systems; and Speech-to-Text and Voice Commands: It can also use voice commands to take notes or initiate actions, making it hands-free in some cases. In essence, Smart Noter AI is built to save time, improve efficiency, and ensure that important details aren't missed in any situation where taking notes is necessary.
11. **Writer**. Best AI writing tool for editing and improving your content. Writer is a whole lot more than a simple AI text generator. Like Jasper and Copy.ai, the web tool is packed with more powerful features that take the tool beyond what ChatGPT can do but instead of workflows and systems, they're called 'Apps.

**The digital learning skills of students of the University of Nigeria, Nsukka,**

Students at the University of Nigeria, Nsukka (UNN) typically possess a range of digital skills that reflect their educational environment and exposure to technology

| S/N | Items | Strongly Agree | Agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1 | Basic Computer Literacy with proficiency in using word processing tools (Microsoft Word, Google Docs); spreadsheets (Microsoft Excel, Google Sheets); and the ability to create presentations (Microsoft PowerPoint, Google Slides). | 27 (10.50) | 34 (13.22) | 100 (38.91) | 95 (37.35) |
| 2 | Internet and Research Skills for effective use of search engines and online databases for academic research as well as use of online communication tools (email, forums, and social media). | 89 (34.63) | 96 (37.35) | 48 (18.67) | 24 (9.33) |
| 3 | Online Collaboration Tools for the use of platforms like Google Workspace, Microsoft Teams, and Zoom for virtual learning and collaboration. | 57 (22.17) | 23 (8.94) | 81 (31.51) | 96 (37.35) |
| 4 | Learning Management Systems (LMS) with the ability to navigate and use university-provided LMS platforms like Moodle for coursework and assignments | 56 (21.78) | 56 (21.78) | 81 (31.51) | 64 (24.90) |
| 5 | Knowledge of academic referencing tools (Zotero, Mendeley). | 37 (14.40) | 48 (18.67) | 101 (39.30) | 71 (27.62) |

***Source:*** *field study (2024).*

**The skills necessary for effective use of AI writing assistance apps**

To effectively use AI writing assistance apps, University of Nigeria students need the following skills:

1. **Research and Information Synthesis**: Ability to source, evaluates, and integrates information accurately into their work. This is the heart of AI writing Assistance tools optimization, as one cannot use what one does not have knowledge of it
2. **Being critical:** the knowledge that the information generated by AI are not usually genuine and correct, even though it seems so. Therefore, the ability to cross-check and cross-examine the points, facts, references generated by AI
3. **Generality**- AI is general purpose. This means that whatever information AI gives you, it gives 10 million other persons that inquire the same. Therefore the ability to use AI generated data/information on a face value or a guide leading to a proper and personalized version of the ideas generated by AI is the way to go
4. **You first, AI second**- people generally and students in particular do not realize that AI follows the computer characteristic of "garbage in, garbage out". Hence, the AI gives you whatever you gave in. therefore; the ability to take charge of your writing is the key to effective use of AI. For instance, whatever research you are carrying out, you should first identify and itemize the ideas you want to develop. Then, you ask AI to give you details on each idea and AI will respond. But when you ask AI to solve this puzzle or generated a complete work on topic, sure it will but what it gives you, it will give any other person seeking the same assistance. However, if you take the lead by doing some basic research and identifying central and core points or ideas to develop, it will certainly keep your research apart from others ad make you unique even though it was AI generated.
5. **Specificity** – while using AI for your work, be specific to the exact term, focus and point. In this manner, AI will give you ideas that suit your research work. however, if you open up, AI will
6. **Referencing aright**- Citations are critical part of writing. This helps you to avoid plagiarism. Therefore, when using AI, be clear to ask it to identify the in-text citations necessary and generated references list afterward. Besides, this specific on references, do well to check the references because AI sometimes generated information that are false including references. AI has once generated for me a reference of me on a subject or topic I haven't written on. AI has once given me an area in Kogi state as a part of Abia state.
7. **AI internalizes your language**- Therefore, having asked AI the initial question that introduced your research concern, and your subsequent questions should be a follow up because AI akready has internalized your research topic.
8. **Understanding of AI Capabilities**: Awareness of what AI tools can and cannot do, including their limitations. While this is basic, it goes beyond to the point of getting AI to give your exactly what you need because it obeys your prompts. Therefore effective optimization of AI writing tools for enhanced learning is dependent on the digital learning skills on the understanding of AI capabilities.
9. **Editing and Proofreading Skills**: Skills to refine AI-generated content for coherence, context, and originality. After all said and done this is the key because AI writing Apps has lineal thinking processes that are bound to come about mistakes. In fact, it is usually writing that AI makes mistakes hence you should carefully check for mistakes.
10. **Ethical Use of AI**: Knowledge of academic integrity and plagiarism to use AI responsibly

**Barriers students face in developing digital learning skills for the usage of AI writing assistance tools**

Students at the University of Nigeria, Nsukka face several barriers in developing digital skills:

1. **Inadequate Infrastructure**: Limited access to reliable internet, insufficient digital devices, and poorly equipped computer labs hinder students' ability to practice and develop digital skills effectively.
2. **High Cost of Technology**: Many students struggle to afford necessary digital tools, such as laptops and software, which limits their ability to engage fully in digital learning and skill development.
3. **Lack of Digital Literacy Programs**: There is a shortage of structured digital literacy training and support services for students, affecting their skill acquisition.

These challenges impact the overall digital competence of students, affecting their employability and academic performance.

**Data Analysis**

Using the STATA for the analysis, the mean rating of the respondents were ascertained alongside their standard deviation. Based on the ratings, decision were reached based on the decision - Accept hypothetical statement on 2.5 minimum mean rating and reject when below 2.5

**Table 1. Mean, Standard Deviation (SD) and Decision for Digital Learning Skills Needs of Nigerian University Students for Utilizing AI Writing Assistant Apps**

| Questionnaire Items | Mean | SD | Decision |
|---|---|---|---|
| Knowledge of AI Writing Assistance Apps | 2.21 | 0.32 | Rejected |
| Ease of use of AI Writing Assistance Apps | 2.05 | 0.52 | Rejected |
| Basic skills required for use of AI Writing Assistance Apps | 2.41 | 0.28 | Rejected |
| High challenges in the usage of AI Writing Assistance Apps | 3.14 | 0.72 | Accepted |
| High general Perception of AI Writing Apps | 2.17 | 0.53 | Rejected |
| **Cluster mean** | **2.39** | **0.47** | **Rejected** |

The result on the table above showed that Digital Learning Skills Needs of Nigerian University Students for Utilizing AI Writing Assistant Apps is very high as the respondents accepted one out of all the items. This was because the mean of all the items but one were below the minimum mean for acceptance which is 2.50. Specifically, the respondents with means of 2.21, 2.05, 2.14 and 2.17 rejected that wide knowledge of AI Writing Assistance Apps; ease of use of AI Writing Assistance Apps; familiar with AI Writing Assistance Apps; and high general perception of AI Writing Assistance Apps. It only accepted high challenges of the usage of AI Writing Assistance Apps among the students.

**Finding and Discussion**

There is very low knowledge of the use of AI Writing Assistant Apps among the University of Nigerian students. In today's digital age, the integration of Artificial Intelligence (AI) in educational tools has revolutionized how students approach learning and academic tasks. Among these innovations, AI writing assistant apps has become increasingly significant, offering students support in generating content, refining their grammar, and enhancing the overall quality

of their writing. However, understanding the extent to which students in Nigerian universities, particularly at the University of Nigeria, Nsukka (UNN), are equipped to utilize these tools effectively is crucial hence the study

In terms of the knowledge of AI Writing Assistance Apps, the survey reveals a diverse range of knowledge levels among UNN students about AI writing assistant apps. Approximately 48% of the respondents rated their knowledge as "Good," while 28% considered their knowledge "Excellent," and 24% rated it as "Fair." These figures indicate that while a significant portion of students feel confident in their understanding of these tools, there remains a considerable number who are only moderately familiar with them. This suggests a need for increased educational efforts to deepen students' understanding of AI writing assistants. The gap in knowledge could be bridged through workshops, seminars, and digital literacy programs aimed at enhancing students' proficiency with these tools, ensuring they are better equipped to use them effectively in their academic endeavors.

In terms of the ease of use of AI Writing Assistant Apps among the University of Nigerian students, the ease of use of AI writing assistant apps is another critical factor in determining their effectiveness in educational settings. According to the survey, 60% of the respondents found these apps "Easy" to use, while 40% described them as "Very Easy." This high percentage of students who find these tools user-friendly suggests that AI writing apps are generally accessible and intuitive, even for those with only basic digital skills. The user interfaces of these applications are likely designed to be straightforward, making them appealing to students who may not have extensive experience with advanced software. However, while ease of use is essential, it is also important to ensure that students are not only comfortable with basic functionalities but are also aware of and capable of utilizing more advanced features that could significantly enhance their academic output.

In terms of the basic skills requirement for the use of AI Writing Assistant Apps among the University of Nigerian students, the findings were dumbfounding. when asked about the basic skills necessary to effectively use AI writing assistant apps, a majority of 64% of students indicated that no specific skills were required, emphasizing the accessibility of these tools. However, a smaller segment, about 4%, noted the importance of basic computer literacy and language skills, particularly in crafting effective prompts. This minority view underscores the need for a foundational level of digital literacy that can empower students to interact more effectively with AI tools. Being able to formulate clear and precise prompts is essential for obtaining the most accurate and useful outputs from these apps. Thus, while the tools may be easy to use on a surface level, developing these underlying skills can enable students to fully exploit the potential of AI writing assistants.

Despite the general ease of use, students face several challenges in deploying AI writing assistant apps effectively. The most significant barrier, cited by 36% of the respondents, is the cost associated with accessing premium features of these apps. Many AI tools offer free versions with limited functionality, reserving their most powerful features for paid subscriptions. This financial barrier is particularly challenging for students who may not have the resources to invest in these premium versions. Other challenges identified include occasional inaccuracies in the information provided by the AI and a lack of comprehensive content. These issues highlight the limitations of free versions and the need for more reliable and extensive data within the apps,

which could be addressed through institutional support or more affordable access to premium features.

Overall, students have a positive perception of AI writing assistant apps, with 64% reflecting favorable opinions. They appreciate the convenience and support these tools provide in their academic tasks, recognizing them as valuable aids in improving the quality of their work and making learning more manageable. This positive sentiment indicates that students are open to and interested in integrating AI into their learning processes, provided that the tools are accessible and effective in meeting their academic needs.

However, to maximize the benefits of AI writing assistant apps, students have articulated specific needs that must be addressed. A recurring theme in the survey responses is the need for access to the paid versions of these apps, as this would enable students to utilize the full range of features available. Additionally, students highlighted the need for better internet access, more accurate and reliable information from the apps, and improved service systems. These needs suggest that while students are willing to embrace AI tools, they require institutional support in terms of resources, infrastructure, and training to do so effectively.

**Recommendations**

Based on the findings of this study on the digital learning skills needs of Nigerian university students and the optimization of AI writing assistance apps at the University of Nigeria, Nsukka, the following recommendations are proposed:

1. **Integration of Digital Literacy Programs**: The university should implement comprehensive digital literacy programs as part of the curriculum. These programs should cover not only basic computer skills but also advanced competencies such as research, data analysis, and the effective use of AI tools. This would help bridge the gap between existing skills and the requirements for utilizing digital and AI resources effectively. In fact, the university should make digital literacy and AI competency courses mandatory for all first-year students, covering essential digital skills, data analysis, and ethical use of technology. This foundational course would ensure that every student, regardless of their major, has a baseline understanding of digital and AI tools. This process should be discipline-specific where embed digital skills training within specific courses across various departments will become a norm For example, science departments could include modules on using AI for data analysis, while humanities departments could focus on AI tools for text analysis and critical writing. This contextual approach would make digital learning more relevant and practical. Then the university should establish a curriculum committee to regularly review and update digital skills courses, ensuring that they remain relevant with the rapidly evolving technology landscape. This would include incorporating feedback from students and faculty to address emerging needs and challenges.
2. **Improvement of Technological Infrastructure**: To facilitate the effective use of AI tools, the university should invest in upgrading its technological infrastructure, including providing high-speed internet, modern computer labs, and access to digital devices. This will ensure that all students have equal opportunities to enhance their digital learning skills. This Tech-infrastructure improvement should actually herald the Provision of Resources and Support for Students to Access and Learn about AI Technologies under these three categories:

- Digital Resource Centers and Labs: Set up dedicated digital resource centers equipped with the latest software and hardware to allow students to practice and explore AI tools. These centers would be staffed with trained personnel who can provide guidance and support.
- Subsidized or Free Access to AI Tools: Collaborate with software providers to offer students free or subsidized access to premium AI tools. For example, the university could negotiate licenses for Grammarly, Mendeley, or Turnitin, ensuring all students can benefit from these resources without financial burden.
- Online Learning Platforms and E-Libraries: Expand the university's digital library to include e-books, online courses, and tutorials on AI and digital literacy. This would provide students with a self-paced learning environment to explore AI technologies beyond the classroom setting.

3. **Training on AI Tools Usage**: Conduct workshops and training sessions specifically focused on the use of AI writing assistance apps such as Grammarly, ChatGPT, and Mendeley. These sessions should emphasize not only the technical aspects but also ethical considerations, such as avoiding plagiarism and ensuring academic integrity. Again, the university should organize workshops and tutorials tailored to different academic disciplines. These sessions would focus on using specific AI tools, such as Grammarly for grammar and style improvement, ChatGPT for drafting and brainstorming, and Mendeley for research management. This approach ensures that students not only learn the technical use of these tools but also how to apply them effectively within their fields of study. They should also Implement training programs that include real-world scenarios where students can practice using AI tools in their academic work. For example, students could participate in exercises where they use AI tools to draft essays, analyze research papers, or create bibliographies, followed by feedback sessions to refine their skills.
4. **Certification Programs** in **Partnerships with Tech Companies**: : Introduce certification programs for students who complete advanced training in AI tools. This not only motivates students to learn but also provides them with credentials that could be beneficial for future employment opportunities and establish collaborations with technology firms to provide students with free or subsidized access to premium versions of AI tools. This would enable more students to benefit from advanced features that can significantly improve their academic work.
5. **Continuous Assessment and Feedback Mechanism**: Develop a system for continuously assessing students' digital skills needs and providing feedback. This can include regular surveys, focus groups, and forums where students can express their challenges and suggest improvements.

## Conclusion

The study on the digital learning skills needs of Nigerian university students, with a focus on optimizing AI writing assistance apps at the University of Nigeria, Nsukka, highlights several key insights. First, while students possess foundational digital skills, there is a significant gap in advanced competencies, particularly in effectively utilizing AI tools for academic purposes. Barriers such as inadequate infrastructure, high costs of technology, and lack of targeted digital literacy programs impede their ability to fully leverage these tools.

The integration of AI writing assistance apps like Grammarly, ChatGPT, and Mendeley can significantly enhance students' learning experiences by improving writing proficiency, research efficiency, and overall academic performance. To optimize the use of these tools, it is crucial to implement comprehensive digital literacy programs that are tailored to the specific needs of the students, addressing both technical skills and ethical considerations in using AI.

This research underscores the importance of a supportive digital environment and targeted skill development initiatives to bridge the existing gaps. By fostering a culture of digital competence and responsible AI usage, universities can empower students to achieve academic excellence and prepare them for the evolving demands of the global workforce.

In conclusion, while Nigerian university students, particularly at UNN, demonstrate a commendable level of familiarity with AI writing assistant apps and generally find them easy to use, there remains a significant need for enhanced digital literacy and access to premium app features. The primary challenges of cost and limited content must be addressed to ensure that all students can fully leverage these tools in their academic work. By providing the necessary resources and training, educational institutions can empower students to utilize AI writing assistants more effectively, ultimately enhancing their learning experiences and academic outcomes.

## References

AECC Nigeria (30 July 2024). 10 Best AI Tools for Students: A Comprehensive Guide. https://aeccglobal.ng/blog/10-best-ai-tools-for-students-a-comprehensive-guide

Ajuwon, G. A. (2003). Computer and Internet use by first-year clinical and nursing students in a Nigerian teaching hospital. *BMC Medical Informatics and Decision Making*, 3(1), 10.

Alabi, O. (2020). Digital literacy skills of Nigerian undergraduates: Implications for learning and research. *International Journal of Learning, Teaching and Educational Research*, 19(6), 25

Almalki, A. (2021). AI in education: Opportunities and challenges for special needs students. *Journal of Educational Technology Systems*, 49(4), 457-469.

Anderson, T., & McCormick, C. (2018). *Digital Learning: A Review of the Literature*. International Review of Research in Open and Distributed Learning, 19(1), 1-20.

Baker, R. S., & Inventado, P. S. (2014). Educational data mining and learning analytics. In D. J. Wiley & J. A. K. (Eds.), *Learning, Education and Data Mining* (pp. 73-91).

Bawden, D. (2008). Origins and Concepts of Digital Literacy. In *Digital Literacies: Concepts, Policies and Practices* (pp. 17-32). Peter Lang.

Cheng, Y., et al. (2021). The Impact of AI Writing Tools on Writing Quality: A Comparative Study. *Journal of Educational Technology & Society*, 24(2), 17-30.

Cohen, E. G. (1994). Restructuring the Classroom: Conditions for Productive Small Groups. *Review of Educational Research*, 64(1), 1-35.

Craig,L; Loskowski, N & Tucci, L. (2024). What is AI (Artificial Intelligence)? https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340

Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilization of e-learning facilities in the educational delivery system of Nigeria: A study of M-University. *International Journal of Educational Technology in Higher Education*, 15(1), 34.

Fawaz, O. I. (APRIL 5, 2023). The Impact of Emerging AI Technologies on Nigerian Education. https://susafrica.com/2023/04/05/the-impact-of-emerging-ai-technologies-on-nigerian-education/

Ghasemi, A., et al. (2021). AI Writing Assistants: Transforming the Writing Landscape for Diverse Learners. *International Journal of Educational Technology in Higher Education*, 18(1), 29.

Glover, K., et al. (2019). The Role of AI in Writing: Challenges and Opportunities. *Computers and Composition*, 52, 21-34.

Hague, C., & Payton, S. (2010). Digital Literacy Across the Curriculum. *Futurelab*.

Ibrahim, D. (2019). Digital literacy among undergraduate students in Nigeria. *Journal of Information Literacy*, 13(2), 99-111.

Jisc. (2015). *Digital Capability Framework*. Jisc.

Johnson, H., et al. (2020). Context Matters: The Limitations of AI Writing Tools. *Educational Review*, 72(4), 513-531.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2019). *Horizon Report: 2019 Higher Education Edition*. EDUCAUSE.

Kaur, P., & Singh, H. (2021). AI in education: Opportunities and challenges for teachers and students. *Journal of Educational Technology Systems*, 50(2), 123-134.

Kirkland, K., & Sweeney, A. (2020). Balancing AI and Traditional Writing Instruction: Strategies for Educators. *Teaching English in the Two-Year College*, 47(2), 166-178.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. *Pearson Education.*

Mackey, T. P., & Jacobson, T. E. (2011). *True Information Literacy: Problem-Based Learning in the 21st Century*. College & Research Libraries, 72(3), 240-256.

Mullen, J., et al. (2020). Assessing the Effectiveness of AI Writing Tools in Higher Education. *International Journal of Technology in Education and Science*, 4(3), 241-255.

Ng, W. (2012). Can We Teach Digital Natives Digital Literacy? *Computers & Education*, 59(3), 1065-1078.

Oye, N. D., Salleh, M., & Iahad, N. A. (2011). Challenges of e-learning in Nigerian university education based on the experience of developed countries. *International Journal of Managing Information Technology (IJMIT)*, 3(2), 39-48.

Pane, J. F., Steiner, E. D., & Baird, M. D. (2015). Continued progress: Promising evidence on personalized learning. *RAND Corporation.*

Ribble, M. (2015). *Digital Citizenship in Schools.* International Society for Technology in Education.

Sari, R. M., et al. (2020). The Effectiveness of AI Writing Assistants: A Systematic Review. *Journal of Language and Linguistic Studies*, 16(1), 255-268.

Sule, J. (2024). Integrating artificial intelligence into education in Nigeria. https://www.thecable.ng/integrating-artificial-intelligence-into-education-in-nigeria/

Watanabe, K., & Yoon, S. (2021). Effects of AI writing tools on students' writing performance: A study of college students. *Computers and Composition*, 59, 102601.

Zawacki-Richter, O., et al. (2019). Digital Education in the Age of AI: Exploring Benefits and Challenges. *Distance Education*, 40(2), 187-201.

Zheng, B., et al. (2016). Examining the Effects of Digital Literacy on Online Learning Engagement and Performance. *Computers in Human Behavior*, 62, 264-274

Zhou, M., et al. (2020). Data privacy and ethical challenges in the use of AI in education. *International Journal of Educational Management*, 34(2), 259-272

Zuboff, S. (2019). *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. Public Affairs.