Real-World AI Systems

https://journals.cypedia.net/rwas

ARTICLE

The Contribution of Generative Artificial Intelligence to Higher Education in Mozambique

Sozinho Manjor [1] **, *Bruno Gonçalves*** [2*]

[1] *Faculdade de Educação e Comunicação, Universidade Católica de Moçambique (UCM), Nampula 3100, Mozambique*

[2] *Centro de Investigação em Educação Básica, Instituto Politécnico de Bragança Campus de Santa Apolónia, Bragança 5300-856, Portugal*

ABSTRACT

The rise of Generative Artificial Intelligence (GAI) is transforming the teaching and learning process, reshaping the traditional relationship between students and educators. Tools like ChatGPT enable real-time generation of texts, images, videos, and responses, fostering more personalized, interactive, and accessible learning experiences. However, alongside these benefits, significant challenges emerge—such as inaccuracies in generated content, student overreliance on AI, and a decline in critical thinking. Many learners tend to accept AI outputs uncritically, which may compromise learning quality. In this evolving educational landscape, educators are no longer faced with the choice of whether to use these tools, but rather how to integrate them ethically, responsibly, and pedagogically. This study aims to explore the role of GAI in higher education, examining its contributions to the teaching and learning process. A qualitative approach was adopted through a structured literature review. The research included peer-reviewed articles from databases such as Google Scholar, Scopus, SciELO, and Web of Science, as well as reports from international conferences. Findings indicate that GAI is increasingly used in higher education for academic writing, research support, audiovisual content creation, and independent study. The

*CORRESPONDING AUTHOR:

Bruno Goncalves, Centro de Investigação em Educação Básica, Instituto Politécnico de Bragança Campus de Santa Apolónia, Bragança 5300-856, Portugal; Email: bruno.goncalves@ipb.pt

ARTICLE INFO

Received: 21 April 2025 | Revised: 25 May 2025 | Accepted: 3 June 2025 | Published Online: 10 June 2025

DOI: https://doi.org/10.64797/rwas.v1i1.56

CITATION

Manjor, S., Goncalves, B., 2025. The Contribution of Generative Artificial Intelligence to Higher Education in Mozambique. Real-World AI Systems. 1(1): 57–66. DOI: https://doi.org/10.64797/rwas.v1i1.56

study concludes that, when guided by sound pedagogical practices, GAI can enhance learning by promoting autonomy, personalization, and engagement.

Keywords: Generative Artificial Intelligence; Higher Education; Personalized Learning; Educational Technology; Digital Ethics

1. Introduction

We live in a global context marked by rapid transformations that affect various dimensions of social life, with a particular impact on education. These changes are driven by the accelerated development of digital technologies, notably the exponential growth of Artificial Intelligence (AI), which is revolutionizing not only teaching and learning processes but also various sectors of society. The COVID-19 pandemic has further reinforced this scenario by driving the intensive use of AI to ensure the continuity of remote learning in the face of the closure of face-to-face educational institutions.

Generative Artificial Intelligence (GAI) has unleashed the acquisition and construction of knowledge in real time and in a very short period. This technology offers teachers and students the possibility of accessing information at any time and from any place, promoting not only the development of learning but also stimulating intellectual autonomy, or "learning to learn".

According to Harari (2019)[1] and Ngoenha (2022)[2], teachers who do not adapt to the digital context and do not reinvent themselves run the risk of becoming obsolete. Thus, the use of digital technologies, particularly GAI, is no longer an option but an unavoidable necessity in the current educational landscape. To ignore this reality means being excluded from a world of constant innovation.

In this sense, the framework of digital skills in IAG for teachers and students, highlight the emergence of a new pedagogical paradigm that reconfigures the traditional relationship between teacher and student, transforming it into a triangular relationship: teacher – IAG – student, Unesco (2024)[3].

The integration of AI into the teaching-learning process should not be seen as a matter of taste or preference, but as a matter of academic survival. This study is relevant in that it contributes to Mozambican academic literature in an area that is still largely unexplored in the national university context. It also aims to raise awareness among different educational actors of the importance of AI as an indispensable tool for improving the quality of education.

Generative Artificial Intelligence thus offers a chance for educational resilience, while at the same time posing significant challenges, especially in developing countries, requiring teachers to constantly reinvent themselves so that they do not remain on the sidelines of technological evolution.

This research aimed to understand the contribution of GAI to improving the quality of the teaching and learning process. The results obtained demonstrate that, when used ethically and responsibly, GAI makes a significant contribution to the transformation of higher education and other educational subsystems.

This article offers an original contribution by specifically exploring the role of generative artificial intelligence in higher education in Mozambique, a context that has been little addressed in the international literature. By gathering relevant evidence and analyzing emerging trends, the study proposes a critical reflection on the opportunities and challenges that this technology represents for Mozambican institutions, considering their socioeconomic, technological, and pedagogical realities.

The article is structured as follows: Section 1 introduces the topic and contextualizes the study; Section 2 presents a review of the relevant literature; Section 3 describes the methodological approach, including data collection and analysis procedures; Section 4 outlines the main results obtained from the literature review; and Section 5 provides final reflections, highlighting key conclusions and implications for educational practice.

2. Literature Review

2.1. Artificial Intelligence

The evolution and development of AI in recent years have profoundly impacted the way people think, act, relate,

and work, reconfiguring the world into two groups: those who are connected and those who are not connected, that is, excluded from the digital world.

According to Harari (2019); Kaufman (2018) and Ngoenha (2024)[1,4,5], AI can be understood as a symbiosis between humans and machines—the latter represented by computers programmed with software endowed with abilities, such as reasoning, learning, and problem solving. Thus, AI is conceived as an intelligent machine capable of performing tasks similar to those of humans.

In Kaufman (2018)[4] view, AI is "the symbiosis between man and machine connected to intelligent systems." He emphasizes that artificial intelligence is a field of knowledge that interconnects language, intelligence, reasoning, and learning, configuring itself as the engineering of the creation of intelligent computer programs that aim to make people's lives more flexible.

Currently, there are heated debates among technology experts about the possibility of these machines surpassing human thinking. Harari (2019)[1] answers affirmatively, highlighting two unique capabilities of AI: connectivity and constant improvement. Corroborating this view, Ngoenha (2024)[5], emphasizes that computers equipped with artificial intelligence can update themselves frequently to improve their performance.

Harari (2019)[1] , notes that AI not only replicates or surpasses human capabilities, but also has unique non-human abilities, making the difference between a human worker and an intelligent machine more than just a difference in degree.

In addition, technology provides access to a wide range of learning resources that extend beyond the classroom, enabling connections with experts and educators from around the world. In this sense, as Ngoenha (2024)[5] points out, technological development equips us with the skills and abilities to master the world and relate to each other differently, despite the great fears that this transformation provokes in society.

The growing development of Artificial Intelligence has gone beyond technical innovation to become a transformative force in how individuals think, interact, and access knowledge. By enabling machines to perform tasks traditionally associated with human cognition—such as reasoning, learning, and problem-solving—AI challenges conventional boundaries between human and machine intelligence. Authors such as Harari (2019), Kaufman (2018) and Ngoenha (2024)[1,4,5],highlight the distinctive features of AI, particularly its capacity for self-improvement and global connectivity, which not only replicate but also exceed human capabilities in certain domains. At the same time, this evolution has contributed to a widening divide between those with access to digital technologies and those without, reinforcing new forms of social exclusion. Within this context, AI must be understood not merely as a tool but as an agent reshaping how people relate to information, to one another, and the world. This perspective is crucial for analysing the role of Generative Artificial Intelligence in educational processes, particularly in fostering new possibilities and challenges for teaching and learning in higher education.

2.2. Generative Artificial Intelligence

Generative artificial intelligence (GAI) is currently one of the most widely used digital technologies that has the greatest impact on people due to its practical applicability in various sectors. Its ability to interact with users, produce content efficiently, and answer questions is creating a new educational paradigm that challenges both the role of teachers and educational institutions.

According to Unesco (2024)[3], GAI is understood as an artificial intelligence technological resource equipped with language to automatically generate information or pedagogical resources from commands written in an interface. Thus, GAI expands human capabilities in the execution of tasks and contributes to the acquisition of knowledge by students, in addition to the professional development of teachers.

Oliveira (2025)[6] points out that AI tools can solve complex problems that require planning skills previously exclusive to humans, as well as answer questions, write texts, describe and create images and videos. The existence of machines endowed with intelligence comparable to that of humans, capable of performing multiple tasks, represents a technological revolution of the 21st century.

According to Oliveira (2025)[6], the evolution of automated systems will increase the efficiency and speed of tasks such as report writing, analysis, brochures, advertisements, diagnostics, and image and video creation, gradually replacing human labor with these efficient systems. Harari

(2019)[1] corroborates this view, pointing out that the evolution of AI will not only remove many humans from the labor market but will also add and create new professions.

Several authors define artificial intelligence in different ways, but there is a consensus around two keywords that summarize these definitions: machine (computer) and intelligence.

The great AI revolution occurred in 2022, with the launch of tools such as Google Imagen (August), Stable Diffusion's Stability AI (August), and, by OpenAI, DALL-E (June), DALL-E 2 (September), and ChatGPT (November) (Santaella & Kaufman, 2024)[7].

These tools are transforming the way we think, act, work, and live. In education, they streamline the teaching and learning process and provoke a new way of thinking about education.

According to Santaella & Kaufman (2024)[7], AI can produce original content from large databases, making a significant and creative impact. Its practical applications include the automated and diversified generation of texts, posts, blogs, images, videos, advertisements, and reports, as well as the personalization of content according to the user's profile and preferences, and the ease of interaction via a question-and-answer model.

However, the effective use of IAG depends on human involvement in all stages of the process. The user initiates the interaction by formulating the request for the generative model to produce the desired content. Therefore, humans are indispensable to ensure the efficiency and validation of the generated content (Davenport & Mittal, 2022)[8].

Furthermore, it is not enough to simply generate content, images, or videos through AGI; the user must critically evaluate the information produced. The process includes content generation, evaluation, editing, and validation, cross-referencing with other reliable scientific sources, as reinforced by Davenport & Mittal (2022)[8].

This cross-checking is essential to avoid uncritical acceptance of the responses generated, such as those from ChatGPT, which are not always accurate or true.

Santaella & Kaufman (2024)[7] point out that OpenAI has already warned that ChatGPT can produce inconsistent or incorrect content, a natural limitation given the novelty of the models, which still require improvement for their consolidation.

The authors of this study understand that the risks are high, especially because some university students may accept content generated by ChatGPT or other generative models as accurate and true in their academic work or assessments, without proper critical analysis.

Generative Artificial Intelligence represents a pivotal advancement in digital technology with profound implications for education. Its ability to autonomously generate diverse content and interact dynamically with users challenges traditional educational roles and prompts a reconsideration of teaching and learning paradigms. While GAI expands human potential by supporting both students' knowledge acquisition and teachers' professional development, its effective and responsible use depends heavily on human oversight. Critical evaluation and validation of AI-generated content are essential to mitigate risks related to inaccuracies and uncritical acceptance, especially in academic settings. As these technologies continue to evolve rapidly, understanding their capabilities and limitations is vital to harness their benefits while safeguarding educational integrity. This nuanced perspective underscores the need for balanced integration of GAI into higher education, emphasizing ethical use and informed engagement.

2.3. AI in the Teaching and Learning Process

The use of digital technologies, such as mobile phones with Internet access, enables the creation of communication networks that are changing social paradigms. In particular, the development of Generative Artificial Intelligence (GAI) models is revolutionizing the teaching and learning process in classrooms.

Unesco (2019)[9] highlights the importance of using artificial intelligence in education to train teachers, support the learning process, assess student progress, and promote educational equity.

Despite their status as digital immigrants, today's teachers rely on devices such as computers, laptops, tablets, or smartphones equipped with GAI to prepare their classes. Through the Internet, they access essential information for the learning of their students, who are digital natives.

In this context, teachers must develop GAI skills to help students streamline their knowledge construction process, promoting collaboration and connection between students and the teacher.

Unesco (2024)[3] recognizes the importance of GAI in education for the new digital era. The vast capabilities of AI to process information and produce knowledge have significant implications, as they replicate the higher-order thinking that underlies human learning. As AI tools automate basic levels of writing and artistic creation, policymakers and educational institutions are forced to reevaluate the why, what, and how of the learning process—critical considerations for education in the new digital age.

AI provides teachers and students with opportunities to acquire information and knowledge in real time, 24 hours a day, from different sources, thus expanding the traditional classroom space.

Aguirre (2024)[10] highlights the importance of AI for improving the teaching and learning process, emphasizing its use as a virtual tutor, functioning as a private teacher available at any time to clarify doubts, in addition to enabling the creation of personalized educational resources tailored to the individual needs of students.

Soares (2024)[11] notes that the ChatGPT tool, which uses generative artificial intelligence, has a transformative power in the teaching and learning process, allowing the creation of content tailored to the profile, learning style, and needs of each student. In this way, the learning experience becomes motivating and innovative.

The results of existing research reveal that despite being a recent tool, ChatGPT is widely used among higher education students in Mozambique, especially at ISUTC, to consult various academic topics (Soares, 2024)[11]. The research confirms that generative artificial intelligence streamlines the teaching and learning process, providing personalized learning.

However, the study also highlights concerns related to students' technological dependence, which can compromise the development of critical thinking and encourage practices such as plagiarism. On the other hand, Soares´study suggests reviewing and adapting educational policies and pedagogical practices in Mozambique to integrate the artificial intelligence component, considering ethical issues, digital inclusion, and adjusting to the new pedagogical paradigm.

Generative Artificial Intelligence is revolutionizing teaching and learning by enabling personalized, accessible, and continuous educational support. While offering great potential to enhance collaboration and knowledge construction, its use also raises concerns about technological dependence and critical thinking. Addressing these challenges requires updated educational policies and practices that ensure ethical integration, digital inclusion, and adaptation to the evolving pedagogical landscape.

2.4. ChatGPT: The New Digital Teacher

The hard and continuous work of computer scientists in the quest to endow machines with intelligence equal to that of human beings culminated in one of the greatest technological revolutions of the digital age: the creation of ChatGPT. This model of Generative Artificial Intelligence (GAI) can interact with users, being able to produce diverse content quickly, with relative precision and in natural language, characteristics that make it a true "digital teacher" available 24 hours a day, adaptable to the educational needs of each student.

ChatGPT was developed by the North American company OpenAI, an organization focused on the research and development of safe and beneficial artificial intelligence for humanity. Its technology is based on natural language models trained with large volumes of data, capable of simulating human conversations with a high degree of fluency and coherence. This capacity for dialogic interaction between machine and human, combined with the practical applicability of the tool, makes ChatGPT a technology widely used in the educational context and several other sectors (Gonçalves & Gonçalves, 2023)[12].

Additionally, ChatGPT's artificial language allows for the reorganization of school practices, keeping up with the accelerated pace of technological evolution (Gonçalves & Gonçalves, 2023); Giraffa & Kohls-Santos, 2023)[12,13]. This technological tool helps both teachers and students to access knowledge, despite the limited access to internet and use of digital technologies in the Mozambican context, as pointed from the 2017 Population Census (National Institute of Statistics-INE, 2017)[14]. For Santos (2023)[15], ChatGPT-4, the most recent version of the Generative Pre-Trained Transformer model, represents a significant advance due to its ability to generate complex texts, answer questions, and assist in the development of school tasks with greater agility and efficiency.

According to Unesco (2024)[3], ChatGPT was the fastest-growing application in history, standing out for its ability to simulate human skills such as creating texts, im-

ages, videos, music, and even software codes. Its intuitive and accessible interface enabled unprecedented popularization, making it the first artificial intelligence tool widely understood and used by diverse audiences.

The educational application of ChatGPT is vast and promising. Gonçalves & Gonçalves (2023)[12] point out five central benefits of the tool in the teaching-learning process: (1) automated and varied textual production; (2) support for language training, helping to improve writing skills; (3) encouraging student engagement in digital environments; (4) providing written feedback in real time; and (5) use as a research center, given its ability to contextualize and answer questions in a structured and understandable way.

However, despite its potential, several authors, such as Unesco (2024); Unesco (2019); Gonçalves & Gonçalves (2023); Giraffa & Kohls-Santos (2023)[3,9,12,13], warn of the need for ethical and conscious use of the tool. The limitations of ChatGPT should also be considered: its inability to understand complex nuances of human language can lead to the production of incorrect, imprecise, or scientifically unfounded responses. Thus, even though machine-user interaction is sophisticated, it does not replace the level of mediation and interpretation that characterizes human pedagogical interaction[12].

In this sense, the authors warn that the indiscriminate and uncritical use of ChatGPT can generate technological dependence and affect essential skills such as critical thinking, text interpretation, and reflective analysis. Therefore, the use of AI tools in the educational context must be anchored in solid pedagogical practices, clear public policies, and an ethical approach that promotes the responsible use of these technologies.

2.5. Challenges of using Generative Artificial Intelligence in Higher Education in Mozambique

Despite the transformative potential of digital technologies, and in particular Generative Artificial Intelligence (GAI), their implementation in the Mozambican education system faces a series of structural and social challenges. The main obstacles include: (1) inequality in access to technology; (2) lack of adequate technological infrastructure; (3) limited internet and electricity connectivity; and (4) technological dependence and denialism.

According to Unesco (2024); Gonçalves & Gonçalves (2023) and Freitas et al. (2023)[3,12,16], the development of GAI technologies remains heavily concentrated in economically advanced countries, which have robust local research, technological innovation, and access to capital capabilities. In this context, developing countries, such as Mozambique, face the risk of being left out of the economic and educational opportunities that emerge from these technologies. This situation reflects one of the biggest obstacles: inequality in access to technology.

In addition, scholars point out that access to IAG tools requires a stable internet connection — a challenging factor in regions with weak digital infrastructure, as is the case in much of Mozambique (Gonçalves & Gonçalves, 2023)[12]. As an illustration, data from National Institute of Statistics (INE)[14], from the 2017 Population Census, indicate that only 5.2% of the Mozambican population had used a computer and only 7.8% had accessed the internet up until that year. These figures reflect the technological backwardness that compromises digital inclusion and the effective use of IAG in higher education.

According to Mussa (2023)[17], limited access to technology, the lack of adequate digital infrastructure, and the scarcity of equipment such as computers, combined with poor connectivity and electrical coverage, significantly compromise the integration of IAG into the teaching and learning process in Mozambican higher education institutions.

The impact of this reality became even more evident during the COVID-19 pandemic. In the point of view of Ngoenha (2022)[2], the health crisis has sharply exposed the weaknesses of the education system in developing countries. For the author, “children who grew up in the countryside and were educated under a tree found themselves catapulted to become cyber students, to be digitally literate”. This abrupt transition highlighted the mismatch between the country’s technological reality and the demands of the new educational paradigm, making it difficult to consolidate an inclusive digital education.

Another relevant challenge concerns the excessive dependence on AI. Although technologies were designed to assist human beings, their indiscriminate and uncritical use can lead to risks such as the replacement of fundamental cognitive skills, inequality in the learning process, and even the devaluation of the role of the teacher. The excessive dependence

on these tools can reinforce the exclusion of students without access to devices or connectivity, in addition to fostering the idea that human teachers can be replaced by automated systems (Faustino, Constantino, and Gonçalves, 2025)[18].

In the face of IAG innovations, today's students have legitimate reasons to question the need for the role of the teacher, Ngoenha (2022)[2]. The author is categorical in stating that, if teachers do not reinvent themselves and take on new roles in the face of emerging technologies, they run the risk of becoming obsolete in the contemporary educational scenario.

Therefore, the challenges of adopting IAG in the Mozambican context are not limited to technological access but also encompass ethical, pedagogical, and structural dimensions. It is therefore essential that public policies, investments in infrastructure, teacher training programs, and digital inclusion strategies work together in an integrated manner to ensure that technologies are tools for emancipation and not exclusion.

3. Materials and Methods

This study adopts a qualitative approach, aiming to understand the contribution of Generative Artificial Intelligence (GAI) to the teaching and learning process, particularly in higher education. A systematic literature review was conducted to collect, analyze, and synthesize existing knowledge on the topic. The qualitative nature of the study is justified by the need to interpret concepts, practices, and challenges in depth, considering contextual and critical perspectives.

Data collection was carried out using four internationally recognized scientific databases: Google Scholar, Scopus, Web of Science, and SciELO. The search covered the period from 2018 to 2025, a timeframe that aligns with significant developments in GAI technologies, including the launch and popularization of tools such as ChatGPT. The following keywords and Boolean combinations were used to guide the search: "generative artificial intelligence" AND "higher education", "AI in education" OR "ChatGPT in learning", "personalized learning" AND "university teaching".
Among others.

Inclusion criteria were: (i) publications in peer-reviewed journals or recognized academic sources, (ii) focus on the use of GAI in educational contexts—especially in higher education, (iii) availability in full text, and (iv) written in English, Portuguese, or Spanish. Exclusion criteria involved duplicated records, publications unrelated to education, or those with insufficient methodological rigor.

A total of 86 documents were initially identified. After screening titles, abstracts, and applying the selection criteria, 38 sources were retained for full analysis. These include scientific articles, book chapters, conference proceedings, and reports from international organizations such as UNESCO and OECD.

The selected materials, **Table 1**, were analyzed using the inductive method, allowing themes and categories to emerge directly from the content. This process involved iterative reading, thematic coding, and grouping of patterns related to the application, benefits, challenges, and ethical implications of GAI in education.

Table 1. Selected articles for the theoretical foundation.

Authors	Year	Title
Aguirre, U.J.C.	2024	*Possibilidades entre a Educação Matemática e Inteligência Artificial Generativa (IAG) em sala de aula*.
Davenport, T.H. & Mittal, N.	2022, 14 de novembro	*How Generative AI is Changing Creative Work.*
Freitas, . E. L. S. X., Bittencourt, I. I., Isotani, S., Marques, L., Dermeval, D., Silva, A. & Mello, R. F.	2023	*Offline Artificial Intelligence for Education: a path to a more inclusive field.*
Faustino, F.; Constantino, S.; e Gonçalves, B.	2025	*Inteligência Artificial na Educação: Desafios e implicações para o ambiente escolar.*
Harari, Y.N.	2019	*21 Lições para o Século XXI.*
Soares, A.A.	2024	*Inteligência Artificial no Ensino Superior: uma pesquisa sobre impactos e percepções*
Gonçalves, F. B. & Gonçalves, V.	2023	*Artificial Intelligence Language Models: The Path to Development or Regression for Education*
Oliveira, A.	2025	*A Inteligência Artificial Generativa.*
Kaufman, D.	2018	*A inteligência artificial irá suplantar a inteligência humana?*
Santaella, L. & Kaufman, D.	2024	*A inteligência artificial generativa como quarta ferida narcísica do humano.*

Table 1. *Cont.*

Authors	Year	Title
Mussa, S.L.J.	2023	*Impacto da inteligência Artificial nas Universidades moçambicanas: desafios e oportunidades.*
Giraffa, L. & Khols-Santos, P.	2023	*Inteligência Artificial e Educação: conceitos, aplicações e implicações no fazer docente.*
Unesco	2024	*Guia para a IA Generativa na Educação e na Pesquisa.*
Unesco	2019	*Consensos de Beijing sobre a Inteligência artificial e Educação.*
Ngoenha, S.	2022	*Crónicas dos Tempos Pandémicos.*
Ngoenha, S.	2024	*Da Wesselia à Wesselia.*

To enhance the credibility of the findings, data triangulation was employed—cross-checking insights across different types of sources and perspectives. This ensured a comprehensive and balanced interpretation of how GAI is influencing pedagogical practices.

The final synthesis of results was organized to directly address the study's main objective, with a specific focus on the context of higher education in Mozambique, contributing to the broader debate on educational innovation in the era of artificial intelligence.

4. Discussion

The literature review and the data presented in this study show that the development of Generative Artificial Intelligence (GAI), especially with the emergence of the ChatGPT tool, has brought about a profound transformation in the teaching and learning process, significantly altering the traditional pedagogical paradigm. , Many studies point the innovations introduced by this technology, as well as its practical applicability and the benefits it offers to the educational context (Unesco, 2024; Oliveira, 2025; Santaella & Kaufman, 2024; Gonçalves & Gonçalves, 2023; Giraffa & Kohls-Santos, 2023)[3,6,7,12,13].

Particularly in Mozambican higher education, as highlighted by Soares (2024)[11], the benefits of ChatGPT are evident. The tool has been widely used by students to consult content, produce texts, and support the personalized learning process. Its ability to generate content in real time, respond interactively, and adapt to the needs of each user reinforces its role as a complementary and dynamic instrument in the educational process, promoting greater autonomy and engagement among students.

Based on the observations of Davenport & Mittal (2022)[8], it becomes clear that the effective use of AI requires not only technical skills but also ethical and intellectual responsibility on the part of users. Data reliability, information curation, and human supervision are essential to ensure that the use of AI does not compromise the integrity of scientific and academic production. Thus, the role of the teacher is redefined: from a transmitter of content to a critical mediator of knowledge, acting in the interpretation, analysis, and contextualization of the information generated by the machine, (Ngoenha, 2024)[5].

However, despite the advances observed, the challenges for the full integration of AI in the Mozambican context remain considerable. Authors such as Unesco (2024); Soares (2024); Gonçalves & Gonçalves (2023);Freitas et al. (2023)[3,11,12,16], identify significant structural barriers, such as: (i) the concentration of production and development of AI technologies in countries with advanced economies; (ii) the fragility of technological infrastructure; (iii) limited access to the internet and electricity; and (iv) denialism and resistance to the adoption of new technologies in educational contexts.

In addition, there are risks associated with excessive dependence on technology, which can intensify educational inequalities between students with and without access to digital resources. Such dependence can also promote the reduction of students' critical and investigative capacity, favoring plagiarism and intellectual complacency, particularly among the less committed(Faustino, Constantino, and Gonçalves, 2025)[18].

In light of these findings, public policies aimed at education in Mozambique must consider not only the incorporation of AI as a pedagogical tool but also the creation of structural conditions that guarantee equitable access, ongoing teacher training, and the appreciation of critical and ethical thinking. AI should not replace human mediation, but rather act as a tool to support the collaborative construction of knowledge.

Finally, future studies can delve deeper into the social, pedagogical, and cultural implications of the use of AI in

Mozambican higher education, with an emphasis on analyzing its effectiveness in contexts of low connectivity, its impact on teacher training, and the formulation of inclusive strategies for the ethical and critical use of artificial intelligence in education.

5. Conclusions

The main contribution of this study lies in contextualizing the use of generative artificial intelligence (GAI) in Mozambican higher education, emphasizing both its transformative potential and the structural, technological, and pedagogical challenges involved. This emerging field remains underexplored in Portuguese-speaking African countries, particularly in Mozambique.

The analysis highlights GAI's growing relevance in supporting research, academic writing, and multimedia content creation. Tools like ChatGPT have the potential to make learning more dynamic, personalized, and student-centered. However, their effective integration requires ethical awareness, critical thinking, and the ability to evaluate AI-generated information—competencies that are essential for a responsible and pedagogically sound use of these technologies.

In a context marked by technological disparities, limited infrastructure, and connectivity issues, the integration of GAI into education is both necessary and urgent. This demands strategic investment in continuous teacher training, with a focus on digital skills and AI literacy, especially given that students often demonstrate greater familiarity with emerging technologies than their instructors.

GAI's practical value lies in expanding access to diverse learning resources, breaking physical barriers, and fostering engagement with global knowledge networks. To fully realize this potential, Mozambique's digital education strategy must involve coordinated efforts among educators, institutional leaders, and policymakers.

Despite existing limitations, the structured and ethical adoption of GAI is no longer optional—it is a strategic necessity. Educational leaders must promote innovation, digital inclusion, and teacher empowerment to ensure institutional readiness.

Ultimately, teachers must assume a central role in developing digital fluency and guiding students toward critical, creative, and collaborative uses of technology. As the pace of technological change accelerates, our responsibility is not only to keep up but to lead the transformation toward a more inclusive, equitable, and future-oriented education system.

This study has some limitations that should be acknowledged. The analysis is based predominantly on a systematic review of the literature, which limits the incorporation of concrete empirical data on the actual use of generative AI in Mozambican institutions. In addition, access to specific and up-to-date national sources was, in some cases, restricted. Future studies could complement this approach with field investigations, interviews, and case studies that directly explore the adoption and impacts of generative AI in specific institutional contexts in Mozambique.

Author Contributions

Conceptualization, S.M.; methodology, B.F.G.; validation, B.F.G.; formal analysis, S.M. and B.F.G.; investigation, S.M.; resources, S.M.; data curation, S.M.; writing—original draft preparation, S.M; writing—review and editing, B.F.G.; visualization, B.F.G.; supervision, B.F.G.; project administration, S.M. All authors have read and agreed to the published version of the manuscript.

Funding

This work received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The databases supporting this study can be found in Google Scholar, Scopus, Web of Science, and SciELO and the links can be found in the references. The search covered the period from 2018 to 2025, a timeframe that aligns with significant developments in GAI technologies, including the launch and popularization of tools such as ChatGPT.

The following keywords and Boolean combinations were used to guide the search: “generative artificial intelligence” AND “higher education”, “AI in education” OR “ChatGPT in learning”, “personalized learning” AND “university teaching”.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Harari, Y.N., 2019. 21 Lessons for the 21st Century. Elsevier: Alfragide, Portugal. (in Portuguese)

[2] Ngoenha, S., 2022. Chronicles of Pandemic Times. Fundação Fernando Leite Couto: Maputo, Mozambique. (in Portuguese)

[3] UNESCO, 2024. Guide to generative AI in education and research (Education 30). Available from: https://unesdoc.unesco.org/ark:/48223/pf0000390241 (cited 1 April 2025). (in Portuguese)

[4] Kaufman, D., 2018. Will artificial intelligence surpass human intelligence? Estação das Letras e Cores: São Paulo, Brazil. (in Portuguese)

[5] Ngoenha, S., 2024. From Wesselia to Wesselia. Editora Fundza: Maputo, Mozambique. (in Portuguese)

[6] Oliveira, A., 2025. Generative artificial intelligence. Fundação Francisco Manuel dos Santos: Lisboa, Portugal. (in Portuguese)

[7] Santaella, L., Kaufman, D., 2024. Generative artificial intelligence as the fourth narcissistic wound of humans atrizes. 18(1), 37–53. DOI: https://doi.org/10.11606/issn.1982-8160.v18i1p37-53 (in Portuguese)

[8] Davenport, T.H., Mittal, N., 2022. How Generative AI is Changing Creative Work. Available from: https://hbr.org/2022/11/how-generative-ai-is-changing-creative-work (cited 1 April 2025)

[9] UNESCO, 2019. Beijing Consensus on Artificial Intelligence and Education. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000372249 (cited 1 April 2025). (in Portuguese)

[10] Aguirre, U.J.C., 2024. Possibilities between Mathematics Education and Generative Artificial Intelligence (GAI) in the classroom. Available from: https://www.sbembrasil.org.br/eventos/index.php/sipem/article/view/453/353 (cited 1 April 2025). (in Portuguese)

[11] Soares, A.A., 2024. Artificial intelligence in higher education: A survey on impacts and perceptions.In: Bié, A.J. (eds.). Explorando 2: Horizontes Científicos em África. Isuresearch: Maputo, Mozambique. pp. 51–57. (in Portuguese)

[12] Gonçalves, F.B., Gonçalves, V., 2023. Artificial intelligence language models: The path to development or regression for education. In: Montenegro, C., Rocha, A., Lovelle, J.M.C. (eds.). Management, Tourism and Smart Technologies – ICMTT 2023. Springer: London, UK. pp. 56–66.

[13] Giraffa, L., Kohls-Santos, P., 2023. Artificial intelligence and education: Concepts, applications, and implications for teaching. Educação em Análise. 8(1), 116–134. DOI: https://doi.org/10.5433/1984-7939.2023v8n1p116 (in Portuguese)

[14] Instituto Nacional de Estatística, 2017. IV General Population and Housing Census: Socio-demographic indicators. Available from: https://www.ine.gov.mz/web/guest/d/iv-recenseamento-geral-da-populacao-e-habitacao-2017-indicadores-socio-demograficos-mocambique_ (cited 1 April 2025). (in Portuguese)

[15] Santos, A., 2023. Challenges and opportunities of artificial intelligence in education and training. READ – Revista de Educação a Distância e Elearning. 6(2).

[16] Freitas, E.L.S.X., Bittencourt, I.I., Isotani, S., et al., 2023. Offline artificial intelligence for education: A path to a more inclusive field. Revista Brasileira de Informática na Educação – RBIE. 31, 307–322. DOI: https://doi.org/10.5753/rbie.2023.3156

[17] Mussa, S.L.J., 2023. Impact of artificial intelligence on Mozambican universities: Challenges and opportunities. Available from: https://revista.unisced.edu.mz/index.php/unisced/article/view/6 (cited 1 April 2025). (in Portuguese)

[18] Faustino, F., Constantino, S., Gonçalves, B., 2025. Artificial intelligence in education: Challenges and implications for the school environment Revista Edapecci. 25(1), 94–102. DOI: https://doi.org/10.29276/redapeci.2025.25.119860.94-102 (in Portuguese)