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LEVERAGING AI TO ENHANCE QUALITY FOR HIGHER EDUCATION INSTITUTIONS (HEIS)

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ABSTRACT

Purpose: This study critically reviews the literature on adopting and using artificial intelligence platforms to enhance quality in Higher Education Institutions (HEIs).

Methodology/Design/Approach: The present study follows a critical literature review on technological innovations, particularly Artificial Intelligence (AI) systems for enhancing quality Open and Distance Education Learning (ODeL). A critical review of the literature was conducted on works that explored the current AI applications that institutions are using to improve the quality of their teaching and learning. This was done through bibliometric analysis, which included a search of popular databases for previously published works. Bibliometric, citation network and keyword analysis were utilized to evaluate the literature review.

Findings: The review highlights the potential of AI systems that Higher Education Institutions can utilize to enhance the quality of education. The Artificial Intelligence platforms for enhancing quality in ODeL institutions include the use of Intelligent tutors, Automated grading, and feedback systems, ChatGPT, Chatbots, and Virtual campuses. The adoption and use of technological innovation are closely linked to students' acceptance, affordability, and usability of the learning technologies.

Implications: This study's results provide implications for researchers, Innovation Hubs, and systems developers and users, including teachers and other education stakeholders.

Keywords: Resource-Constrained Environments, Distance Education Learning, Artificial intelligence, Higher Education, Technologies, Chatbot, Digital platforms.

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1. Introduction

Quality assurance is crucial in open and distance learning, especially in the context of the rapid expansion of open and distance learning institutions across the globe (Manzoor, 2021; Mahlangu, 2021). The implementation of AI in open and distance learning institutions presents numerous opportunities, particularly in improving student performance, shaping learning designs, and complementing learning strategies (Sari & Purwanta, 2021). Furthermore, the effective implementation of AI in open and distance learning requires a strong national framework to guide student assessment systems and ensure wide access to quality educational opportunities (Mwangi, 2021).

Integrating artificial intelligence (AI) in open and distance learning can revolutionize education by improving efficiency, personalization, and learner support (Liu et al.,2023). However, it is essential to ensure quality assurance and develop robust national frameworks to support the effective implementation of AI in open and distance learning (Zuhairi et al., 2020).AI has been used to enhance the quality of open and distance e-learning institutions. It can automate the grading process, provide automated feedback, and even predict student performance. Overall, the integration of AI in education has shown promising results in improving the quality of teaching and learning processes, enhancing student engagement, and personalizing learning experiences. As the field continues to evolve, further research and development in AI applications for distance learning teaching and learning are essential to fully harness its potential in education.

2. Related Works

This section outlines an analysis of existing literature on AI and QA in OdeL institutions of higher learning. Most studies on AI and OdeL have been undertaken using different methodologies and scopes. A study by Dogan, et al. (2023 investigated the use of AI in online learning and distance education processes by reviewing 276 papers identified from Scopus. The articles under review were published between 1999 and 2022. The study results showed that the interest in AI in distance education increased in 2015 and peaked in 2021. The study concluded that there is increasing research interest and use of a wide range of AI technologies, which prompts more interest in examining the use of AI in higher education.

Similar studies are proposed to examine the literature on AI and Quality assurance in ODeL; for instance, Garcia-Martinez (2023) used a systematic literature review and meta-analysis to analyze the impact of AI on computational science on student performance. The study reviewed 455 manuscripts from Web of Science and Scopus, of which only 18 were fully included. The study showed the usefulness of applying education AI-based methods over traditional methods. Bond et al., 2024) undertook a meta-systematic review of artificial intelligence in higher education, reviewing 66 published between 2018 and 2023.

The study revealed a predominance of using adaptive systems and personalized learning in higher education. Jamalova et al. (2022) conducted a systematic mapping study using 37 articles recommended for the community that aimed to create and adopt AI systems for understanding learners' behavior and learning patterns during distance education. During the study, distance learning courses that led to the identification of learning behavior patterns were identified. The study concluded that distance learning systems based on AI technologies are becoming more widespread due to the increasing need for knowledge and the pandemic-driven lifestyles. Aljarrah et al. (2021) reviewed 15 articles focusing on creating systems that enhance learning by analyzing and understanding emotions during distance learning. The researcher used Preferred reporting Items for systematics Reviews and Meta-Analysis (PRISMA). The study revealed that emotional literacy is one of the famous problems distance learners face in the eLearning environment. In a related study, Tan et al. (2022)shortlisted journal articles on artificial intelligence techniques for collaborative learning for review. The study selected 41 publications from May 2002 to 2022 using the PRISMA protocol. The study identified two gaps with varying definitions of collaborative learning and how collaborative learning is different from cooperation learning. The study also revealed variations in the research context, goals, and approaches to using AI to support collaborative learning.

Popenci et al.,(2023) conducted a qualitative and quantitative analysis of publications pursuing systematic literature review following steps proposed by Pickering and Byrne(2014). The analysed papers covered the period between 2011 and 2023. The study concluded that AI can be a tool for improving teaching and learning but also noted that it must be handled or used cautiously. The study results also revealed a declining trend in learning quality and high stress levels among students and academics. Gomez and Okur (2023) reviewed 171 papers on AI in open and distance learning. The review was based on papers published between

2007 and 2021. the study demonstrated a sharp increase in publications about AI in distance learning around 2018. The study also projects that research in AI in distance learning will maintain its increasing momentum. The study demonstrated that AI can be used in OdeL for pedagogical and systems-wide solutions. Kuleto et al. (2021) used observations and participatory observations to understand how much knowledge AI and ML students have and explore further AI opportunities and challenges. The study concluded that AI provides students with excellent learning opportunities in an interactive and personalized setting. It also helps academics discover different ways in which different students learn, making it easy for lecturers to tailor their teaching methods to meet the needs of learners.

The systematic review addresses the growing prevalence of online learning in higher education and the transformative nature of played by artificial intelligence in enhancing the quality of distance learning. Despite the increasing reliance on AI in higher education, a noticeable gap exists in the literature regarding comprehensive reviews focussing on the implications of the application of AI in the context of its effects on quality assurance. This study aims to fill this gap by offering a meticulous overview of empirical research in the application of AI in open and distance e-learning, particularly how it affects the quality assurance of higher education institutions. The review of previous studies revealed that research of AI in Open and Distance eLearning had a noticeable increase after 2010, thus showing that a lot must be covered in terms of contributing to the area of AI and Quality assurance in Distance and open eLearning and Most papers published in the databases show that the research on the subject lacks the aspect of quality assurance. Most papers published are from computer science and focus on the technological implementation of AI in higher education.

This study, therefore, contributes to the existing literature by adding the dimension of Quality assurance. Based on the preceding observations from the related literature, the study aims to systematically review papers on AI and quality assurance in distance and eLearning in higher education. In this context, the paper seeks answers to the following questions. What are the :

1. The research trends in the sampled publications
2. Who were the prominent authors of Artificial Intelligence and Quality Assurance in Education between 2015 and 2023?

3. What were the top publishing countries in Artificial intelligence and Quality assurance in education between 2015 and 2023?
4. What major journals included papers on Artificial intelligence and Quality assurance in education between 2015 and 2023?

3. Methodology and Methods

The review was quantitative, and bibliometric analysis was applied. This involved using academic publications as data sources to understand better how research is produced and analyzed. The computer-assisted review methodology identifies core research or authors by covering all publications related to a given area or field (Bornmann, 2021).

3.1 Bibliometrics and Research Tools.

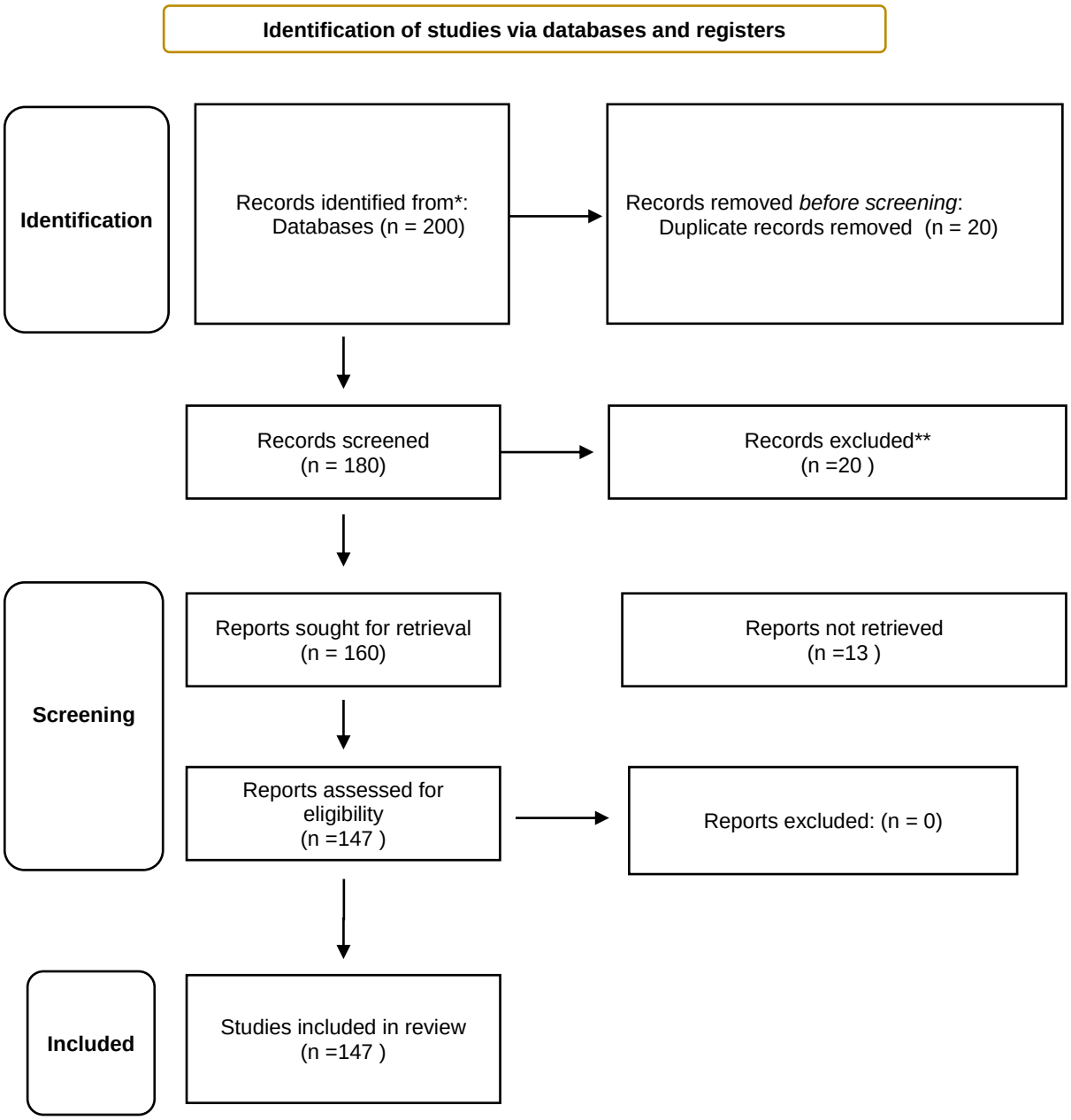
This study assumed the application of bibliometric analysis by studying abstracts and keywords within existing literature on AI and quality assurance in education. Bibliometrics supports the analysis of the development of a particular field from multidimensional perspectives, such as sorting out the current state of research in the field, tracking research (Jing, et al., (2023).trends, and presenting major research forces. The bibliometric method was applied using two software, VOS Viewer and Publish, and Perish. Vos Viewer is a tool used to conduct statistical analysis of authors and keyword network analysis(Bukar et al., 2023). This study used VOS Viewer to analyse the significant forces of AI and QA in distance and eLearning in higher education by using network visualization and generating density maps. Publish and Perish was used as a data provision source by retrieving data used for this study. Data used for this study was retrieved from Google Scholar. Publish or Perish is a software program that retrieves and analyzes academic citations from external data sources(Al Husaeni, et al., (2022).

3.2 Data Retrieval

In a Bibliometric study, the first step is to choose databases with specific indexes (Öztürk et al.,2024). How to design bibliometric research: an overview and a framework proposal. Review of managerial science, 1-29.). This study used Google Scholar as a data source because it collates results across the internet and is free to use. This web-based search engine catalogues between 2 to 100 million records of both academic and grey

literature (Haddaway et al.,2017). It also constantly expands and includes publishers' content and content unavailable in controlled databases (Halevi et al.,2017). It has, therefore, evolved as an attractive resource for most researchers. The period of the study was January 2024 to March 2024. With the advent of Artificial intelligence in the 20th century, systematic research of AI in education became more prevalent in the early 21st century, and the inclusion of quality in the AI and education conundrum became prevalent at the end of this century. The literature included in this study underwent strict inclusion criteria. The flow of data retrieval and filtering is presented in Figure 1.

Figure 1 data retrieval and filtering flow chart



The study selected the literature of studies undertaken between 2016 and 2024 as the data source. The study period was limited to 9 years because the investigated area matured significantly within that period; hence, more data from published journal articles was expected. Most authors who researched AI in Distance learning used a period between 5 to 10 years. For instance, Gocmez and OKur's (2023) search period was from 2007-2022, Doge et al. (2023) search period from 1999-2022, and Bond et al. (2024) search period was from 2018-2023. The choice of a 9-year search period was deemed appropriate.

Table 1 summarizes the retrieved data. It shows that 147 relevant papers were obtained.

Table 1: Summary of Retrieved Data.

Category	Specific Standard requirements
Research Database	Google Scholar
Citation Indexes	Citation counts, Citation Per year
Searching Period	January 2024 to March 2024
Searching Keywords	Higher Education, Quality Assurance, Artificial intelligence, Distance Learning
Document types	Articles
Sample Size	147

3.3 Data Filtering

Data obtained from the Google Scholar database was thoroughly screened to avoid duplicate papers, irrelevance, non-conformity with the research theme, or an article that was too short. This study performed the following steps to check and screen the data.

1. First, articles that were deemed irrelevant were removed.
2. Secondly, papers without publication dates were omitted from the sample.
3. Thirdly, articles with no citations were also excluded from the study.

Finally, 53 papers that did not match the theme were excluded, and only 147 articles were retained for use in the study. Table 2 shows the selection criteria that guided which articles to include or exclude from the study.

Table 2: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
The research topic had to focus on AI in education, and the studies had to relate to aspects of quality assurance.	The research article is not relevant to AI in education unless it relates to AI in medicine, the military, or agronomy.
Articles were considered if they were full texts or published articles.	Papers with less than three pages, conference proceedings, books, and book chapters
Papers should have abstracts, keywords, research questions, and conclusions(results).	The paper seriously lacks necessary information, such as an abstract, author information, keywords, methods, and conclusions.
Papers should have been cited more than once	The paper has not been cited at all.

3.4 Limitations of the Review

This review is not devoid of limitations. This review used the PRISMA protocol to select articles to answer the research questions. PRISMA guidelines have been developed to improve the reporting of systematic reviews (Uttley, et a., (2023), but the PRISMA framework in systematic literature reviews has notable shortcomings such as inadequate reporting, and missing information on the study protocol (Basenach, et al., (2023). One of the procedures for selecting publications for the study was to leave out conferences and book chapters. Due to this search pattern and selection strategy, they may be very insightful conference papers and book chapters that may have been omitted during the narrowing of the scope.

The study obtained articles from the Google Scholar database using Open Alex software. Since the software is open source, it has limitations.

4. Results

4.1 Quantitative Analysis by authors.

An analysis of the author's publications provides information regarding the representative scholars and the core strength of the research area. Table 3 presents information on the core authors in the field of Artificial intelligence and quality assurance in open and distance learning, including the authors' names, publications, and the average number of citations per article. The table shows that de Oliveira Durso and Arruda are prolific writers in the field of AI and QA in OdeL(1608cutations), followed by Salas-Pilco, and Yang(1131citations)and Dogan, T Goru Dogan, and Bozkurt with 789 citations.

Table 3: Top 10 publishing Authors in Artificial intelligence and Quality assurance in education between 2016 and 2024.

Rank	Authors	Citations	Average Citation per Paper
1.	S de Oliveira Durso, EP Arruda	1608	4
2.	SZ Salas-Pilco, Y Yang	1131	38.5
3.	ME Dogan, T Goru Dogan, A Bozkurt	789	68
4.	S Popenici, H Catalano, G Mestic…	744	1
5.	L Göçmez, MR Okur	532	0
6.	A Aljarrah, M Ababneh, D Karagozlu, F Ozdamli	517	5
7.	F AlDhaen	457	10
8.	V Kuleto, M Ilić, M Dumangiu, M Ranković…	368	47.33
9.	R Manhiça, A Santos, J Cravino	276	5.5
10.	G Jamalova, F Aymatova, S Ikromov	267	0.5

4.2 Quantitative Analysis by Countries

To learn which countries have made the most significant contributions to AI and QA in Odel, the present study analyzed publications from 54 countries, among which the top 10 are presented in Table 4. Data analysis shows that China is the leading country with 14 documents worth 1084 citations, followed by India with seven documents with 860 citations, Australia with seven articles worth 704 citations, Canada with 694 citations, and Malaysia with 7 articles cited 694 times. Jing et al. (2023) also found that China is top in publications on adaptive learning, an aspect of AI. The same study also included Canada, Spain, and the USA among the top 1o countries that publish a lot in AI in education. These findings are also corroborated by González-Calatayud, et al.,2021 and Marengo et al., 2023.

Table 4 Top 10 publishing countries in Artificial intelligence and Quality assurance in education (ranked by the number of documents)

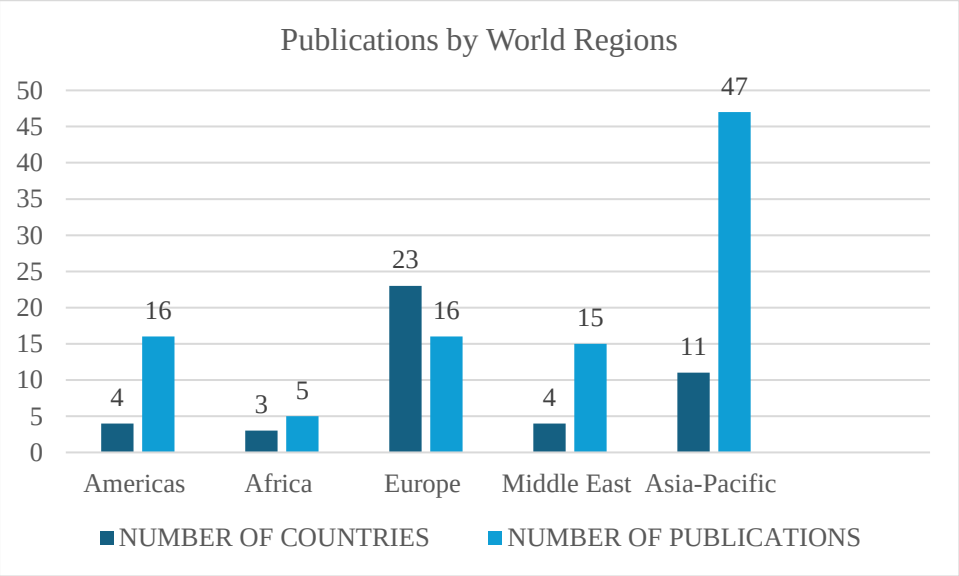
Rank	Name of country	Documents	Citations
1.	China	14	1084
2.	India	9	860
3.	Australia	7	704
4.	Canada	7	694
5.	Malaysia	7	634

6.	Spain	7	580
7.	Taiwan	6	576
8.	UAE	7	397
9.	USA	7	298
10.	Saudi Arabia	7	224

4.3 Quantitative analysis of regions

The study conducted a detailed analysis to gain more insight into which geographical regions conduct more research on AI and QA in Odel, and the results are presented in Figure 2. The results show that the Asia Pacific region is most engaged in AI and QA research in ODeL, followed by Europe, the Americas, and the Middle East. The results also reveal that Africa is the last region studied for AI and QA in ODeL.

Figure 2: Publications by World Regions



4.4 Quantitative Analysis of Journals.

Journals are the primary vehicle for publishing research results. The present study, therefore, analyzed the top ten journals that published results on AI and QA in OdeL and calculated the average number of citations per year. The results of the analysis are presented in Table 5. The results show that the Journal of Artificial Intelligence is the most influential journal that contains research results on AI and QA in OdeL, followed by the International Journal of Educational Technology in Higher Education, Education and Information Technologies , and Interactive Learning Environments

Table 5: Top 10 journals publishing in Artificial intelligence and Quality assurance.

Rank	Name of journal	Publisher	Citations per Year
1.	Journal of Artificial Intelligence	Degipark	789
2.	International Journal of Educational Technology in Higher Education	Springer	321.6
3.	Education and Information Technologies	Springer	184
4.	Interactive Learning Environments	Taylor and Francis	179
5.	Journal of Education Technology in Education	Springer	142
6.	Computers and Education: Artificial Intelligence	Elsevier	139
7.	Education Sciences	MDPI	137
8.	AI and Ethics	Springer	120.5
9.	Procedia Computer Science	Elsevier	88.67
10.	International Journal of Innovation Studies	Elsevier	66.75

4.5 Quantitative Analysis: Top 10 Influential Articles and their essential contributions.

Several metrics can be used to measure an article's influence. One way to determine this is by using the number of times an article is cited. This metric indicates the number of times other papers cited a published article. Table 6 indicates the top ten (10) influential articles, and the number of times other published papers have cited them. The results of the analysis presented in Table 10 show that the article by Chen, L., Chen, et al. (2020), Artificial Intelligence in Education: A Review, is the most influential article with 2037 citation counts, followed by an article by Baidoo-Anu, & Ansah, (2023), Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning, with 1641 counts and Chen, et al. (2020), Application and theory gaps during the rise of artificial intelligence in education, with 677 citation counts.

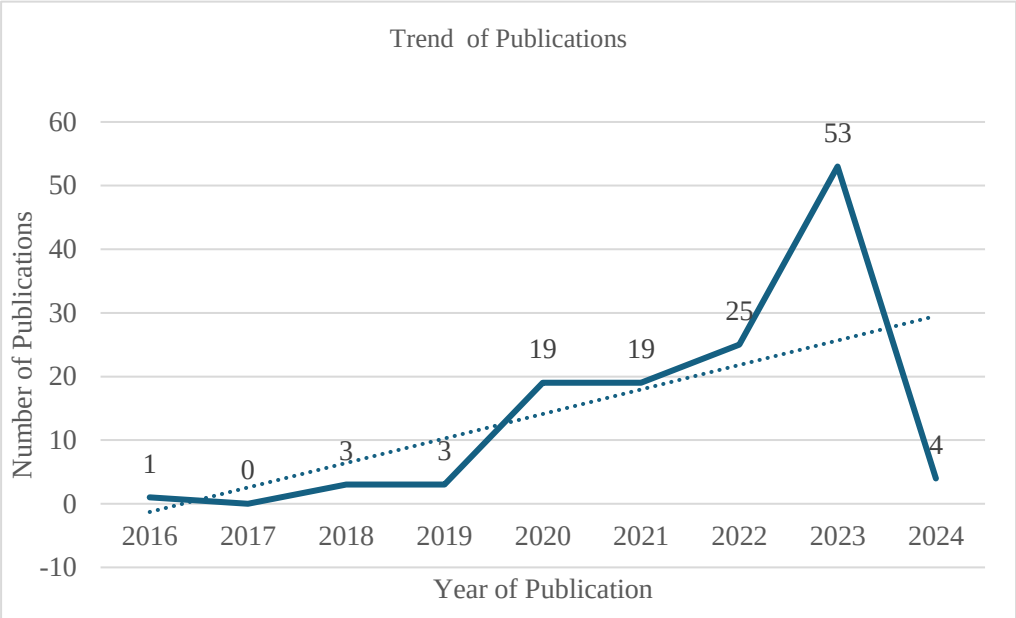
Table 6 Top 10 Influential Articles and their essential contributions.

Rank	Author(s)	Title of Article	Times Cited Count
1	Chen, L., Chen, P., & Lin, Z. (2020).	Artificial intelligence in education: A review	2037
2	Baidoo-Anu, D., & Ansah, L. O. (2023).	Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning	1641
3	Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020).	Application and theory gaps during the rise of artificial intelligence in education	677
4	Ouyang, F., Zheng, L., & Jiao, P. (2022).	Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020	545
5	Guan, C., Mou, J., & Jiang, Z. (2020).	Artificial intelligence innovation in education: A twenty-year data-driven historical analysis	406
6	Chiu, T. K., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023)	Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education	398
7	Luan, H., Geczy, P., Lai, H., Gobert, J., Yang, S. J., Ogata, H., ... & Tsai, C. C. (2020).	Challenges and future directions of big data and artificial intelligence in education	396
8	Tang, K. Y., Chang, C. Y., & Hwang, G. J. (2023).	Trends in artificial intelligence-supported e-learning: A systematic review and co-citation network analysis (1998–2019).	270
9	Kuleto, V., Ilić, M., Dumangiu, M., Ranković, M., Martins, O.M., Păun,	Exploring opportunities and challenges of artificial intelligence and machine learning in higher education institutions	263
10	Bahroun, Z., Anane, C., Ahmed, V., & Zacca, A. (2023).	Transforming education: A comprehensive review of generative artificial intelligence in educational settings through bibliometric and content analysis	208

4.6 Trend analysis

Figure 3 shows the number of papers on Artificial intelligence and Quality assurance in education between 2016 and 2024. The graph shows that the number of publications rose around 2017 and peaked in 2024. These results support the findings of Munir et al. (2022), who found that the use of AI in digital education after 2015 is becoming more prominent as more and more researchers are attracted to conducting studies to explore the potential of AI/ML in education.

Figure 3: Trend analysis of publications in AI and Quality Assurance



4.7 Quantitative Analysis of Most Frequently Used Words.

Bibliometric analysis was further conducted using additional data such as frequently used words in the title and words frequently used in abstracts. The results are summarised in Table 7. The Table shows the top 10 words used in the title and the top 10 frequently used in the abstract. The most used words in the titles are systematic reviews, challenges and opportunities, potential benefits, and bibliometric analysis. This indicates that most of the studies conducted were mainly reviews of the impact of AI, its challenges, and opportunities. It also shows that the reviews were conducted mainly through bibliometric analysis. The table also shows that the reviews focussed on online learning, distance learning, and the effect of quality assurance.

Table 7: The most frequently used words.

The Most Frequently Used Words in Titles				The Most Frequently Used Words in Abstracts		
No	Word	Frequency		No	Word	Frequency
1	Systematic review	33		1	Online learning	40
2	Review	24		2	Quality assurance	25
3	Challenges and opportunities	18		3	Distance learning	18
4	Potential benefits	10		4	Moocs	15
5	Bibliometric analysis	9		5	Online courses	14
6	Application	8		6	Digital technologies	13
7	Impact	7		7	Teaching and learning	12
8	Assessment	6		8	Machine learning	9
9	Emerging trends	6		9	Personalized learning	6
10	Transformation	4		10	AI Applications	4

4.8 Bibliometric Analysis

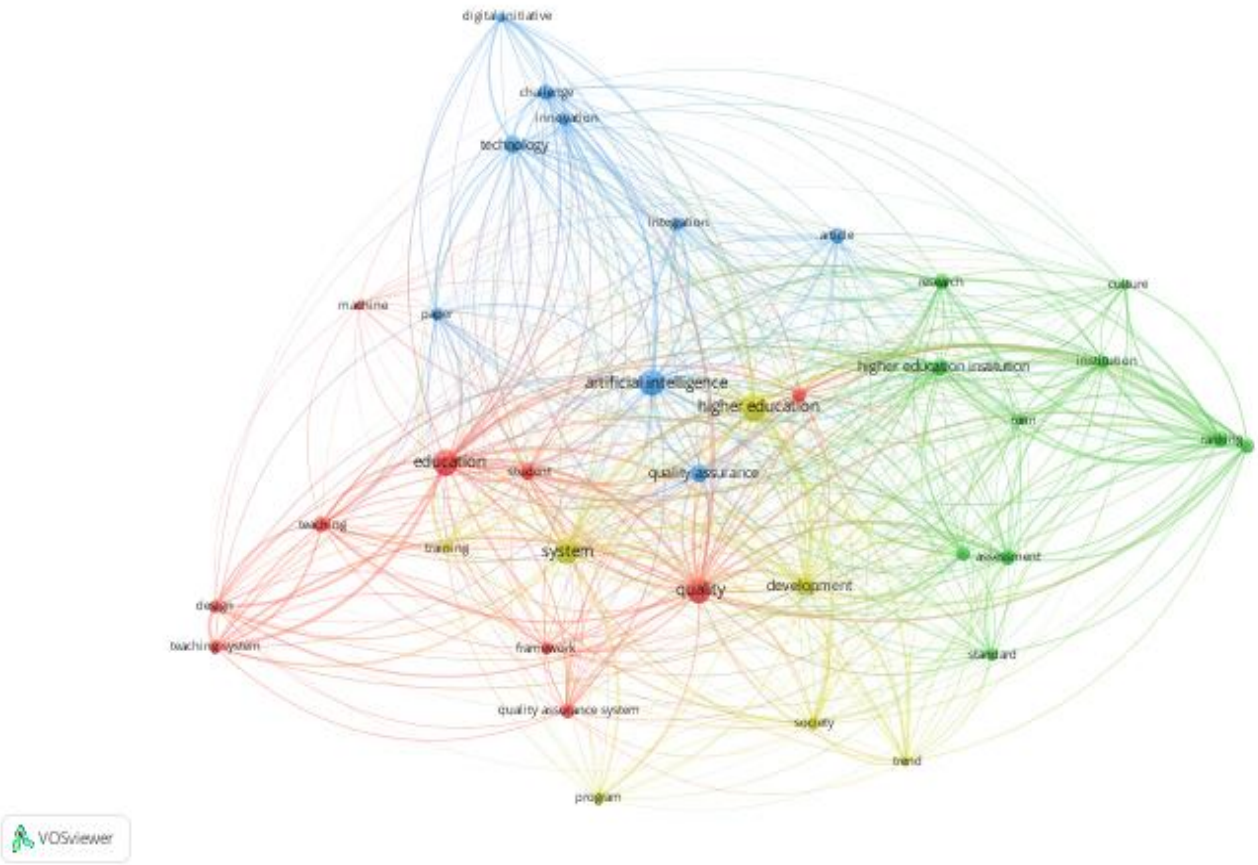
Bibliometric analysis is a popular but rigorous technique applied in systematic literature review to explore and analyse large volumes of data. According to Donthu et al.(2021), it enables the researcher to unpack evolutionary nuances of a specific field while elucidating on emerging areas in the field of study. This study used VosViewer software to analyze bibliometric networks by creating network visualizations and density maps. The results of the bibliometric analysis included the Keyword occurrence analysis, Co-Citation Network Visualization, and density visualisation maps.

4.8.1 Network visualization for Keyword Occurrence analysis

The keyword Occurrence analysis is a famous platform used in bibliometric analysis to reveal core research topics (Phoong et al., 2022). In this study, the analysis was conducted using 1963 words to reveal the research hotspots or themes in the AI and QA in Open and Distance learning education. To identify the essential keywords' co-occurrence, the minimum frequency was limited to 10 words, which resulted in 32 words used in the visual analysis. Figure 4 shows the keyword's co-occurrence network visualization. The figure shows that the

top ten co-occurring keywords were system with 11 occurrences, followed by University(11 occurrences), Integration((10), Data(9), Student(8), Assessment(8), Challenges(7), and implementation with six (6) occurrences.

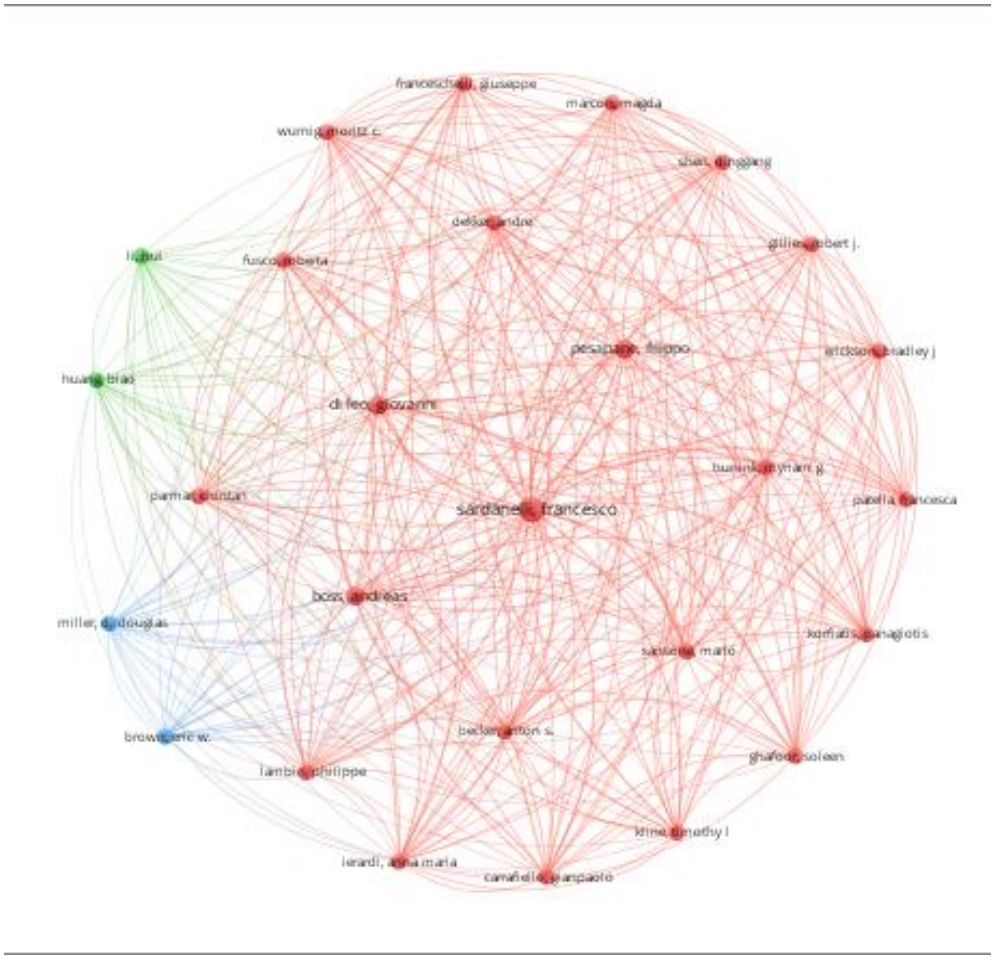
Figure 4: Network Visualization for Keyword Analysis: Source (VosViewer)



4.8.2 Co-Citation Network Visualization.

Citation analysis refers to the link between two studies cited by the same study (Vaneck and Waltman, (2022). It is the most reflective and standard tool for identifying studies of central importance in scientific research in a specific field(Mei et al.). Co-citation analysis established relationships between authors based on their co-cited times. Authors were included if the minimum number of citations exceeded one. The analysis included only authors with more than two citations. The result of the analysis yielded only 32 authors who met the threshold. The results in Figure 5 reveal that The top five authors highly cited were Chen, Tsong Yueh(7 citations), Sandel, Francesco (5 citations), Zhou, Zhi, Guan(5 citations Towe, Dove(4 citations), and Pessapane, Fillipo with three citations.

Figure 5 Overlay visualization of co-citation by authors: Source (VosViewer)

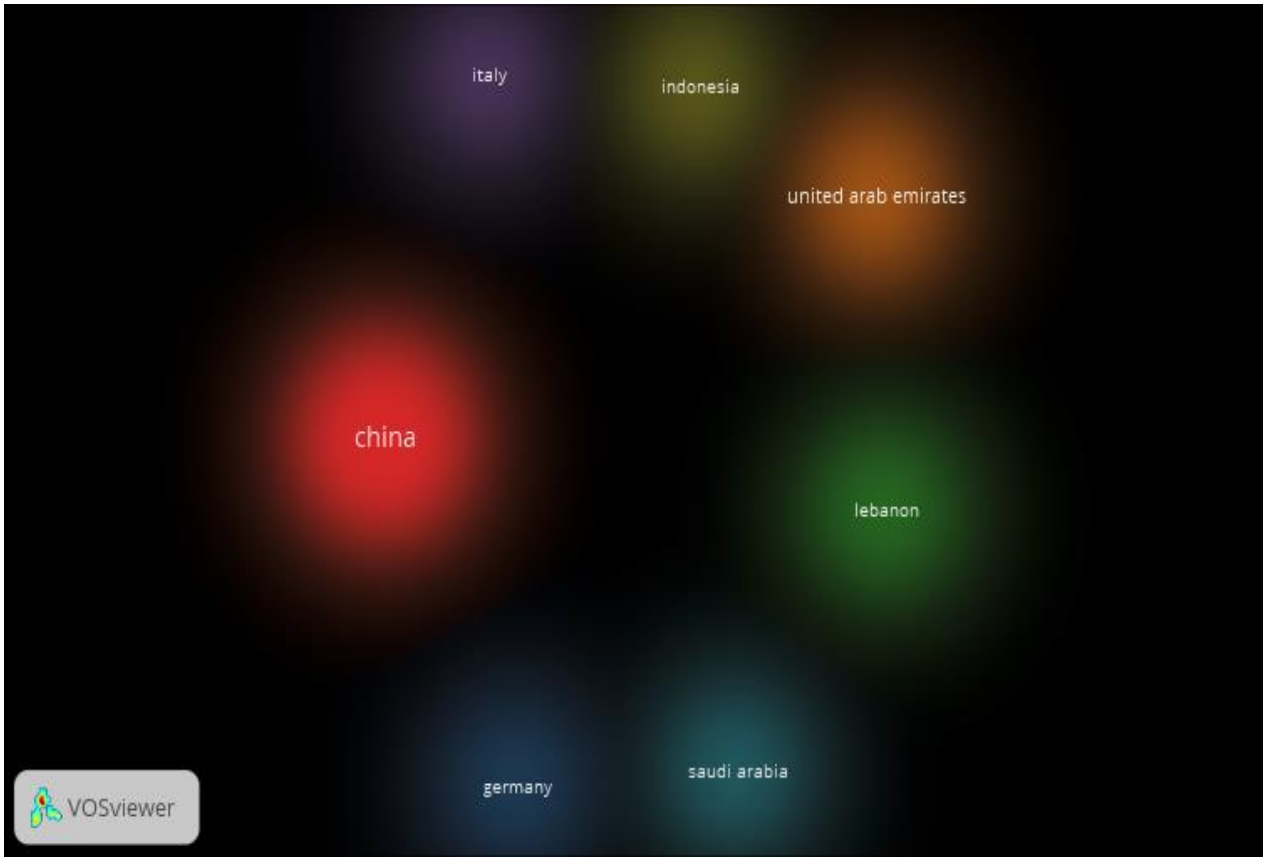


4.8.3 Density Visualisation Co-Authorship by Countries

A density visualization map was used to visualize patterns of several geographic locations by using color gradients based on the concentration of geographical data. The density visualization maps were generated using Vos Viewer, which is regarded as a powerful tool for data visualization in mapping text data and analyzing text networks in various fields (Bukar et al., 2023). Countries' co-authorship networks were mapped using the total strength of the individual country's links with other countries. The strength represents collaboration strength, while the node size represents collaboration clusters. In this study, density mapping was generated, and density visualization was represented by the colour label for the density of a particular point. Figure 6 presents a density visualization map of authorship by country. Authors within the same country were clustered together using the same color. The map was created with at least 17 countries, from which seven major clusters were created. The

clusters are led by Italy with 463 citations followed by China with 35, then Germany (30 citations), Tanzania (26 citations), Saudi Arabia (23), and. the United Arab Emirates with13 citations.

Figure 6: Co-Authorship by Countries: Source (Vos Viewer)



5 Conclusions and Recommendations

Based on the analysis of the systematic literature review, the following conclusions and recommendations were observed:

This research study used bibliometrics to assess the adoption and use of artificial intelligence platforms to enhance the quality of higher education institutions' core literature over ten years. Other research approaches could be applied in the future to complement the results of this study. It is also concluded that although the use of the Goggle Scholar database was convenient in providing publications needed for this study, advanced databases such as Scopus should be considered in the future to enhance the quality of the findings.

The study also concludes that European countries are leading research on AI and quality assurance in distance learning. However, the more extensive output of research publications is from the Asia Pacific region. Given this scenario, there is a need for more scholarly work on AI and QA in OdeL from the African continent. It is also concluded that most studies on Artificial intelligence and Quality assurance focus largely on challenges and opportunities. In the future, more studies should focus on new AI platforms that support teaching and learning in Open and Distance e-Learning environments and their impact on the quality of teaching and learning. The attention to the use of AI in higher education is more focused on online learning, particularly MOOCs and online courses.

The study concludes that most research concentrated on AI's opportunities and challenges. Against this backdrop, more research should be undertaken on AI systems that could enhance the quality of teaching and learning in open and distance e Learning.

The study concludes that despite a comprehensive systematic review of the subject matter under investigation, manual sorting of data to augment the shortcomings of the open software could have excluded and overlooked some relevant articles.

6. Ongoing Research Themes and Future Perspectives

Based on the study outcomes and impressions gained through the review of publications, the study identified the following themes as pivotal to contemporary research on AI in Open and Distance education. These are Adaptive and Personalised learning in Open and Distance e Learning and the application of AI Ethics in Open and Distance Learning. In the future, the study proposes that studies should focus more on evaluating the implementation of AI in both formative and summative assessments and using AI in developing learning materials for a distance learner.

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