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Artificial Intelligence (AI) as a Tool to Address Academic Challenges in South African Higher Education

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Abstract. This systematic literature review (SLR) study explores artificial intelligence (AI) as a tool to address academics challenges in South African higher education. Numerous difficulties beset higher education system in South Africa, such as a lack of funding, high student-to-lecturer ratios, and unequal access to high-quality education. Relevant academic databases, such as PubMed, Google Scholar, ERIC, and Web of Science, was searched using a combination of keywords relating to South African higher education, AI in education, academic issues, and AI technologies. A total of twenty (20) documents were identified and used in this study. The examination looks at how AI is currently being used, how it affects how people teach and learn, and the opportunities and challenges that come with using it in this setting. The results show that artificial intelligence (AI) technologies, including automated assessment tools, intelligent tutoring systems, and adaptive learning platforms, have the potential to improve personalized learning experiences, boost student engagement and academic performance, and facilitate effective management of educational resources. However, overcoming several issues, such as a lack of technological know-how, restricted infrastructure, concerns about equity, and ethical implications is necessary for the successful integration of AI in South African higher education. It encourages educators, politicians, and technology experts to work together to establish long-term solutions for incorporating AI into teaching and learning processes while maintaining inclusivity, equity and ethical issues.

Keywords: Artificial Intelligence; Higher Education; South Africa; Technologies; Teaching and Learning

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1. Introduction

South African higher education faces a slew of obstacles that impede the delivery of high-quality teaching and learning experiences. These issues include insufficient resources, overcrowded classrooms, and regional differences in access to education. Education institutes globally are faced with some challenges (Keku, Asabea, Adu, Kodua, Patterson, Adu-Gyamfi & Aninakwa, 2022) and the South African system is not exempted. In the past few years, people have become really fascinated about possibilities of artificial intelligence (AI) as a tool for addressing these issues and improving the efficacy and productivity of teaching and learning processes (Malik et al., 2019). According to Chukwuere (2017), the South African educational system in the postcolonial era continues to transform through digitalisation. Technology is becoming a transforming agent in Africa (Uzomah, Isanbor & Uzomah, 2023). Artificial intelligence encompasses the advancement of intelligent computer systems capable of executing tasks typically reliant on human intelligence like learning, tackling problems, and making decisions (Borges et al., 2021). AI technologies have a lot of different uses in higher education, including assessment tools, adaptive educational platforms, automated assessment, as well as data analytics for educational insights (Chen et al., 2020). By personalizing lessons, boosting student involvement, automating administrative processes, and giving real-time feedback and support, these technologies have the potential to revolutionize education.

Using AI-powered adaptive learning platforms, for example, educators can modify instructional content and resources to individual student needs, supporting individualized learning experiences (Davies et al., 2021). AI can also assist in overcoming the issues of limited faculty capacity and high student-to-teacher ratios by providing virtual tutoring and support, allowing students to access educational resources and guidance from a distance. Furthermore, AI technologies enable the gathering and processing of vast quantities of educational data, which can then be used to guide evidence-based decision-making, improve curriculum design, and identify at-risk kids who may require additional assistance. Institutions can optimize resource allocation, identify areas for improvement, and execute tailored interventions to boost student success by harnessing these findings.

However, incorporating AI into South African higher education is not without difficulties. Significant challenges to wider adoption include a lack of infrastructure, unequal access to technology, and worries about data privacy and ethics. Furthermore, there is a need to guarantee that to ensure that artificial intelligence tools are created and implemented in a fair fashion egalitarian, and culturally sensitive manner, considering the varied educational contexts and issues experienced by South African students (Borges et al., 2021). This SLR investigates the present status of research on AI as a tool for addressing academic challenges faced by the HEIs in South Africa. This review explores the possible benefits, constraints, and opportunities related to the application of AI technologies. Finally, the findings of this SLR will help to establish informed plans and suggestions for effective implementation of AI technologies within the

context of South African HEIs, allowing universities to overcome hurdles and improve educational outcomes for all students.

1.1 Background of the study

South African HEIs encounter several obstacles in providing students with high-quality teaching and learning experiences. A complex collection of issues, including limited resources, huge class sizes, inequality in access to education, and the need to serve different student groups with varying learning requirements, shape these challenges (Singh & Thurman, 2019). South Africa, like many other countries, recognizes AI's disruptive potential in a variety of fields, including education. AI can give novel answers to long-standing issues confronting higher education institutions, such as the need to expand educational resources, boost student engagement, and create tailored learning experiences. Educators may supplement their teaching methods, optimize administrative operations, and obtain vital insights into student performance and progress by employing AI tools and applications.

AI technologies for teaching and learning in higher education have numerous uses. Intelligent tutoring systems can deliver tailored instruction by responding to the demands and learning styles of individual students. Adaptive learning platforms can dynamically adjust material and resources to improve student learning experiences (Davies et al., 2021). Automated assessment systems can help to streamline grading operations and provide students with fast feedback (Chen et al., 2020). Data analytics can produce actionable insights that can be used to inform instructional decisions and student support actions. Nonetheless, despite the potential benefits, integrating AI in South African higher education confronts several hurdles. Infrastructure constraints, particularly in resource-constrained places, may stymie AI technology uptake and utilization. The disparity in digital access, characterized by unequal availability of technology and internet connectivity creates impediments to equitable implementation (Luttrell et al., 2020). Furthermore, concerns about data privacy, security, and ethical issues surrounding AI use must be carefully addressed to develop trust and assure responsible adoption.

Given the importance of higher education in driving growth to the economy, social mobility, also, in solving societal concerns, an examination of the current level of research on AI as a tool to address academic challenges in South African higher education is of paramount importance. This study consolidates existing knowledge and provide insights into the potential benefits, constraints, and opportunities related with AI integration in this setting by undertaking a systematic literature review (SLR). The study's findings can help policymakers, educators, and stakeholders build informed strategies and suggestions for the effective and fair adoption of AI in the context of HEIs in South Africa. HEIs can use AI technologies to overcome existing restrictions, improve educational outcomes, and ensure inclusive access to excellent education for all students by addressing the stated difficulties and capitalizing on the potential.

1.2 Problem statement

Numerous problems impede the delivery of high-quality academic experiences in South Africa's HEIs. Limited resources, high student-to-teacher ratios, inequality in access to education, and the need to cater to different student groups are among the obstacles (Landa et al., 2021). Addressing these issues is critical for ensuring equitable access to high-quality education and improving academic achievements for all children. While there is rising interest in using artificial intelligence (AI) as a tool to solve these teaching and learning difficulties, there is a shortage of complete comprehension on the way whereby AI can be effectively implemented in South African HEIs. Existing research on AI in education primarily focuses on global contexts, with few studies particularly addressing its use and impact in South African higher education (Ferguson et al., 2019).

With reference to the above narrative, the question is, how can the integration of AI technologies address academic challenges in South African HEIs? This study attempts to fill that knowledge gap by carrying out a systematic literature review and integrating current research to present information regarding the possibilities of AI in HEIs. A rigorous examination on the present status research status and practical uses of artificial intelligence in this setting is required to influence decision-making, policy formulation, and educational practices (Malik et al., 2019). The outcomes of this research will enhance the body of knowledge concerning AI in higher education in South Africa, contribute to formulation of policy, enlighten decision-making, and provide practical recommendations for the successful integration of AI technology by addressing this issue. Finally, the goal of this research is to improve teaching and learning techniques, increase equity, and improve educational results for South African higher education students.

1.3 Research objectives and questions

1.3.1 Research objectives

The objectives of this study are to determine and examine the challenges impeding good academic experiences in the South African Higher sector today. In addition, the goal is to explore how Artificial Intelligence (AI) technologies could address specific academic difficulties in South African higher education. Lasty, the study explores and offers solutions for utilising AI tools to address academic difficulties in the South African higher education. These objectives will address the following research questions:

1.3.2 Research questions

1) What are the challenges confronting South African HEIs in the current age?
2) What AI tools can address academic challenges in South African HEIs?
3) How can AI tools be used to address academic challenges in South African HEIs?

This research intends to provide an understanding towards the prospects of AI in tackling academic difficulties in South African HEIs by addressing these research objectives and questions with pertinent references. The findings of this study can be integrated towards influencing decision-making, assisting policy development, and provide practical recommendations for the successful implementation of AI tools to enhance academic experiences in South Africa.

2. Literature Review

2.1 Teaching and learning in South African HEIs

A combination of historical, social, and economic forces defines the landscape of education in South African HEIs. The legacy of apartheid-era practices has had a significant impact on educational access and quality in the country (Gumede, 2020). Higher education was largely segregated during the apartheid era, with little options for black students to pursue tertiary education (Gumede, 2020). Obstacles to ensuring equitable access and improving the value of teaching and learning experiences exist (Parker et al., 2020). Inadequate financial resources, insufficient infrastructure, and huge class numbers continue to be obstacles to effective instruction (Parker et al., 2020).

Furthermore, the heterogeneous student population in South African higher education provides additional complications for educators due to variances in language, socioeconomic background, and educational readiness. The necessity to provide inclusive and culturally responsive teaching methodologies adds to instructors' problems in fulfilling students' different learning demands (Singh & Thurman, 2019). Given that South Africa is a multicultural society, it would be ideal for HEIs to tailor-make AI technologies to fit this diversity in languages and cultural landscape.

2.2 The challenges confronting South African HEIs in the current age

South African Higher Education Institutions face numerous challenges that impede their ability to deliver quality education and maintain operational efficiency. Several of the challenges are outlined below.

a) Limited financial resources: HEIs in South Africa face limited financial resources, which limits faculty recruitment and development as well as facilities and learning resources (Zano, 2020). Inadequate financing impedes efforts to offer ideal teaching and learning environments, negatively impacting the quality of education provided to pupils.

b) High student-to-lecturer ratios: In South African higher education institutions, high student-to-teacher ratios pose obstacles for customized instruction and student support (van de Werfhorst et al., 2020). Large class sizes make it harder for teachers to deliver individualized attention, perhaps resulting in gaps in learner engagement and learning.

c) Access to quality education is inequitable: Despite greater access to HEIs, inequities in access and opportunities persist, notably along racial and socioeconomic lines (Parker et al., 2020). Unequal allocation of resources and educational opportunities exacerbates inequities, preventing equitable educational outcomes from being achieved (Gumede, 2020).

d) Language barriers: South Africa's multilingualism provides language obstacles in teaching and learning. English remains the dominating language of teaching in higher education, possibly disadvantageous to students who do

not speak English as their first language (Zano, 2020). Language challenges can impede effective communication, comprehension, and learning engagement (Granger & Lefer, 2020). AI integration into SA HEIs should be tailored to fit the linguistic and multicultural landscape.

e) Uneven access to technology and internet connectivity, especially in rural and underprivileged areas, causes a digital gap that inhibits students' ability to engage with online resources, digital learning platforms, and educational technologies (Parker et al., 2020). This difference exacerbates educational inequities.

Finally, due to historical injustices, limited resources, and diverse student populations, learning and teaching in South African higher education face considerable obstacles. Addressing these issues is critical to ensuring equitable access to high-quality education for all kids. The incorporation of AI technologies possesses the capability to enhance academic processes, as well as, overcome these problems. The sections that follow will investigate the role of AI as a tool for addressing highlighted difficulties and improving academic outcomes in South African HEIs.

2.3 AI tools used in South African HEIs

Artificial intelligence (AI) tools are being recognized as viable answers to academic difficulties in South African higher education (Malik et al., 2019). These tools include a wide range of apps that help improve teaching techniques, encourage personalised learning experiences, and simplify administrative procedures. The following are some examples of AI tools used in South African HEIs for teaching and learning:

a) Intelligent Tutoring Systems (ITS): ITS implores AI algorithms to make available tailored teaching, as well as support to students. These systems tailor learning content and pace to achieve each student's unique requirement, also, providing customized feedback, and coaching (Zhang & Aslan, 2021). Learning gaps can be handled more successfully by personalizing education to each student's knowledge level, increasing student engagement and performance.

b) Adaptive learning platforms: use AI to dynamically change the information and resources offered to according to their academic accomplishment and learning style (Davies et al., 2021). These platforms leverage data analytics to identify each student's areas of strength and weakness, allowing for personalized learning paths. By delivering individualized training and encouraging self-directed learning, adaptive learning systems can improve learning results.

c) Automated grading and assessment tools: AI-based automated grading and assessment technologies can streamline the evaluation process, decreasing the burden on instructors and providing students with quick feedback (Mousavinasab et al., 2021). Machine learning algorithms are used in these applications to analyse student replies and generate objective judgments

(Mousavinasab et al., 2021). Instructors can save time by using automated assessment systems, allowing them to focus on delivering targeted support to students.

d) Data analytics for educational insights: AI-powered data analytics solutions enable instructors to evaluate massive volumes of educational data and obtain relevant insights. These insights can help teachers make better instructional decisions, identify at-risk pupils, and implement evidence-based interventions (Zhang & Aslan, 2021). AI analytics can help universities optimize resource allocation, discover effective teaching tactics, and improve student support mechanisms.

2.4 The application of AI tools in addressing academic challenges in South African HEIs

Making use of AI tools can overcome previously recognized difficulties while also increasing teaching and learning results. The following are significant ways in which AI techniques can help to address these issues:

a) Intelligent Tutoring Systems: Artificial intelligence (AI) solutions such as intelligent systems for tutoring and customised learning platforms provide personalized training suited to specific student needs (Kurni et al., 2023). These technologies assist students in overcoming learning gaps and engaging with material in a way that meets their learning preferences by altering content, pace, and instructional tactics (Chen et al., 2020). According to online tutoring through intelligence tutoring systems will modify educational landscape (Krishnan, 2021) and specifically in South Africa.

b) Gamification components: Through interactive and immersive learning experiences, AI systems can encourage active student involvement. Gamification components and virtual reality simulations, for example, combined into AI tools can boost student enthusiasm and participation (Mousavinasab et al., 2021). Increased involvement leads to improved knowledge and skill retention.

c) Automated Grading and Assessment Systems: AI solutions, notably automated grading and assessment systems, can improve resource management by automating typical administrative chores (Chen et al., 2020). This frees up educators' time to focus on developing successful educational tactics and providing students with personalised support.

d) AI Analytics: The use of AI-powered analytics and insights based on data in education can inform evidence-based decision-making (Alam, 2021). Educators can discover areas for improvement, provide targeted interventions, and improve curriculum design by examining data on student performance, engagement, and learning patterns.

While AI tools provide intriguing solutions, their successful deployment in South African higher education necessitates resolving specific contextual constraints. These limitations include inadequate infrastructure, access to technology, and

assuring equitable deployment of AI technologies to overcome the digital divide (Luttrell et al., 2020). Furthermore, ethical considerations, data privacy, and the requirement for inclusive practices must be carefully addressed to enable the appropriate and equitable use of AI tools in universities.

In conclusion, using AI tools in South African HEIs could address issues, personalize instruction, increase student involvement, and optimize resource management (Malik et al., 2019). Institutions may improve teaching and learning results, promote inclusion, and empower students to succeed in the quickly evolving digital world by properly integrating AI technologies and tackling contextual problems.

3. Research methodology

Systematic literature review (SLR) was employed as a research strategy. An SLR is a thorough technique to gathering, evaluating, and synthesizing existing research on a certain issue (Chukwuere, 2022; Emojong' & Korir, 2022; Tranfield et al., 2003). It entails a systematic and clear procedure for identifying relevant literature, evaluating its quality, and extracting essential findings to address research questions. The SLR helps with current information on a research focus area, as well as give clarity on future paths to research (Kunisch, 2018). The SLR technique helped the researcher towards a thorough understanding of the missing research areas, as well as addressing the questions in the current literature.

This research utilized the preferred reporting items for systematic review and meta-analysis (PRISMA) within the field of AI as a tool to address academic challenges in South African higher education. The technique was considered relevant for the research as it enabled the researcher to give a comprehensive review of the available literature concerning the application of AI technologies to address academic difficulties in South African higher education. Furthermore, when compared to other traditional research methods, the SLR is regarded as the most practicable research method when it comes to transparency (Aarseth et al., 2017).

3.1 Search Strategy

The literature employed in this study made use of a systematic search technique ensure the SLR's thoroughness and rigor. Relevant academic databases, such as PubMed, Google Scholar, ERIC, and Web of Science, was searched using a combination of keywords relating to South African higher education, AI in education, academic issues, and AI technologies. Some search terms were used in searching for the literatures, they are as follows: "AI and Teaching and learning", "Teaching and learning challenges", "Artificial Intelligence", "South African higher education", and "AI tools in teaching and learning". The search was done in English language and the type of documents used are Journal articles, conference papers and book chapters. There was no time limit applied to this study. The search brought about a total of 65 documents which, after the completion of the search process, 27 duplicated documents emanating from the articles, book chapters and conference papers were discarded, leaving the researcher with a total number 38 usable documents.

Inclusion and Exclusion Criteria

In a bid to ensure that pertinent articles are included relating to this SLR, the researcher read through all the abstracts of the 38 papers and made sure that the studies matched the following inclusion criteria:

1) Published in respected conference proceedings or peer-reviewed publications.
2) These articles or conference proceedings were for the period 2020 to 2024 to ensure relevance because the area of AI is dynamic
3) Concentrate on South African higher education.
4) Address higher education's academic challenges.
5) Investigate the adoption of AI techniques or technology in teaching and learning environments.
6) The English Language was medium of communication in the studies selected for this paper

Studies that were categorised were omitted from this study. Out of the total of 38 research papers, 18 were deemed to be irrelevant towards this study, as such, were excluded from the study. Thorough verification was conducted by the researcher to reinforce assessment, making sure to avoid excluding relevant and articles that are non-related, also, reducing the number of articles. The following Table 1 displays the results of the search.

Table 1: Search results summary

Search Results	PubMed	Google Scholar	ERIC	Web of Science	Total no. of Publications	Total excluded from the current study	Total included in the current study
Conferences	3	7	3	2	15	12	3
Book Chapters	5	5	4	4	18	14	4
Journal Article	7	15	6	4	32	19	13
Total	15	27	13	10	65	45	20

3.2 Data Extraction, Quality Assessment and Analysis

Data extraction involved gathering relevant information from the included studies, such as study objectives, research methods, AI technologies utilized, findings, and limitations. To answer the study questions, the data were synthesized, and the synthesis involved comparing and contrasting findings from various studies as well as identifying patterns, trends, and gaps in the literature.

The retained 20 documents' quality and rigor was evaluated with the help of the six-question review created by Pitchforth et al., (2017). This evaluation aided in ensuring the findings' validity and reliability, also, to ascertain whether these documents satisfy the requirements for inclusion and exclusion for this study. A PRISMA component approach was initiated towards the process of applying the checklist. With the use of a "yes" or "no" score, the checklist evaluated the six-

study criteria, also, the researcher rigorously conducted the quality assessment and went on to further verify and reinforce the evaluation. The researcher arrived at a conclusion regarding the 20 documents by making use of the checklist that was created by Pitchforth et al., (2017). Table 2 below shows the quality assessment checklist:

Table 2: Quality Assessment criteria (Pitchforth et al., 2017)

Quality Assessment questions	Consensus
Q1 Are the objectives of the study properly identified?	Yes
Q2 Is the context of the study stated clearly?	Yes
Q3 Do the research methods back up the aims of the study?	Yes
Q4 Does the study possess an understandable description of the materials/scales employed?	Yes
Q5 Is there a precise statement of the findings?	Yes
Q6 Are the limitations of the study discussed properly and explicitly?	Yes

4. Results

A comprehensive analysis was conducted on a set of 20 documents in relation to AI as a tool to address academic challenges within higher education in South Africa were analysed using content analysis while making use of the procedures laid out by Jarvis et al., (2003) and Aarseth et al., (2017). The researcher thoroughly reviewed individual papers, and followed the procedure of going through each inclusion and exclusion criteria that was applied, and made use of relevant documents that fit in. However, studies that were not relevant to this study were omitted for the data analysis. These studies did not meet the inclusion criteria as stated above. The illustration in table 1 above highlights the information of every article that was found, used or excluded during the research process. They were indicated in the table 1 as "inclusion in the current study" and "Exclusion from the current study".

Based on AI as a tool to address academic challenges in South African higher education, articles with relation to the study were sourced by applying the SLR approach. There was further categorisation of each article based on the authors, title of the articles, strengths and weaknesses, enabling the researcher to pinpoint the important details that comprehends the research objectives of this study. The important details which were identified followed the SLR approach. As detailed in Table 3 below, the researcher did a thorough review and discussion on these important details, giving extensive insight and details.

Table 3: Categorisation of reviewed studies

Author	Title	The challenges confronting higher education in South Africa in the current age	What AI tools to address academic challenges in South African HEIs	How can AI tools be used to address academic challenges in South African HEIs?
Maphalala & Adigun, (2021).	Academics' Experience of Implementing E-Learning in a South African Higher Education Institution	Inequitable access, linguistic difficulties, and a varied student body	Automated Grading and Assessment Tools	Streamlining grading procedures, as well as delivering fast feedback
Gumede, (2020). (Moonasamy & Naidoo, 2022)	Higher Education in Post-apartheid South Africa: Challenges and Prospects	Disparities in access to quality education. Limited resources, high student-to-teacher ratios, inequality in access to education	Data Analytics for Educational Insights	Identifying at-risk students and implementing evidence-based interventions
Davies et al., (2021)	Personalization of e-learning process using ai-powered chatbot integration	Limited resources and diverse student needs	Adaptive Learning Platforms, Intelligent Tutoring Systems	Adapting material, personalizing education, and increasing student engagement
Malik et al., (2019)	An analysis of the role of artificial intelligence in education and teaching	Challenges and prospects for emerging countries	Chatbots powered by artificial intelligence and learning analytics	Improving student support and evaluating learning data
Luttrell et al., (2020)	The digital divide: Addressing artificial intelligence in communication education.	Digital divide, limited access to technology	Mobile Apps and Online Learning Platforms	Bridging the digital gap and fostering remote learning
Granger & Lefer, (2020).	The Multilingual Student Translation Corpus: a resource for translation	Language diversity and language barriers	AI Tutoring Systems that are Multilingual	Providing assistance to multilingual pupils and managing language barriers

	teaching and research			
Borges et al., (2021)	The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions	AI's educational applications and benefits	Various AI Tools	Individualized learning paths, personalization
Kurni et al., (2023)	Intelligent Tutoring Systems	Personalized learning and instructional design difficulties	Intelligent Tutoring Systems	Content adaptation, feedback, and self-directed learning support
Chen et al., (2020)	Artificial Intelligence in education: A review	The effect of AI on education, including opportunities and problems	AI Tools of Various Kinds	Data-driven decision-making and personalized learning

5. Discussion

This research explores application of AI as a tool to address academic challenges in South African HEIs while identifying and analysing themes using SLR (as classified in Table 3). In addition, Table 3, highlights the authors of studies that have made significant contributions to AI in the education sector. These are the studies that were selected and used in this paper because they satisfied the inclusion/exclusion criteria. The emphasized themes encompass the barriers and prospects of AI as a tool for teaching and learning in South African higher education, as well as solutions to these challenges. Based on the discovered themes and findings, implications for educational practice, policy, and further research will be investigated.

Academic difficulties in HEIs will be recognized and classified. The artificial intelligence methods utilized to solve these difficulties will be studied and their usefulness in higher education will be discussed. The analysis will emphasize the possible advantages and disadvantages of AI integration, as well as how these tools might be leveraged to improve educational experiences. The themes will address the primary research purpose of the study.

5.1 Theme 1: The challenges confronting South African HEIs in the current age

The objective is to identify and assess the major hurdles and impediments that educators and students encounter currently in South Africa. The exploration of this goal provides light on the complex and numerous issues that impede good academic experiences within HEIs in South Africa. In today's world, teaching and learning within HEIs encounter a slew of obstacles that hamper the delivery of high-quality education and student achievement. These issues include limited resources, high student-to-teacher ratios, inequality in access to education, and the need to cater to different student groups (Moonasamy & Naidoo, 2022). Singh

and Thurman (2019) emphasize the influence of low resources and inadequate facilities on higher education institutions' ability to provide quality learning experiences.

Gumede (2020) underlines the necessity of resolving inequities in access to high-quality education to guarantee that all children have equal opportunity. Furthermore, Van de Werfhost et al. (2020) emphasize the complications associated with embracing diversity in higher education, as well as the obstacles of fulfilling the unique demands of students from different backgrounds and various learning styles. While Granger and Lefer (2020) highlight the linguistic limitations encountered within South African higher education, where multilingualism might pose difficulties in effective communication and teaching. These issues pose significant barriers to providing inclusive and effective academic experiences in HEIs in South Africa. However, Mannay (2024) states that integrating AI technologies in higher education provides an avenue for enhancing teaching and learning experiences. This means that AI integration into the SA HEI environment should consider the linguistic and cultural diversity of the country. Multilingual tutoring systems will be imperative to solve linguistic challenges.

5.2 Theme 2: AI tools to address academic challenges in South African HEIs

The research objective of "What AI tools to address teaching and learning challenges in South African higher education?" is critical in identifying and understanding the specific technologies that can effectively handle the unique challenges encountered by South African educational institutions. The SLR presents a variety of AI tools that been employed to enhance instructional and educational processes in a variety of educational environments. Kurni et al., (2023) discusses how intelligent systems for tutoring and customised learning platforms are used to provide individualized training, adjust content to individual student needs, and increase student engagement.

Maphalala and Adigun, (2021) addresses the use of AI-based Automated Grading and Assessment Tools for speeding grading processes and providing students with fast feedback. Furthermore, Granger and Lefer (2020) highlight the importance of Natural Language Processing Tools in assisting multilingual students and enhancing language learning in South African higher education. Malik et al., (2019) research findings demonstrate the capabilities AI Chatbots and Learning Analytics to improve student support services and analyse learning data for evidence-based decision-making. These AI solutions have demonstrated promising outcomes in tackling difficulties related to teaching and learning and possess the capacity to improve South African higher education by fostering personalized, data-driven, and inclusive educational experiences. However, it is essential for higher education institutions to evaluate their students' individual requirements and circumstances when integrating these AI tools to ensure their effective deployment and meaningful impact.

5.3 Theme 3: How AI tools can be used to address academic challenges in South African HEIs

Exploring how AI tools can be utilized to solve academic difficulties in South African higher education is critical to discover novel ways for enhancing educational outcomes in the setting of limited resources and varied student populations. AI technologies provide opportunity to tailor instruction, improve resource management, and assist evidence-based decision-making, addressing issues such as high student-to-teacher ratios, unequal access to education, and language obstacles. Davies et al., (2021) demonstrate how intelligent systems for tutoring and customised learning platforms can be used to provide individualized learning experiences, adaptive content, and customised education for students based on their individual needs and learning speed.

Borges et al., (2021) examines the promise of AI-powered automated grading and assessment technologies for streamlining grading processes, providing timely feedback, and assisting educators in effectively managing huge class numbers. According to Granger and Lefer (2020), Multilingual AI Tutoring Systems play an important role in helping various student groups, overcoming language problems, and fostering inclusivity. These studies show that AI tools have the potential to transform South African higher education's teaching and learning, making it more effective, efficient, and inclusive, eventually improving educational quality (Funda & Piderit, 2024).

6. Recommendation and future study

The SLR findings give rise to several recommendations to improve the integration of AI tools in South African higher education. These recommendations may include:

1) Promoting faculty development and training to help them gain technical experience and abilities in using AI tools for teaching and learning. Ummi et al (2024) suggest that university instructors should adapt teaching strategies consistent with constructivist theories to enhance student engagements in academic subjects.
2) Addressing infrastructure constraints and the digital divide to enable fair access to artificial intelligence-powered educational materials and technologies. Infrastructure challenges could be mitigated by engaging in collaborative and partnership efforts. For example, some South African universities are partnering with universities in developed economies such as Belgium, Germany and the United States of America. In the process, students for SA HEIs visit and attend lectures at universities in these countries. Partnerships and collaborations cane lead to joint issuance of degrees between universities.

3) Conducting additional research and pilot studies to investigate specific implementation techniques and issues in various South African higher education institutions. There is still a lack of educational perspectives in AI in education as recent reviews have stressed (Chen et al., 2020). To reach the full potentials of AI in education, collaborative research focusing on AI technology

applications that may result in direct or indirect effects on learning outcomes in real educational settings is particularly vital.

4) Collaborating with educational institutions, policymakers, and AI professionals to develop new solutions to teaching and learning difficulties.

Future research can focus on specific topics such as the development of culturally appropriate AI tools, the ethical implications of AI integration, and the long-term impact of AI adoption on educational outcomes. Future reviews may extend the search scope to include other reputable databases, specialized journals, or peer-reviewed conference proceedings. Additional key words, such as specific AI technology (e.g., machine learning) or its educational applications may retrieve more relevant publications. However, future reviews should also be mindful of the search results, as sometimes publications on other topics, such as game-based learning also appear in the search result.

7. Implication of the study

The study's systematic literature review on "AI as a tool to address academic challenges in South African higher education" has numerous important implications. To begin, the findings highlight the ability of AI technology to alter South African higher education, addressing major obstacles such as limited resources, high student-to-teacher ratios, and inequality in access to education. Institutions may personalize education, optimize resource allocation, and provide evidence-based support for decision-making by employing AI solutions such as smart systems for tutoring and customised learning platforms technology, and AI-empowered Learning Analytics.

Secondly, the study emphasizes the necessity for specific implementation strategies to accommodate the distinctive setting of South African higher education, such as multilingualism and different student populations. Institutions may enable fair access to AI-powered educational materials by encouraging faculty development and tackling the digital gap. Furthermore, the study underlines the significance of ethical considerations, data privacy, and inclusion while implementing AI technologies.

Finally, the implications of this study can enlighten policymakers, educators, and stakeholders, allowing for evidence-based decision-making and strategic planning to improve educational methods in South African HEIs. The implications of the study contribute to nurturing excellent education, increasing equity, and enhancing educational outcomes for all students in South Africa by leveraging the revolutionary potential of AI.

8. Conclusion

This systematic literature analysis highlights the academic challenges faced by South African Higher Education Institutions (HEIs) and the promise of AI tools to overcome these challenges. The study emphasizes the opportunities that AI technology can provide for individualized learning experiences, effective resource management, and data-driven decision-making. These technologies

have the potential to transform educational practices by tailoring instruction to individual student needs and optimizing the allocation of resources. However, the analysis also shows the importance of addressing key issues such as infrastructure constraints, ethical concerns, and digital inequality to enable equitable AI inclusion. Without resolving these issues, the benefits of AI cannot be fully realized, and disparities in educational access and quality may be exacerbated. This systematic literature review's synthesis of prior research adds significantly to the body of knowledge on AI in South African higher education. By recognizing the benefits and challenges of AI integration, institutions can make informed decisions to improve teaching and learning methods. Ultimately, this will enhance educational outcomes for all students, ensuring that advancements in technology contribute positively to the academic landscape.

9. References

Aarseth, W., Ahola, T., Aaltonen, K., Økland, A., & Andersen, B. (2017). Project sustainability strategies: A systematic literature review. *International Journal of Project Management, 35*(6), 1071–1083. https://doi.org/10.1016/j.ijproman.2016.11.006

Alam, A. (2021). "Should Robots Replace Teachers? Mobilisation of AI and Learning Analytics in Education," International Conference on Advances in Computing, Communication, and Control (ICAC3), Mumbai, India, 2021, 1-12, https://doi.org/10.1109/ICAC353642.2021.9697300

Borges, A. F., Laurindo, F. J., Spínola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management, 57*, 102225. https://doi.org/10.1016/j.ijinfomgt.2020.102225

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *Ieee Access, 8,* 75264-75278. https://doi.org/10.1109/ACCESS.2020.2988510

Chen, X., Xie, H., Zou, D. & Hwang, G.J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education, Computers and Education: *Artifificial Intelligence*, 1(2020)100002: https://doi.org/10.1016/j.caeai.2020.100002

Chukwuere, J. E. (2022). Social media and COVID-19 pandemic: a systematic literature review. *Journal of African Films and Diaspora Studies*, *5*(1),5. https://doi.org/10.31920/2516-2713/2022/5n1a1

Chukwueren, J. (2017). From decolonisation to digitalisation of education in South Africa. *International Journal of Science and Research*, *73*(12/1). https://doi.org/10.21506/j.ponte.2017.12.15

Davies, J. N., Verovko, M., Verovko, O., & Solomakha, I. (2021). Personalization of e-learning process using ai-powered chatbot integration. In: Shkarlet, S., Morozov, A., Palagin, A. (eds) Mathematical Modeling and Simulation of Systems (MODS'2020). MODS 2020. *Advances in Intelligent Systems and Computing*, *1265*. Springer, Cham. https://doi.org/10.1007/978-3-030-58124-4_20.

Funda, V. & Piderit, R. (2024). A review of the application of artificial intelligence in South African Higher Education, Conference on Information Communications Technology and Society (ICTAS), Durban, South Africa, 44-50, https://doi.org/10.1109/ICTAS59620.2024.10507113

Emojong', O., & Korir, G. (2022). Important pillars in delivery of mass campaign messages to a target audience through earned media. *African Social Science and Humanities Journal*, *3*(1), 53-56. https://journals.jfppublishers.com/asshj

Ferguson, B. T., McKenzie, J., Dalton, E. M., & Lyner-Cleophas, M. (2019). Inclusion,universal design and universal design for learning in higher education: South Africa and the United States. *African Journal of Disability, 8*(1), 1-7. https:// https://doi.org/10.4102/ajod.v8i0.519

Granger, S., & Lefer, M. A. (2020). The Multilingual Student Translation corpus: a resource for translation teaching and research. *Language Resources and Evaluation, 54*(4), 1183-1199. https://doi.org/10.1007/s10579-020-09485-6

Gumede, V. (2020). Higher Education in Post-apartheid South Africa: Challenges and Prospects. Vusi Gumede Research and Publications. Retrieved from https://www.researchgate.net/publication/353946096_Higher_Education_in_Post-apartheid_South_Africa_Challenges_and_Prospects#fullTextFileContent (accessed 20 June 2024).

Jarvis, C.B., MacKenzie, S.B., & Podsakoff, P.M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research, 30*(2), 199–218. https://doi.org/10.1086/376806

Keku, E., Asabea, S., Adu, V., Kodua, A. S. A., Patterson, E., Adu-Gyamfi, E. E., Adade, P., & Aninakwa, P. (2022). The extent of self-reported impact of COVID-19 on daily academic activities and incomes among university students in Kumasi, Ghana. *African Social Science and Humanities Journal*, *3*(4), 129-136.https:// https://doi.org/10.57040/asshj.v3i4.269

Krishnan, U. (2021). The Industry 4.0 and its associated technologies. *Journal of Emerging Technologies*, *1*(1), 1-10. https://doi.org/10.57040/jet.v1i1.24

Kunisch, S., Menz, M., Bartunek, J.M., Cardinal, L.B., & Denyer, D. (2018). Feature topic at organizational research methods: How to conduct rigorous and impactful literature reviews? *Organizational Research Methods, 21*(3), 519–523. https://doi.org/10.1177/1094428118770750

Kurni, M., Mohammed, M. S., & Srinivasa, K. G. (2023). A beginner's guide to introduce artificial intelligence in teaching and learning. Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-031-32653-0

Landa, N., Zhou, S., & Marongwe, N. (2021). Education in emergencies: Lessons from COVID-19 in South Africa. *International Review of Education, 67*(1-2), 167-183. https://doi.org/10.1007/s11159-021-09903-z

Luttrell, R., Wallace, A., McCollough, C., & Lee, J. (2020). The digital divide: Addressing artificial intelligence in communication education. *Journalism & Mass Communication Educator, 75*(4), 470-482. https://doi.org/10.1177/1077695820925286

Malik, G., Tayal, D. K., & Vij, S. (2019). An analysis of the role of artificial intelligence in education and teaching. In *Recent Findings in Intelligent Computing Techniques: Proceedings of the 5th ICACNI 2017, 1*, 407-417. Springer Singapore. https://doi.org/10.1007/978-981-10-8639-7_42

Mannay, J.A. (2024). Integrating Artificial Intelligence(AI) in Language Teaching: Effectiveness, Challenges and Strategies, *International Journal of Learning, Teaching and Educational Research,* 23(2)2024:361-382: https://doi.org/10.26803/ijlter.23.9.19

Maphalala, M. C., & Adigun, O. T. (2021). Academics' Experience of Implementing E-Learning in a South African Higher Education Institution. *International Journal of Higher Education, 10*(1), 1-13. https:// doi:10.5430/ijhe.v10n1p1

Mousavinasab, E., Zarifsanaiey, N., R. Niakan Kalhori, S., Rakhshan, M., Keikha, L., & Ghazi Saeedi, M. (2021). Intelligent tutoring systems: a systematic review of

characteristics, applications, and evaluation methods. *Interactive Learning Environments, 29*(1), 142-163. https://doi.org/10.1080/10494820.2018.1558257

Moonasamy, R. A., & Naidoo, G. M. (2022). Digital Learning: Challenges experienced by South African university students' during the COVID-19 pandemic. *The Independent Journal of Teaching and Learning, 17*(2), 76-90. *On-line version* ISSN 2519-5670

Parker, R., Morris, K., & Hofmeyr, J. (2020). Education, inequality and innovation in the time of COVID-19. *JET Education Services*. Johannesburg, South Africa, 1–49. https://www.jet.org.za/resources/theme-9-final-july-2020-parker-et-al.pdf/@@download/file/Theme%209%20Final%20report%20Parker%20et%20al.pdf (accessed 06 August 2024).

Pitchforth, E., Nolte, E., Corbett, J., Miani, C., Winpenny, E., van Teijlingen, E., Elmore, N., King, S., Ball, S., Miler, J., & Ling, T. (2017). Community hospitals and their services in the NHS: identifying transferable learning from international developments –scoping review, systematic review, country reports and case studies. *NIHR Journals Library*, *5*, 1–220.https://doi.org/ 0.3310/hsdr05190

Segoe, B. A., & Bisschoff, T. (2019). Parental involvement as part of curriculum reform in South African schools: does it contribute to quality education?. *Africa Education Review*, *16*(6), 165-182. https://doi.org/10.1080/18146627.2018.1464692

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *American Journal of Distance Education, 33*(4), 289-306. https://doi.org/10.1080/08923647.2019.1663082

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Ummi, A., Chenshuai, W., Vijayaratnam, P., Rajanthran, S.K., Girija, V. & Ravindran, T. (20204). Exploring Teaching Strategies Used by University Instructors to enhance Engagement in Academic Subjects, *International Journal of Learning, Teaching and Educational Research,* 23(9):543-559: https://doi.org/10.26803/ijlter.23.9.27

Uzomah, M. M., Isanbor, P. O., & Uzomah, C. S. (2023). African tech development: The ideal and summit of contemporary African philosophy and literary studies. *African Social Science and Humanities Journal*, 4(1), 23-36.https://doi.org/10.57040/asshj.v4i1.351

van de Werfhorst, H., Kessenich, E., & Geven, S. (2020). The digital divide in online education. Inequality in digital preparedness of students and schools before the start of the COVID-19 pandemic. SocArXiv. https://doi.org/10.31235/osf.io/58d6p. (accessed 31 July 2024).

Zano, K. (2020). High school english foreign language teachers'perceptions related to multilingualism in a classroom: a case study. *Ponte International Journal of Science and Research, 76*(5). https://doi.org/10.15587/2519-4984.2022.257869

Zhang, K., & Aslan, A. B. (2021). AI technologies for education: Recent research & future directions. *Computers and Education: Artificial Intelligence, 2*, 100025. https://doi.org/10.1016/j.caeai.2021.100025