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RECEIVED 18 November 2024

ACCEPTED 20 January 2025

PUBLISHED 03 March 2025

CITATION

Ocen S, Elasu J, Aarakit SM and
Olupot C (2025) Artificial intelligence in
higher education institutions: review of
innovations, opportunities and challenges.
Front. Educ. 10:1530247.
doi: 10.3389/feduc.2025.1530247

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Artificial intelligence in higher education institutions: review of innovations, opportunities and challenges

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Artificial intelligence is revolutionizing industries including institutions of higher learning as it enhances teaching and learning processes, streamline administrative tasks and drive innovations. Despite the unprecedented opportunities, AI tools if not used correctly, can be challenging in education institutions. The purpose of this study was to comprehensively review the AI innovations, opportunities and challenges associated with the use of AI in higher Education of learning. A systematic literature review methodology was adopted and used to locate and select existing studies, analyze and synthesize the evidence to arrive at clear conclusion about the current debate in the area of study. Following the PRISMA, the study analyzed a total of 54 documents that met the inclusion and exclusion criteria set for selection of the documents. The review unveiled many opportunities including enhanced research capabilities, automation of administrative tasks among others. Artificial Intelligence tools are found to refine and streamline the administrative tasks in different units in higher institutions of learning. The challenges include ethical concerns, integrity issues and data fabrication issues. With the challenges notwithstanding, the benefits of Artificial Intelligence cannot be over emphasized. Artificial intelligence remains a powerful tool for research, automation of administrative tasks, personalized learning, inclusivity and accessibility of educational content for all. Emphasis should be put in regulatory frameworks detailing how such tools can be used while maintaining the level of ethical standards required.

KEYWORDS

artificial, intelligence, innovations, opportunities, challenges, literature

1 Introduction

Technology and Artificial Intelligence (AI) is revolutionizing industries including institutions of higher learning. In education institutions of higher learning, artificial intelligence presents unprecedented opportunities to enhance learning experiences, streamline administrative tasks and drive innovations. Artificial intelligence tools are widely used to enhance teaching and learning process in higher institutions of learning. Tools such as intelligent tutoring systems provide personalized, adaptive learning experiences to students. They can also be used to assess students' current knowledge level, identify gaps and adapt the learning content according. Other tools such as Natural Language Processing allow computers to understand, interpret and generate human languages. As a result, chatbots that answer

students' questions and give feedback to students regarding questions, assignments and facilitate discussions on online forums has been developed.

However, it is also important to note that the artificial tools if not used correctly can be challenging in education institutions. While Artificial Intelligence tools can play a significant role in helping students with their writing, there is evidence that over reliance on Artificial Intelligence tools by students contributes significantly to the loss of creativity and moral issues (Liang, 2023). Liang further notes that Artificial Intelligence makes suggestions that are contrary to social ethics and law. The development and deployment of artificial intelligence requires access to detailed data. The need for detailed data especially in education institution could easily affect data privacy, and security. As Artificial Intelligence models are not generally developed in consideration of educational usage or student privacy, the educational application of these models may not be aligned with the educational institution's efforts to comply governing laws. There is death of scholarly work on the innovation, challenges, and opportunities regarding the use of artificial intelligence tools in education institutions of higher learning unfortunately, little has been done to profile these studies and use them for policy decisions.

As early as 1950, Allan Turing defined proposed the Turing Test to provide satisfactory operational definition of intelligence (Turing, 1950). According to the Turing test, intelligence is the machine's ability to exhibit a behavior indistinguishable from that of a human being when engaged in natural language conversation (Turing, 1950; Stuart Russell, 2010). The art of creating machines that perform functions that require intelligence when performed by people is referred to as artificial intelligence (Gignac and Szodorai, 2024). Artificial intelligence is about the system's ability to recognize patterns quantifiable through the observable development of actions or responses while achieving the complex goals in the complex environment (Goertzel, 2014). Simply put, artificial intelligence is the automation of as a way of automating activities that are associated with human thinking, such as decision making, problem solving, learning among others (Goertzel, 2014).

Conducting literature review on the status of artificial intelligence in terms of innovations, challenges and opportunities in education institutions of higher learning offers an opportunity to summaries, synthesize the arguments and ideas of existing knowledge on artificial intelligence and the opportunities it offers and challenges. In this study, a systematic literature review approach is adopted to systematically identify, evaluate and synthesize literature. The findings from this study provide useful insights in designing policies to guide

on the use of artificial intelligence tools in education institutions of higher learning.

2 Methodology

This study follows the common approach of a systematic literature review suggested by Denyer and Tranfield (2009). This approach sharpens specific methodology of literature review and provides clear instructions for locating and selecting existing studies, analyze and synthesize data to arrive at clear conclusion about the current debate in the area of study (Denyer and Tranfield, 2009; Fraske, 2022). The following five procedural steps (see Figure 1) for systematic review defined by Denyer and Tranfield (2009) were followed: question formulation, locating studies, study selection and evaluation, analysis and evaluation, reporting and using results. Although there are biases associated with systematic literature approach for example, using limiters (time, data bases and journal restrictions), broadening the perspective in terms of wide time frame, i.e., 2000–2024 and using more than one data base made it possible to capture a wide number of the articles to answer the study.

2.1 Research steps

2.1.1 Step 1: Question formulation

To be able to gain an understanding and knowledge on technology readiness frameworks, the following questions are formulated to guide the study.

1. What Artificial Intelligence tools are majorly used in higher institutions of learning?
2. What opportunities exist for Artificial Intelligence in higher institutions of learning?
3. What challenges can be paused by the increasing use of Artificial Intelligence tools in Education institutions of higher learning?

2.1.2 Step 2: Locating studies

It is particularly of prime importance to ensure that the right records and or articles are selected for systematic literature review. To be able to achieve the objective of this study, data was collected from reputable databases and journals. The databases considered for data collection included Science direct, Emerald and other sources (Google Scholar and Google General). In selecting the databases, emphasis was

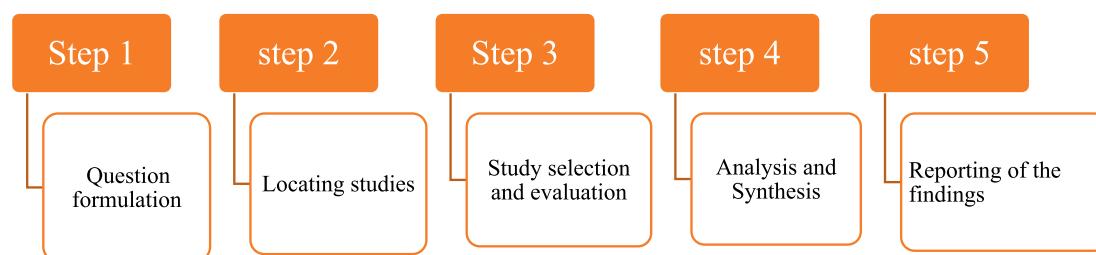


FIGURE 1
Steps in conducting systematic reviews (Denyer and Tranfield, 2009).

put on those databases that provide metadata and abstracts: Metadata includes information on; year of publication, journal title, volume and Digital Objective Identifier (DOI) number. Secondly, the databases must have wide coverage of peer-reviewed academic literature. The choice for Emerald and Science Direct was due to the fact that they are most extensively used databases in literature search and most of the bibliometric analysis use these data bases for their search (Aghaei Chadegani et al., 2013; Mongeon and Paul-Hus, 2016). Other search engines, especially Google Scholar, were considered and used during the search process.

Regarding journal selection, emphasis was put on the major leading journals. Such journals were identified using the impact and cite factor. The journals classified and ranked in A, B, and C categories were considered as credible journals and were used for content collection. Furthermore, where the Clarivate Analytics classification was not applicable, journal impact and cite factor was used to identify credible journals from which the articles and records were extracted. Tables 1, 2 present the Boolean words and the inclusion and exclusion criteria, respectively.

2.1.3 Step 3: Study selection and evaluation

In this section, papers are identified and then screened based on the inclusion and exclusion criteria. Given a high volume of papers identified in the first stage, the first exclusion focused on the dipline as indicated in the databases. All papers whose topics refer to engineering are excluded. Papers are further scrutinized alongside the aim of the study. The screening is done using the title, abstract key and words. After the final review and screening, 53 papers were included in the dataset.

2.1.4 Step 4: Analysis and synthesis

The final step of the analysis summarizes the papers/documents based on the content, type of the study and field of the research. Several steps were followed in analyzing full text articles or records following the steps of Siva et al. (2016), we first established the categories: year, publication, type of articles and level of assessment, as shown in Table 3. Thematic analysis includes the frameworks, and their respective measurements used in different papers analyzed in this study.

2.1.5 Step 5: Reporting

The final step involves reporting the findings of the study and identifying the key research gaps that exist in the literature. Figure 2 summarizes the data collection and screening process of this study.

3 Findings

In this study, 58 documents were synthesized (see Table 4: summary of synthesized documents) and the findings are presented in tables and figure for easy interpretations.

TABLE 1 Search boundaries and keywords.

Search boundaries	Science direct, Emerald, Google general, Google scholar
Search terms	"AI in education," "AI tools in education," "artificial intelligence in education," "AI opportunities in education," "AI risks in education"

3.1 Yearly analysis

The annual numerical analysis of the 54 articles included in the dataset is shown in Figure 3. From the analysis, results show that most of the papers (42) included in the analysis were published in 2024. A significant number of the papers (10) were published in 2023. The remaining two paper were published in 2022 and 2021 with each year having one paper.

The surge in publications in artificial intelligence especially in higher institution of learning is because many institutions of learning and research institutions consider artificial intelligence as a critical area that can drive improvement in learning processes.

3.2 Data sources

Several journals have published articles on artificial intelligence in higher institutions of learning as shown in Table 5. The selected 58 articles (records) on artificial intelligence in higher institutions of learning were published in 36 different journals. Computers and Education: Artificial Intelligence published the highest number (12) of articles followed by Heliyon and Procedia Computer Science that published 6 and 4 articles, respectively. Several other journals including Technology in Society, Technological Forecasting and Social Change, System, SCIENCE International Journal, Procedia, Patterns, Nurse Education Today, Learning and Individual Differences, Journal of Surgical Education, Journal of Open Innovation: Technology, Market, and Complexity published at least one journal article.

It can be noted that Computers and Education: Artificial Intelligence, Heliyon and Procedia Computer Science are the core journals publishing work on artificial intelligence in higher institutions of learning.

3.3 Regional coverage (analysis by country)

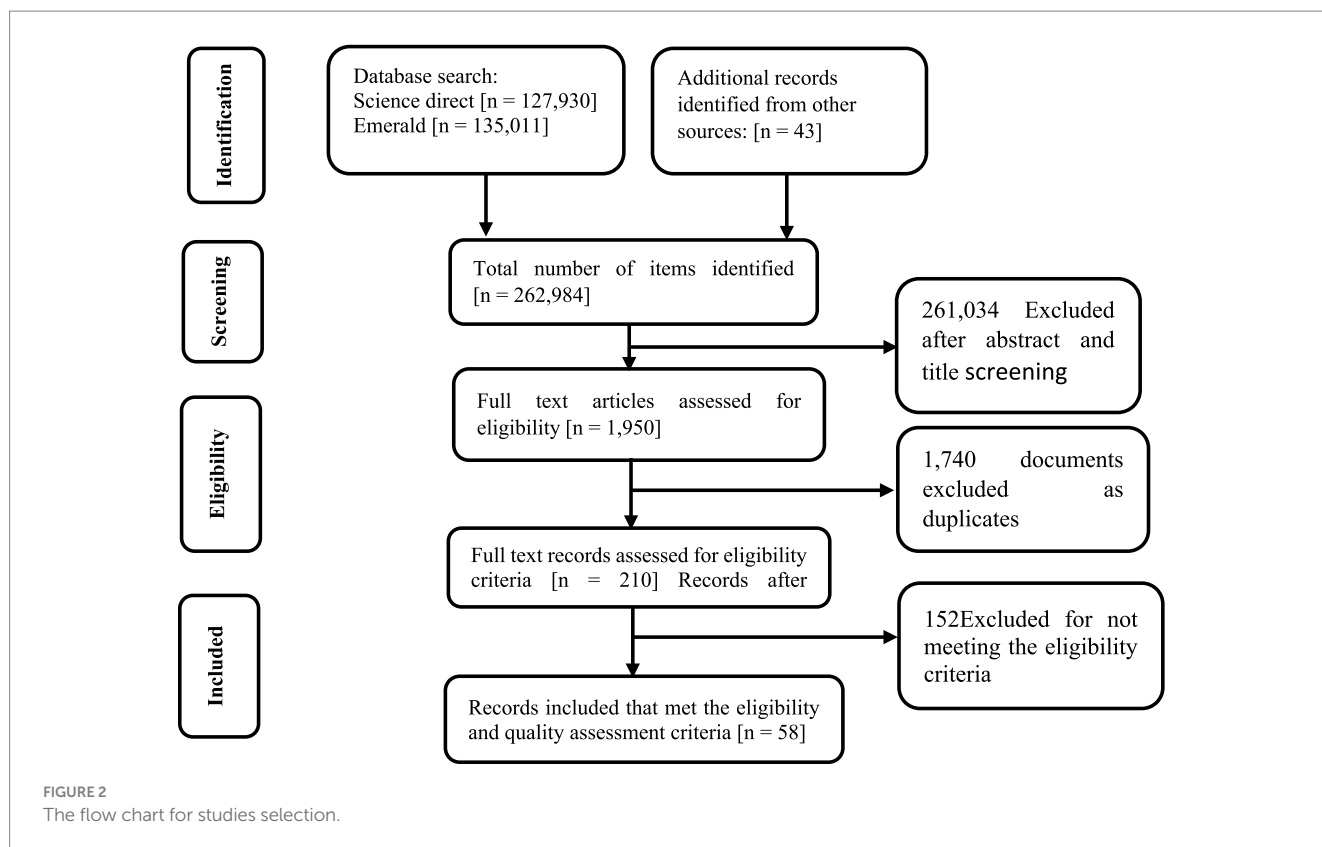
Table 6 and Figure 4 respectively present information about country where the research was undertaken. The findings show that most of the papers (10 out of 58) included in this synthesis came from USA while 4 papers came from Canada. The dominance of USA in

TABLE 2 Inclusion and exclusion criteria.

Inclusion	Exclusion
- Peer reviewed Journal articles written in English - Articles published between 2000 and 2024 - Books and book chapters - Reports from reputable organizations	- Non-peer reviewed journal articles - literature review articles - conference papers, errata, discussion papers, short communications are all excluded

TABLE 3 Analytical categories.

Category	Description of the category
Year	The year in which the article/document was published
Publication	The name of the journal in which the article was published
Level of application	Whether the assessment was for individual/organization user or vendor readiness



publishing research on Artificial Intelligence in higher institutions of learning can be attributed to several factors. Firstly, the USA promotes open access to academic research and encourages dissemination of knowledge such that many institutions have open publication policies which increase visibility of research worldwide (Kankam et al., 2024). Secondly, the early adoption and innovation in education technology could be another factor explaining the dominance of the USA in publishing in Artificial Intelligence in higher institutions of learning. USA has a very long history of integrating technology into education ranging from e-learning platforms to Artificial intelligence-driven adaptive learning systems (Kabudi et al., 2021). Furthermore, many of these technologies originate from the US, and this gives researchers an early lead in studying and publishing in artificial intelligence in higher institutions of learning (Zawacki-Richter and Latchem, 2018).

In terms of the continents, most of the documents analyzed came from Asia (14) followed by Europe with 10 documents. This is because these regions have invested a lot of resources in research and development. For instance, countries like China aiming to the worlds in Artificial Intelligence by 2030 has a national strategy with significant funding dedicated to Artificial Intelligence development (Roberts et al., 2021).

3.4 Artificial intelligence tools in higher institutions of learning

Artificial intelligence has been found to play a critical role in motivating students, raising their engagement levels and learning interest as well as academic performance (Owan et al., 2023; Nazari et al., 2021). Table 7 presents different categories of artificial

intelligence tools commonly used in higher institutions of learning in education sector. From the findings, we note that most of the artificial intelligence tools reported in literature are the AI-Driven Research Tools. They include ChatGPT, Avid note, Elicit, Perplexity, Consensus, Semantic Scholar, Research Rabbit, Scholarcy, Mendeley, Zotero, ChatPDF among others. Some of these tools are used as reference and data management tools while others are used to aid and improve writing. Commonly, Grammarly and writelab are used to improve on the grammar and the sentence formatting of the work.

Artificial tools commonly used for teaching and conferencing include Zoom, Google Meet, Webex, Microsoft Teams, WhatsApp, Instagram and Moodle.

3.5 The impact of AI on stakeholders in institutions of higher learning

It is evident that artificial intelligence impacts several educational activities (Akinwalere and Ivanov, 2022; Southworth et al., 2023). This study sought to identify existing case studies where artificial intelligence has impacted different stakeholders (students, researchers, administrators tutors/lecturers) within higher institutions of learning (Slimi, 2023). The Table 8 shows different case studies indicating how artificial intelligence influences different stakeholders in higher institutions of learning.

Chatbot technology positively impacts students' learning and satisfaction. Chatbot is used as a powerful tool to teach entrepreneurship education programs in higher education. According to Vanichvasin (2022), Chatbot improve on students learning and satisfaction (Vanichvasin, 2022). Another AI too that has impacted education in higher education institutions is the Google meet technology. Eduwem

TABLE 4 List of documents included in the synthesis.

	Authors	Title	Journal
1	Bahassi et al. (2024)	Cognitive Systems for Education: Architectures, Innovations, and Comparative Analyses.	Procedia Computer Science
2	Zhang and Aslan (2021)	AI technologies for education: Recent research & future directions	Computers and Education: Artificial Intelligence
3	Al-Khatib et al. (2024)	The potential of artificial intelligence to revolutionize health care delivery, research, and education in cardiac electrophysiology	Heart Rhythm
4	Rahimi and Sevilla-Pavón (2024)	The role of ChatGPT readiness in shaping language teachers' language teaching innovation and meeting accountability: A bisymmetric approach.	Computers and Education: Artificial Intelligence
5	Wang et al. (2023)	A Diffusion of Innovation Perspective for Digital Transformation on Education	Procedia Computer Science
6	Zhang et al. (2023)	Does expansion of college education benefit urban entrepreneurship and innovation in China?	Heliyon
7	Nahar (2024)	Modeling the effects of artificial intelligence (AI)-based innovation on sustainable development goals (SDGs): Applying a system dynamics perspective in a cross-country setting.	Technological Forecasting and Social Change
8	Lim et al. (2023)	Generative AI and the future of education: Ragnarok or reformation? A paradoxical perspective from management educators	International Journal of Management Education
9	DeCook et al. (2024)	AI-Generated Graduate Medical Education Content for Total Joint Arthroplasty: Comparing ChatGPT Against Orthopedic Fellows	Arthroplasty Today
10	Hoseinzadeh and Garcia (2024)	AI-driven innovations in greenhouse agriculture: Reanalysis of sustainability and energy efficiency impacts	Energy Conversion and Management: X
11	Bouteraa et al. (2024a)	Understanding the diffusion of AI-generative (ChatGPT) in higher education: Does students' integrity matter?	Computers in Human Behavior Reports
12	Mortlock and Lucas (2024)	Exploratory Research in Clinical and Social Pharmacy Generative artificial intelligence (Gen-AI) in pharmacy education: Utilization and implications for academic integrity: A scoping review	Exploratory Research in Clinical and Social Pharmacy
13	Joo and Park (2024)	Teaching and Learning Model for Artificial Intelligence Education Teaching and Learning Model for Artificial b, Intelligence Education	Procedia Computer Science
14	Lee et al. (2024)	The impact of generative AI on higher education learning and teaching: A study of educators' perspectives	Computers and Education: Artificial Intelligence
15	Gao (2024)	Design of urban innovation space system using artificial intelligence technology and internet of things	Heliyon
16	Stogiannos et al. (2024)	The American Society of Radiologic Technologists (ASRT) AI educator survey: A cross-sectional study to explore knowledge, experience, and use of AI within education	Journal of Medical Imaging and Radiation Sciences
17	Kinnula et al. (2024)	Nurturing systems thinking among young people by developing business ideas on sustainable AI	International Journal of Child-Computer Interaction
18	Samadhiya et al. (2024)	Bridging realities into organizations through innovation and productivity: Exploring the intersection of artificial intelligence, internet of things, and big data analytics in the metaverse environment using a multi-method approach	Decision Support Systems
19	Shal et al. (2024)	Leadership styles and AI acceptance in academic libraries in higher education	Journal of Academic Librarianship
20	Acar (2024)	Commentary: Reimagining marketing education in the age of generative AI	International Journal of Research in Marketing
21	Yao and Wang (2024)	Factors influencing pre-service special education teachers' intention toward AI in education: Digital literacy, teacher self-efficacy, perceived ease of use, and perceived usefulness	Heliyon
22	Parviz (2024)	AI in education: Comparative perspectives from STEM and Non-STEM instructors	Computers and Education Open
23	Stöhr et al. (2024)	Perceptions and usage of AI chatbots among students in higher education across genders, academic levels and fields of study	Computers and Education: Artificial Intelligence
24	Southworth et al. (2023)	Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy	Computers and Education: Artificial Intelligence

(Continued)

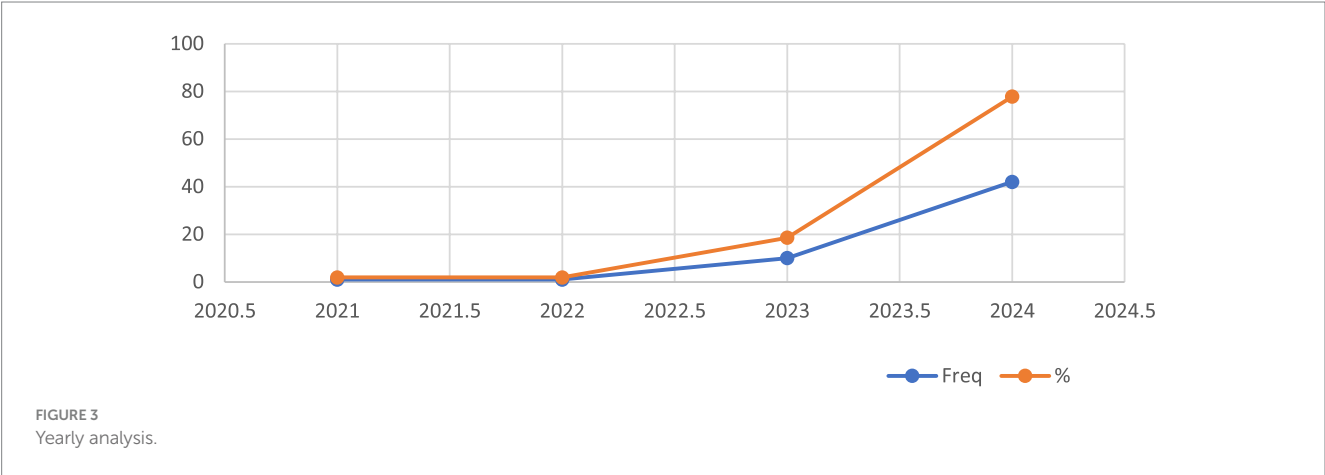
TABLE 4 (Continued)

	Authors	Title	Journal
25	Dai et al. (2023)	Reconceptualizing ChatGPT and generative AI as a student-driven innovation in higher education	Procedia CIRP
26	Dahri et al. (2024)	Extended TAM based acceptance of AI-Powered ChatGPT for supporting metacognitive self-regulated learning in education: A mixed-methods study	Heliyon
27	Saihi et al. (2024)	A Structural equation modeling analysis of generative AI chatbots adoption among students and educators in higher education	Computers and Education: Artificial Intelligence
28	Bouteraa et al. (2024b)	Open Innovation in the Financial Sector: A Mixed-Methods Approach to Assess Bankers' Willingness to Embrace Open-AI ChatGPT	Journal of Open Innovation: Technology, Market, and Complexity
29	Ayanwale and Ndlovu (2024)	Investigating factors of students' behavioral intentions to adopt chatbot technologies in higher education: Perspective from expanded diffusion theory of innovation	Computers in Human Behavior Reports
30	Tafazoli (2024)	Exploring the potential of generative AI in democratizing English language education	Computers and Education: Artificial Intelligence
31	Attard-Frost et al. (2024)	The governance of artificial intelligence in Canada: Findings and opportunities from a review of 84 AI governance initiatives	Government Information Quarterly
32	Tam et al. (2023)	Nursing education in the age of artificial intelligence powered Chatbots (AI-Chatbots): Are we ready yet?	Nurse Education Today
33	Jayabalan and Dorasamy (2024)	Revitalizing Higher Education Institutions: Embracing Frugal Innovation for Transformation	Procedia Computer Science
34	Yuwono et al. (2024)	Co-creation in action: Bridging the knowledge gap in artificial intelligence among innovation champions	Computers and Education: Artificial Intelligence
35	Wong et al. (2024)	Advancing LGBTQ+ inclusion in STEM education and AI research	Patterns
36	Terzieva et al. (2024)	Trends, Challenges, Opportunities, and Innovations in STEM Education.	IFAC
37	Gebeshuber and Doyle-Kent (2024)	Innovations and Challenges in Engineering Education for the Future: Contributing to the un-Sustainable Development Goals (SDGs)	IFAC
38	Padovano and Cardamone (2024)	Toward human-AI collaboration in the competency-based curriculum development process: The case of industrial engineering and management education	Computers and Education: Artificial Intelligence
39	Al-Zahrani (2024)	Unveiling the shadows: Beyond the hype of AI in education	Heliyon
40	Ou et al. (2024)	Academic communication with AI-powered language tools in higher education: From a post-humanist perspective	System journal
41	Parker et al. (2024)	Graduate instructors navigating the AI frontier: The role of ChatGPT in higher education	Computers and Education Open
42	Sathe et al. (2024)	How I GPT It: Development of Custom Artificial Intelligence (AI) Chatbots for Surgical Education.	Journal of Surgical Education
44	El Koshiry et al. (2023)	Unlocking the power of block chain in education: An overview of innovations and outcomes.	Blockchain: Research and Applications
44	Ivanov et al. (2024)	Drivers of generative AI adoption in higher education through the lens of the Theory of Planned Behavior	Technology in Society
45	Dolenc and Brumen (2024)	Computers and Education: Artificial Intelligence Exploring social and computer science students' perceptions of AI integration in (foreign) language instruction.	Computers and Education: Artificial Intelligence
46	Kasneci et al. (2023)	ChatGPT for good? On opportunities and challenges of large language models for education.	Learning and Individual Differences
47	Rayhan et al. (2022)	Appraisal of high-stake examinations during SARS-CoV-2 emergency with responsible and transparent AI: Evidence of fair and detrimental assessment.	Computers and Education: Artificial Intelligence.
48	Okoye et al. (2024)	Machine learning model (RG-DMML) and ensemble algorithm for prediction of students' retention and graduation in education.	Computers and Education: Artificial Intelligence
49	Abdel Magid et al. (2024)	Opportunities and shortcomings of AI for spatial epidemiology and health disparities research on aging and the life course.	Health and Place

(Continued)

TABLE 4 (Continued)

	Authors	Title	Journal
50	He et al. (2024)	Practical application of interactive AI technology based on visual analysis in professional system of physical education in universities.	Heliyon
51	Borisov and Stoyanova (2024)	Artificial intelligence in higher education: pros and cons	SCIENCE International Journal
52	Suvrat Jain (2023)	Role of artificial intelligence in higher education- an empirical investigation	International Journal of Research and Analytical Reviews
53	Sirghi et al. (2024)	Challenges of Artificial Intelligence on the Learning Process in Higher Education.	Amfiteatru Economic
54	Vanichvasin (2022)	The impact of educational Chatbot on student learning experience	International Education Studies
55	Eduwem et al. (2023)	Adoption of Google Meet Technology and Evaluation Competence of Evaluation Students in Nigeria	international journal of Education, Learning and Development
56	Huang and Tan (2023)	The role of ChatGPT in scientific communication: writing better scientific review articles	American journal of cancer research
57	Bettayeb et al. (2024)	Exploring the impact of ChatGPT: conversational AI in education	Frontiers in Education
58	Slimi (2023)	The Impact of Artificial Intelligence on Higher Education: An Empirical Study	European Journal of Educational Sciences



et al. (2023) noted that Google meet technology helps in the generation of new information and knowledge. Google meet classroom is very useful and effective in improving students' skills, abilities, discipline, and independent learning through teaching materials (Eduwem et al., 2023).

ChatGPT is a powerful research tool because it enhances information retrieval, data analysis, and idea generation while supporting drafting, editing, and summarization of texts (Huang and Tan, 2023). It provides methodological guidance, citation assistance, and access to multidisciplinary knowledge, making it useful for diverse research fields (Bettayeb et al., 2024). It allows scientists to focus on analyzing and interpreting literature reviews. By automating repetitive tasks and improving efficiency, ChatGPT helps researchers focus on critical thinking and analysis (Bettayeb et al., 2024). Embracing ChatGPT helps scientists produce meaningful research in a more efficient and effective manner (Bettayeb et al., 2024).

3.6 Opportunities for artificial intelligence in higher institutions of learning

Our literature synthesis shows that Artificial Intelligence presents several opportunities for enhanced learning, transformed teaching

and administration as well as research (Akinwalere and Ivanov, 2022). Table 9 presents key areas in higher institutions of learning where Artificial Intelligence is critically needed.

Artificial Intelligence tools are applied in almost all stages of research. Artificial Intelligence tools help in locating studies from different databases, analyze such studies and report findings. In terms of data analysis and interpretation, Artificial Intelligence tools can process and analyze vast amount of data quickly thus helping researchers to gain insights from complex datasets (Haleem et al., 2022). El Koshiry et al. (2023) and Akinwalere and Ivanov (2022) note that Artificial Intelligence tools improve the inclusion and accessibility of information for all. They also improve administrative tasks through automation.

3.7 Challenges of artificial intelligence use in higher institutions of learning

Technology plays a key role in equipping students with the necessary information and skills. With the information communication technology skills, students can achieve quality education free from the constraints of location and time (Akinwalere and Ivanov, 2022). Despite this promise the use of artificial intelligence tools (technologies comes

TABLE 5 List of journals.

Journal	Freq.
Technology in Society	1
Technological Forecasting and Social Change	1
System	1
SCIENCE International Journal	1
Procedia Computer Science	4
Procedia CIRP	1
Patterns	1
Nurse Education Today	1
Learning and Individual Differences	1
Journal of Surgical Education	1
Journal of Open Innovation: Technology, Market, and Complexity	1
Journal of Medical Imaging and Radiation Sciences	1
Journal of Business Research	1
Journal of Academic Librarianship	1
International Journal of Research in Marketing	1
International Journal of Research and Analytical Reviews	1
Frontiers in Education	1
American journal of cancer research	1
International Journal of Management Education	1
International Journal of Child-Computer Interaction	1
IFAC	2
Heliyon	6
Heart Rhythm	1
Health and Place	1
Government Information Quarterly	1
Energy Conversion and Management: X	1
Decision Support Systems	1
Computers in Human Behavior Reports	2
Computers and Education: Artificial Intelligence	12
Computers and Education Open	1
Blockchain: Research and Applications	1
Arthroplasty Today	1
Amfiteatru Economic	1
International Education Studies	1
International journal of Education, Learning and Development	1
European Journal of Educational Sciences	

with serious concerns and challenges). [Table 10](#) below summarizes some of the challenges identified from the literature synthesis.

Researchers report that over reliance on Artificial Intelligence affects the level of critical thinking (cognitive abilities) of the users. [Zhai et al. \(2024\)](#) noted that integrating AI dialogue systems in different educational subjects such as writing has a dual impact on learners’ cognitive abilities. They noted that while these technologies enhance writing proficiency, boost self-confidence as well as streamline research tasks, they also introduce some risks including diminished creativity, plagiarism and bias ([Zhai et al., 2024](#)).

TABLE 6 Analysis according to region.

Country	Freq.
Algeria	1
Bangladesh	1
Britain	1
Bulgaria	1
Canada	5
China	1
Egypt	1
Finland	1
Germany	1
India	1
Indonesia	1
Iran	1
Ireland	1
Italy	1
Malaysia	1
Mexico	1
Morocco	1
Northern Ireland	1
Pakistan	1
Qatar	2
Romania	1
Russia	1
Saudi Arabia	4
Singapore	1
Slovenia	1
South Africa	1
Spain	1
Sweden	2
United Arab Emirates	1
USA	12
Viet Nam	1
Nigeria	1

4 Discussion

The purpose of this review paper was to identify the Artificial Intelligence tools commonly used in higher institutions of learning, review the opportunities and challenges presented by the dominance of AI in higher institutions of learning. The discussion section focusses on the opportunities and challenges presented by Artificial Intelligence in higher institutions of learning.

4.1 Opportunities of artificial intelligence in higher institutions of learning

Ordinarily, researchers face challenges when it comes to conducting research the traditional way without the help of the Artificial Intelligence tools. By leveraging the computer’s cognitive power, researchers can

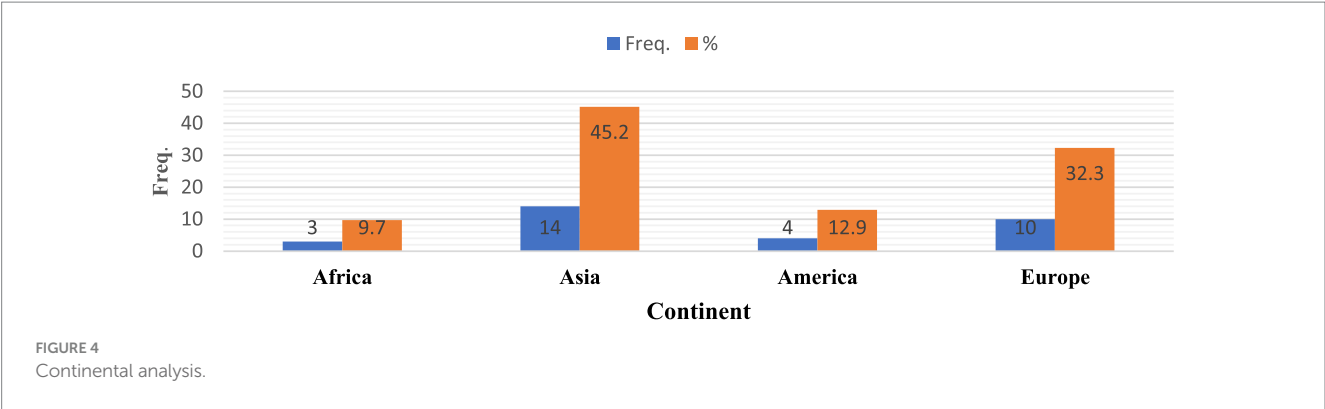


TABLE 7 Tools used in higher institutions of learning.

No.	Category	Tools
1	Natural Language Processing (NLP) Tools	1. Grammarly 2. Turnitin 3. Writelab 4. Hemingway editor
2	Virtual Teaching Assistants	1. Moodle or Claroline 2. T-Bot, Q-Bot 3. IBM's Watson Assistant 4. Chatbots
3	AI-Driven Research Tools	1. ChatGPT 2. Avid note 3. Elicit 4. Perplexity 5. Consensus 6. Semantic Scholar 7. Research Rabbit 8. Scholarcy 9. Mendeley 10. Zotero 11. ChatPDF
4	Video conferencing tools:	1. Zoom 2. Google Meet 3. Webex 4. Microsoft Teams 5. WhatsApp 6. Instagram 7. Moodle
5	Intelligent tutoring systems (ITS):	1. ALEKS 2. Carnegie Learning 3. Knewton.
6	Computer-based testing (CBT) platforms:	1. ExamSoft 2. JAMB CBT 3. UNICAL Postgraduate e-exams 4. ProProfs 5. Question mark

conduct research with a lot of ease. Several tools including Mendeley, end note and Zoterox are useful for bibliometric and referencing of different materials cited in the work. With the Artificial Intelligence tools, the time spent conducting research is reduced. Artificial Intelligence- powered tools such as Research Rabbit, Sematic Scholarcy automate the literature review process, summarize main findings, identify methodologies and

TABLE 8 Case studies showing the impact of AI on stakeholders in higher institutions of learning.

AI tool	Title of the study	Reference
Chatbot	The impact of educational Chatbot on student learning experience	Vanichvasin (2022)
Google meet	Adoption of Google Meet Technology and Evaluation Competence of Evaluation Students in Nigeria	Eduwem et al. (2023)
ChatGPT	The role of ChatGPT in scientific communication: writing better scientific review articles	Huang and Tan (2023)
ChatGPT	Exploring the impact of ChatGPT: conversational AI in education	Bettayeb et al. (2024)
ChatGPT	The Impact of Artificial Intelligence on Higher Education: An Empirical Study	Slimi (2023)

TABLE 9 Opportunities for AI in higher institutions of learning.

Area of application	Reference
Research	Akinwalere and Ivanov (2022) ; Abdel Magid et al. (2024) ; Bouteraa et al. (2024b) ; European Commission (2024) .
Inclusion and accessibility	Akinwalere and Ivanov (2022) ; Tam et al. (2023) ; El Koshiry et al. (2023) ; Tafazoli (2024) ; Southworth et al. (2023) ; Nahar (2024) .
Automated administrative tasks	El Koshiry et al. (2023) ; Akinwalere and Ivanov (2022) ; Shal et al., (2024) ; Zhang et al. (2023) ; Ou et al. (2024) .
Individualized learning	Saihi et al. (2024) ; Zawacki-Richter and Latchem (2018) ; Ivanov et al. (2024) ; Akinwalere and Ivanov (2022) ; Nassoura (2022) ; Essel et al. (2022)

highlight research trends ([Fabiano et al., 2024](#)). Fabio et al. further noted that Artificial Intelligence tools and capabilities act as the cornerstone for modern automation of systematic reviews due to their large-language models ([Fabiano et al., 2024](#)). Tools such as OpenAI's gpt3 and gpt4 are models specifically trained on very large datasets of text and able to demonstrate comprehension of such texts ([Fabiano et al., 2024](#)). With these capabilities, Artificial Intelligence enhances research and makes it less cumbersome to the researcher.

Through Artificial Intelligence-powered platforms, educational content can be tailored to suit individual learning styles, pace and capabilities ([Bhutoria, 2022](#)). With the aid of Artificial Intelligence

TABLE 10 AI- related challenges.

Challenge/concern	Reference
Ethical consideration –data privacy	Zhang and Aslan (2021); Al-Zahrani (2024); Attard-Frost et al. (2024); Roberts et al. (2021).
Integrity	Bouteraa et al. (2024a); Mortlock and Lucas (2024); Lee et al. (2024); Lim et al. (2023).
Lack of critical thinking	Tam et al. (2023); Kasneci et al. (2023); Al-Zahrani (2024)

technologies, students with learning disabilities, adaptive learning systems adjust lessons in real time to suite such students (Bhutoria, 2022). Furthermore, Artificial Intelligence-enabled personalized learning allows multimodal learning experiences using text, audio, video and other interactive elements. This allows learners to access information anywhere at any time (U.S. Department of Education, 2024). The multimodal approach allows all different learning needs and preferences to be met. Artificial Intelligence-tools help make global classrooms available to all including those speaking different languages through translator that creates power points subtitles in real time for what the instructor is saying (Akinwalere and Ivanov, 2022). The students who may not be able to attend class for one reason or the other are catered for since Artificial Intelligence-powered learning platforms are capable of breaking the silos between class and traditional ways of learning (Akinwalere and Ivanov, 2022).

The use of Artificial Intelligence tools to automate administrative tasks in higher institutions of learning is one key area where service has improved greatly (Osman et al., 2024). Queuing in lines to access a service given by the administrators should be something of the past. Students should be able to access services such as registration, verification and semester enrolment online using the artificial intelligence tools (Zhang et al., 2023). AI tools are found to refine and streamline the administrative tasks in different units in higher institutions of learning (Buetow and Lovatt, 2024).

4.2 Challenges/risks associated with the use of artificial intelligence tools in higher institutions of learning

Whereas the use of Artificial Intelligence tools in higher institutions has its own advantages as already discussed, there are also some key concerns that need to be addressed. The cases of academic dishonesty including fabrication of data using Artificial Intelligence tools is on the rise (Chen et al., 2024). The proliferation of Artificial Intelligence tools has led to falsification, fabrication of data, plagiarism as well posing dilemma in maintenance of ethical standards in research (Chen et al., 2024). A lot of cases of misconduct facilitated by the use of sophisticated Artificial Intelligence tools have spotlighted the vulnerabilities especially in regulatory systems and this calls for vigilance while indulging heavily in the use of Artificial Intelligence tools (Chen et al., 2024). Complaints of lack of necessary transparency while using Artificial Intelligence technology in research have also been reported. In data processing and results generation, algorithms are used. Researchers may not know the working principles and the processes of decision making undertaken by in the algorithms. As a results, wrong interpretations can be attached to the results generated (Chen et al., 2024).

Overreliance on Artificial Intelligence tools especially for problem solving and generating content creates an environment for passive learning which is counterproductive when it comes to developing

learners who are critical thinkers (Darwin et al., 2024). Therefore, the utilization of Artificial Intelligence tools in institutions of learning more so by the students and instructors should be approached with care so that the intended purpose of enhancing critical thinking as premised as one of the benefits should be bolstered rather than diminished.

5 Conclusions and recommendation

The purpose of this study was to identify the opportunities for Artificial Intelligence in education specifically, identify the opportunities and challenges. The review unveiled many opportunities including enhanced research capabilities, automation of administrative tasks among others. Artificial Intelligence tools are found to refine and streamline the administrative tasks in different units in higher institutions of learning. The challenges include ethical concerns, integrity issues and data fabrication issues.

Despite the concerns raised in literature, the benefits of Artificial Intelligence cannot be over emphasized. Artificial intelligence remains a powerful tool for research, automation of administrative tasked, personalized learning, inclusivity and accessibility of educational content for all. Emphasis should be put in regulatory frameworks detailing how such tools can be used while maintaining the level of ethical standards required. Furthermore, whereas, there is a significant progress in leveraging artificial intelligence to enhance educational tasks such as administrative tasks, including summarizing existing research and records management, there is limited progress in meeting specific requirements of educators especially in assessment of the education outcomes for the learners. Consequently, AI tools have yet to fully align with the specific requirements of educators.

Author contributions

SO: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. JE: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. SA: Investigation, Project administration, Supervision, Writing – review & editing. CO: Data curation, Formal analysis, Methodology, Visualization, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Generative AI was used in the creation of this manuscript.

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