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APPLICATION TO ARTIFICIAL INTELLIGENCE (AI) IN TEACHING AND LEARNING PROCESS IN NIGERIA

BY

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Abstract

The continuous evolution of science and technology has given birth to the application of artificial intelligence in the educational process of teaching and learning. Artificial intelligence (AI) has entered the field of teaching and has improved education by providing teachers with practical teaching tools. Thus, this paper unravels the ways and manners in which artificial intelligence (AI) is used to ease and improve educational processes of teaching and learning. Problems bedevilling the use of artificial intelligence (AI) in education as well as viable solutions were suggested. In view of this, it is evident that artificial intelligence (AI) is not only handy and useful in other fields of endeavour but also in the promotion and reformation of the traditional system of teaching and learning of education in Nigeria. Artificial intelligence technology has not only promoted changes in the educational mode of teaching and learning, in various campus of learning and teaching, it also helps to develop curriculum, and the entire education industry is also undergoing changes through artificial intelligence (AI) technology from basic education to higher education and adult education. The reformation of teaching and learning process of education will break the time and space restrictions in traditional educational system thus, form a superhighway of

information, promote fair processes in education, and make teaching and learning process more interesting and reasonable. Introducing Artificial intelligence (AI) in the wider cultural context not only imparts technical skills, but also nurtures critical thinking and ethical considerations around the use of such technology. Artificial intelligence (AI) approaches can benefit the educational sector in various circumstances. Examples of Artificial intelligence (AI) assisted education include innovative virtual learning, intelligent teaching, and data analysis and prediction. So, it is important to note that as learning requirements rise, Artificial intelligence (AI)-enabled education is becoming increasingly crucial. Artificial Intelligence in education systems provide timely, personalized training and feedback to both teachers and students. They mostly use machine learning-related technologies which are strongly related to statistics models and cognitive learning theory, to increase the value and effectiveness of learning. The above issues are to the paper seeks to address in teaching, learning and learning process in education.

Keywords: Artificial Intelligence, Teaching, Learning, Process, Education.

Introduction

Over the years, science and technology has been evolving continuously to ease our daily activities in all areas of specialization and one of the products of this persistent advancement is the application of artificial intelligence in the process of teaching and learning in schools and education sector as a whole (Adekunle, 2023)¹. The author added that in recent years, it has been observed that Artificial intelligence (AI) has entered the field of teaching and improved the quality of education by providing teachers with practical teaching tools. Similarly, the government and schools are paying more and more attention to the development of artificial intelligence (AI) in education as it is increasingly becoming a part of our daily lives.

Artificial intelligence technology has not only promoted changes in the educational mode of teaching and learning, in various campus of learning and teaching, it has also helped to develop curriculum, and the entire education industry is also undergoing changes through artificial intelligence (AI) technology from basic education to higher education and adult education (Malik, Tayal & Vij, 2019)². Artificial intelligence technology is believed to play an important role in promoting the reformation of teaching and learning in various institutions of education and these systems can help people learn better and achieve their learning goals (Romero-Rodríguez, 2019)³.

Artificial intelligence (AI) promises new intelligent teaching tools to educational institutions and/or schools which will form new teaching and learning modes, and promote innovation in teaching evaluation methods and teaching management methods. In view of this, there is need for educators to actively change their way of thinking, explore new forms of combinations between artificial intelligence and conventional teaching, and promote the deep integration of technology, learning, and teaching, and the innovative development of education and teaching (Guo & Xiao, 2021)⁴.

The reformation of teaching and learning process of education will break the time and space restrictions in traditional educational system thus, form a superhighway of information, promote fair processes in education, and make teaching and learning process more interesting and reasonable (Zhang & Li, 2021)⁵. Adopting this innovative system enhances students' cognitive development according to their own potential; whereas teachers' repetitive workload will be replaced by artificial intelligence systems and the campus environment will become more intelligent.

Artificial Intelligence (AI) in Teaching and Learning Process of Education

Artificial intelligence (AI) refers to the development of computer systems that can perform tasks that typically require human intelligence such as learning, problem-solving, reasoning, perception and language understanding. AI systems use algorithms and data to make decisions often independently, and can improve their performance over time through machine learning. Applications of Artificial intelligence (AI) are diverse and they include Virtual assistants (e.g., Siri, Alexa), Image and speech recognition, Natural Language Processing (NLP), Robotics, Predictive analytics, Fraud detection, Autonomous vehicles, Healthcare diagnosis, Chatbots, Cyber security. Broadly speaking, Artificial intelligence (AI) aims to enhance human capabilities, automate tasks, and drive innovation in various industries including the education sector (Adekunle, 2023)⁶.

The world is constantly evolving and the field of education which one of the fundamental human right is no exception. Artificial Intelligence (AI) has emerged as a popular tool in the education landscape, promising a new era of efficiency, creativity, and support in teaching and learning process with a new horizon like never. Having stated these, Artificial intelligence brings with it a wealth of opportunities in online course design and delivery, among them: are

- I. **Efficiency in Content Creation:** AI can produce and update educational content quickly, freeing educators from laborious tasks. This not only saves time but also ensures that content remains current and relevant.
- II. **Task Automation:** Repetitive administrative tasks can now be automated using Artificial intelligence (AI), enabling educators to focus on what truly matters to their pupils and/or students (learners). This means more time for hands-on facilitation, and fewer learners left behind.
- III. **Enhanced Student Engagement:** Artificial intelligence (AI) can be a powerful ally in keeping learners engaged and motivated. By analysing individual learning patterns, adaptive Artificial intelligence (AI) tools can personalise content delivery, catering to unique learning styles. On the other hand, generative Artificial intelligence (AI) tools can be trained to incorporate learning design best practices into course activities.
- IV. **Visual Learning Aids:** Complex information can be visualized quickly and accurately using image-generating Artificial intelligence (AI) tools like Canva, Visme, Microsoft Sway, and more, making abstract concepts more accessible for learners.

- V. **Support for Special Needs:** Artificial intelligence (AI) capabilities such as text-to speech, visual recognition, speech recognition and more can be tailored to support learners with special needs, offering ways to adapt learning resources for more inclusive lessons.
- VI. **Fostering 21st Century Skills:** Introducing Artificial intelligence (AI) in the wider cultural context not only imparts technical skills, but also nurtures critical thinking and ethical considerations around the use of such technology.
- VII. **Virtual Tutors:** Provide immediate feedback and support to students, helping them to overcome learning challenges and achieve mastery of complex concepts. Intelligent tutoring systems can adapt their instruction based on students' responses and provide targeted interventions when necessary.

According to Thuong and Minh (2023)⁷ in their research on how Artificial intelligence (AI) has changed education's administrative, instructional, and learning components; assert that AI in education started with computers and computer systems and evolved into online learning platforms. According to the authors, embedded technologies allow robots and humanoid robots to function as teacher colleagues, autonomous educators, and catboats. Robots on various platforms and technologies have enhanced instructors' efficacy and efficiency, improving educational quality. Thus, AI has enhanced students' learning experiences by customizing and personalizing learning materials based on their needs and skills. AI has greatly influenced education, notably in administration, instruction, and learning in the educational system or individual educational institutions.

Contemporary Applications of Artificial Intelligence (AI) in Teaching and Learning Process of Education

Nigerian educational system is observed to be very dependent on out-dated practices. Although there are knowledge gaps in the current grading systems, a dose of Artificial intelligence (AI) tools and technology can usher in a new era of automation. According to estimates, the market for Artificial intelligence (AI) in education has grown to \$3.68 billion by 2023, according to marketsandmarkets.com⁸, with a CAGR of 47% from 2018 to 2023 (Subrahmanyam & Swathi, 2018)⁹. Educators should consider designing a digital transformation inside their area to include the relevant Artificial intelligence (AI) technologies that generate the intended outcomes. As such, it is paramount to look into some of the most important topical AI uses in teaching and learning process of education.

I. Universal Access to Education:

Providing high-quality education to all students, regardless of region or race, is difficult. However, Artificial intelligence (AI) can dramatically improve student teacher and peer-educator interactions. Artificial intelligence (AI) technologies provide intelligent data collection, tailored timetables, unique occupations, and 24/7 education. They can also build language translations, subtitles, and regional plug-and-play applications to promote universal learning and eliminate outmoded or inefficient instructional methods (Guilherme, 2019)¹⁰. AI-powered systems can analyse enormous volumes of data in real-time and integrate the

cloud, allowing businesses with global branches to do short administrative, testing, and instructional duties identically.

II. Administrative Tasks:

Artificial intelligence (AI) simplifies the routines of administrators in schools, colleges, and institutions through automatic scheduling, rescheduling, attendance, grading, financing, bookkeeping, and record-keeping (Sharma, Tomar, Bhardwaj, & Sakalle, 2021)¹¹. Similarly, Artificial intelligence (AI) comes handy in numerous professional roles like:

Eliminating truancy warnings

- Automatically send report cards and other correspondence to parents.
- Schedule and plan meetings.
- Send student forms, enrolments and other documentation to the appropriate department via automation.
- Reduce the amount of time spent on progress reports.
- Make any other record-keeping chores more efficient.

In a nutshell, Artificial intelligence (AI) allows professors and teachers to concentrate on increasing educational quality rather than laborious paperwork and lowering work strain.

Assessment Programs

After collecting measurements for scoring assignments from teachers or professors, Artificial intelligence (AI)-powered grading software employs machine learning to develop calculating methods (Alam, 2021)¹². The tools mimic how teachers grade pupils. Teachers' input and Artificial intelligence (AI) can swiftly evaluate essays, papers, and tests in several languages. They may swiftly incorporate them into a virtual environment or cloud platform. It helps instructors focus on other activities when there are numerous papers to grade.

III. Voice-activated:

Tools Voice assistants are a fun and practical method to help users and bring learning into the home. The following are some of the advantages of voice assistants in education:

- Efficient time saving for students and teachers
- Community learning opportunities
- Personalized instruction in seconds

Even if the users don't have smart speakers, these Artificial intelligence (AI)- powered voice assistants can be used in smartphone apps.

IV. Personalized Education:

Artificial intelligence (AI) technologies help students learn by creating tailored study programs and tailoring lessons. They discover knowledge gaps and provide instructional resources, evaluation tools, and feedback for preschool through college students. AI-powered software, games, and applications may help students learn at their own pace, time, and repetition needs. This machine-assisted classroom helps teachers tailor lessons to students. It may greatly improve flexible learning and give all learners a firm foundation.

V. Smart Content:

Smart content can range from digital textbooks, manuals, instructional snippets, and videos to Artificial intelligence (AI) systems that create individualized educational environments depending on tactics and goals. Find ways to use Artificial intelligence (AI) to personalize education, a worldwide trend. Using web-based curricula, schools can create AR and VR learning environment (Huda, Elkoubaiti & Mrabet, 2020)¹³. Artificial intelligence monitoring and assessment systems can simplify content for different learning types and varying learning speeds. Artificial intelligence (AI) and machine learning algorithms may discover curricular gaps and help teachers address them when many pupils give erroneous answers.

VI. Intelligent Tutoring:

Intelligent chemistry and other disciplines. Engagement, grading, and tutoring comprehension guide their design.

VII. Virtual Learning Environment:

VR technology lets students engage with information on their mobile devices or laptops. Virtual learning environments can promote immersion, group learning, and student counselling. Virtual reality headsets can help kids focus by blocking distractions (Huda et. al., 2020)¹⁵. Interactive virtual simulations offer students soft skill coaching, life skills, and self-development.

Artificial Intelligence (AI) Techniques with Scenarios in Teaching and Learning

Perrotta & Selwyn (2020)¹⁶ in their research on application of deep learning in education stated that Artificial intelligence (AI) approaches can benefit the educational sector in various circumstances. Examples of Artificial intelligence (AI) assisted education include innovative virtual learning, intelligent teaching, and data analysis and prediction. So, is important to note that as learning requirements rise, Artificial intelligence (AI)-enabled education is becoming increasingly crucial. Intelligent education systems provide timely, personalized training and feedback to both teachers and students. They mostly use machine learning-related technologies which are strongly related to statistics models and cognitive learning theory, to increase the value and effectiveness of learning. Itemized below are the main applications of Artificial intelligence (AI) in education along with the key technologies that underpin them.

- Intelligent schools can be actualized through Artificial intelligence (AI) techniques like virtual labs, augmented reality (AR), virtual reality (VR); hearing and sensing technologies.

- Online and mobility of remote education is also possible with the aid of virtual personalized assistants, edge computing and real-time analysis.

- Personalized intelligent teaching employs the help of Artificial intelligence (AI) techniques such as intelligent teaching systems, data mining or Bayesian knowledge interference and learning analytics.

Grading and evaluation are now easily and automatically done via CBT using - artificial intelligence techniques like computer vision, image recognition, and prediction system.

- Students' and Schools' assessment also sought the competence of Artificial intelligence (AI) technologies and/or techniques which include academic analytics, adaptive learning methods and personalized learning approaches to eliminate computational error, data redundancy and poor performance of students due to incompetency and laxity on the part of teachers.

- Building curriculums: academic systems and/or schools now employ the aid of Artificial intelligence (AI) techniques like big data, data analysis, clustering algorithms, as well as machine learning or deep learning technology in building standard and up-to-date curriculums.

According to Chen & Kim (2022)¹⁷, Artificial intelligence (AI) systems use machine learning, data mining, and knowledge model methodologies for learning analysis, recommendation, comprehension, and acquisition. Teaching materials, data, and intelligent algorithms comprise an Artificial intelligence (AI) education system with two parts:

- The system model (which contains the learner, teaching, and knowledge models), and
- The intelligent technology.

Romero & Ventura (2020)¹⁸ illustrated in Figure 1 below that a model's contribution to a data map which builds structures and association rules for education data is crucial to learning as the model is an artificial intelligence system's brain. The learner model improves AI learning systems' autonomy. Information from students' behavior while learning determines it. Students' ideas and talents are examined to determine their learning capacity. The learners' knowledge mastery is assessed by mapping the knowledge analysis's findings, learner modeling links learning objectives, resources, tools, and instructional techniques. The knowledge model produces a knowledge structure map with learning components, sometimes adding specialized information and instructions to avoid typical mistakes and misconceptions. The teaching model established the knowledge field's norms, which combined the learner and knowledge field models, allowing instructors to personalize instruction. Thus, Students are more inclined to conduct themselves well, act well, or ask for help as they learn. Artificial intelligence (AI) systems can always use the tutoring model's teaching theories. The user interface displays learners' performance through speech, typing, and clicking and outputs words, figures, cartoons, and agencies. The sophisticated HMI performs Artificial intelligence (AI) functions, including speech recognition, emotion detection, and natural language interaction.

I. Machine Learning: The core of machine learning is the process of parsing, which produces meaningful patterns and organized information based on a sampling data set known as "training data. For instance, machine learning can help students choose classes and even universities by providing recommendations. It "matches" students with institutions where they can grow the most by using data on student success, aspirations, and preferences. Additionally, this technology can help teachers better understand how students absorb each concept (Goksel & Bozkurt, 2019)¹⁹. To help students grasp the course material better, instructors can modify their teaching strategies in response to cumulative student performance data. For instance, photo recognition and machine learning predictions can be used to assess tests and homework for students, yielding results more quickly and reliably than humans.

II. Learning Analytics: Learning analytics uses student characteristics and knowledge objects from learner and knowledge field models. Learning analytics applies machine learning to education. Intervening with at-risk pupils or offering feedback and instructional content is one way to tailor education to specific students. Machine learning, data visualization, learning sciences, and semantics are used. Artificial intelligence (AI)-based competency learning may uncover student insights and predict their fundamental abilities, allowing institutions to respond proactively. Artificial intelligence (AI)'s broad learning capabilities and competencybased learning power learning analytics. AI can identify prospective dropouts based on multiple characteristics, providing schools with early warning systems and actionable data. Learning analytics should expand to encompass interpersonal skills, the arts, and literature, which complicate evaluating competencies and learning outcomes. Learning analytics must be specialized enough for individual learning environments and wide enough for numerous institutions and courses. Innovative learning analytics will help students, instructors, administrators, and institutions learn.

III. Data Mining: Educational data mining provides automatic, methodical answers. Artificial intelligence (AI)-based educational data mining creates intrinsic association rules and customizes information for students. A few writing exercises can assess student demographics and grade information. This is done via machine learning regression, which may also predict student achievement. Data mining improves knowledge acquisition and learning by understanding learning situations and students. Data mining extracts hidden information through pattern recognition and predictive modelling, allowing educators to alter curriculum development. Data mining-based Artificial intelligence (AI) can help students study at their own speed and choose their learning technique from knowledge field data, which is one of its most important uses.

Similarly, Pokrivicakova 2019)²⁰ talked about Artificial intelligence education apps like Tablet, which gives pupils personalized teaching and language learning writing and translation tools focus on the same themes. Artificial intelligence (AI) is also used in education to give teachers or instructors directions. Artificial intelligence (AI) in web-based education (AIWBES) has made teaching and learning more effective than ever by adding teacher-like capabilities important tools for instructors. The use of AIWBES in teaching and the incorporation of teacher-like functionalities make the platform a strong tool for instructors

(Koh, 2019)²¹. Meanwhile, Adaptive learning software uses Artificial intelligence (AI) or machine learning to "adapt" a student's learning route in real-time. Teaching pupils to acquire and retain information can be done in numerous ways. Artificial intelligence (AI) in education has erased national and international barriers, enabling global online and web-based learning (Kumar & Sharma, 2022)²².

Some of the Problem Facing Artificial Intelligence (AI)

With every great opportunity introduced by Artificial intelligence (AI) tools and capabilities, educators should be supported in overcoming the challenges that arise as well. As far as the incorporation of Artificial intelligence (AI) in teaching and learning process of education, these are some of the major problems that may arise:

- i. **Technical Expertise:** Some educators may struggle with a lack of technical expertise, spending an excessive amount of time and effort trying to adapt Artificial intelligence (AI) tools to their needs. To design effective prompts for generative Artificial intelligence (AI) tools, educators need to understand how to formulate questions that elicit the desired responses from Artificial intelligence (AI) systems which can sometimes require knowledge about the underlying processes.
- ii. **Cost:** Implementing Artificial intelligence (AI)-powered solutions can be financially demanding, making it a challenge for institutions with budget constraints. However, with many providers opting to use a credit system to manage usage among different team members and issue invoices, the cost has become less prohibitive.
- iii. **Ethical Concerns:** Privacy, security, plagiarism, inequity, and the potential disruption of the job market are among the ethical concerns that need careful consideration when integrating Artificial intelligence (AI) in teaching and learning process of education.
- iv. **Quality Concerns:** Maintaining high standards and ensuring Artificial intelligence (AI)-generated content aligns with educational teaching and learning objectives is critical. An over-reliance on Artificial intelligence (AI) tools may lead to a decline in quality and richness of educational content, with the risk of perpetuating inaccuracies or biases present in the training data of the Artificial intelligence (AI) model.
- v. **Human-Artificial Intelligence (AI) Collaboration:** There may be resistance to adopting Artificial intelligence (AI) in teaching and learning process of education due to concerns about job displacement. However, Artificial intelligence (AI) is not a replacement for human creativity. Educators and learners contribute unique perspectives and creative thinking that Artificial intelligence (AI) cannot replicate.

Instead, AI serves as a valuable tool to augment human capabilities.

Way Forward Or Solution

Given the challenges of implementing Artificial intelligence (AI) in education, it is unsurprising that there is resistance among stakeholders. Here are some strategies to address common concerns and misconceptions:

- i. **Educate stakeholders:** Provide clear and accurate information about the potential benefits of Artificial intelligence (AI) in education and address any misconceptions or fears.
- ii. **Highlight the role of teachers:** Emphasis that Artificial intelligence (AI) is meant to enhance, not replace, the role of teachers. AI can support teachers by automating administrative tasks and providing personalised learning experiences.
- iii. **Ensure privacy and security:** Address concerns about learner privacy and data security by implementing robust privacy policies and security measures. Communicate these measures to stakeholders to build trust.
- iv. **Involve stakeholders in decision-making:** Include teachers, learners, and administrators in the decision-making process regarding the implementation of Artificial intelligence (AI) tools. This collaborative approach can help address concerns and ensure buy-in from all stakeholders.
- v. **Share success stories:** Highlight examples of successful Artificial intelligence (AI) implementations in education and showcase the positive impact on student learning outcomes. This can help alleviate fears and demonstrate the potential of Artificial intelligence (AI) in education.

Conclusion

Science and technology has been evolving continuously over the years, to ease our daily activities in all areas of specialization and one of the products of this persistent advancement is the application of artificial intelligence in the process of teaching and learning in schools and education sector as a whole. In recent years, it has been observed that Artificial intelligence (AI) has entered the field of teaching and improved the quality of education by providing teachers with practical teaching tools. Artificial intelligence (AI) applications such as virtual reality, simulations, and providing students with practical skills are noteworthy. More so, Artificial intelligence (AI) guides teachers by providing students with pedagogical tools such as customized teaching and language learning tools. It also improves the work of teachers and trainers, increasing efficiency, effectiveness, and quality. Artificial intelligence (AI) can increase the speed at which students learn and help instructors by identifying gaps. With the ability to deliver customized content to students, it provides teaching that suits students' needs, abilities, and skills. Additionally, Artificial intelligence (AI) is used in administrative tasks, especially grading, plagiarism checking, and commenting on student work. In this way, it helps teachers spend more time speeding up their administrative work. Artificial intelligence (AI) applications in education serve as an important tool to make the teaching and learning process more efficient and effective.

Suggestions

The following recommendations were based on the issues surrounding the use of Artificial intelligence (AI) in teaching and learning process of education in Nigeria:

1. Nigerian government should provide sponsorship to potential software developers, Artificial intelligence (AI) specialist and engineers to acquire more skills, technical know-how and expertise from skilled individuals and organizations abroad so as to encourage development and implementation of efficient Artificial intelligence (AI)-powered systems in Nigerian various institutions of learning as well as in other sectors for national development.
2. Adequate funding should equally be provided to the local sponsors for continuous productivity and advancement in the field.
3. Monitoring and evaluation teams should also be setup for quality assurance, prevention of embezzlement and failure of the projects both for government owned institution of learning and Artificial intelligence (AI) specialist team.

Suggestions for Further Research

Future studies should delve even deeper into the role of Artificial intelligence (AI) in education generally and conduct more research to better understand the potential of various Artificial intelligence (AI) technologies and they work.

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