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Original Research

AI in Higher Education in Portugal, Angola, and Brazil: Public Policies, Implementation, and Ethical Governance

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Abstract: This study analyses the integration of Artificial Intelligence (AI) in education across Portugal, Angola, and Brazil, focusing on public policies, implementation strategies, and structural challenges. Addressing a gap in comparative research among Lusophone countries, it examines how variations in technological capacity, institutional development, and digital inclusion shape AI adoption. The central question explores how these countries implement AI in education and what policies and challenges emerge within their socioeconomic and institutional contexts. Adopting a comparative and predominantly qualitative approach, the study draws on secondary data from UNESCO, OECD, the World Bank, and national policy frameworks. The three countries, representing different continents within the Community of Portuguese Language Countries (CPLP), were purposefully selected to enable cross-contextual analysis through document review, thematic coding, and data triangulation. Findings reveal that Portugal benefits from EU alignment and infrastructure investment but lacks specific AI-in-education legislation; Angola faces digital exclusion and externally driven initiatives; and Brazil advances a national AI strategy yet struggles with regional disparities and limited teacher training. Common weaknesses include scarce algorithmic transparency, insufficient evaluation mechanisms, and absence of independent oversight. The study concludes that sustainable AI integration requires context-sensitive policy design, teacher capacity-building, equitable digital access, and ethical governance supported by international collaboration.

Keywords: *Higher Education, Public Policies, Educational Innovation, Technology, Artificial Intelligence (AI)*

Introduction

Current society is experiencing profound cultural, economic, and social transformations, driven by the accelerated evolution of information and communication technologies (David et al. 2025; Karakose and Tubulas 2025; Morgado et al. 2024). In this scenario, competitiveness and the pursuit of excellence have become imperatives, requiring the definition of quality and success benchmarks, as well as the adoption of organizational criteria that promote asynchronous learning and community-oriented research (Morin 2002).

The university, as a privileged space for the production and dissemination of knowledge, plays a central role in this process (Morgado et al. 2024, 2025). As Dias Sobrinho (2015)

emphasizes, its essential mission is to promote day-to-day process excellence while keeping firmly in view the essential purposes that give those processes meaning. This entails ensuring that education and training activities, as well as the generation, management, and dissemination of knowledge, are carried out to the highest standards of academic, scientific, and technical rigor, underpinned by full ethical, civic, political, and social responsibility. Ultimately, the objective is to educate citizens: individuals with strong civic values and technically and scientifically robust knowledge, capable of responding effectively and with social relevance to society's needs and challenges.

Thus, higher education must respond to contemporary demands through innovative teaching–learning models that reconcile scientific rigor with social relevance (Morgado et al. 2025; Kimbanda et al. 2025; Tünnermann Bernheim and Chaui 2008). University research, when oriented toward solving real-world problems, not only advances scientific progress but also contributes to the promotion of sustainable development and social transformation.

The integration of Artificial Intelligence (AI) in education has been the subject of growing attention in academic literature and international strategic documents. Organizations such as OECD (2021) and UNESCO (2021) highlight AI's potential to personalize learning, support pedagogical decision-making, and promote digital inclusion, while also warning of risks related to privacy, algorithmic transparency, and the widening of social inequalities.

In the three Lusophone countries analyzed—Portugal, Angola, and Brazil—AI adoption reflects markedly different socioeconomic realities, institutional capacities, and levels of technological maturity. In Portugal, the National Artificial Intelligence Strategy ("AI Portugal 2030," Fundação para a Ciência e a Tecnologia [FCT] 2019) and the Digital Transition Action Plan (European Commission 2019) align with European Union (EU) guidelines, prioritizing teacher digital training, modernization of infrastructure, and ethical data usage, although specific legislation on AI in education remains at an early stage. However, part of the literature (Luckin and Issroff 2018; Zawacki-Richter et al. 2019) points out that the technological emphasis tends to outweigh pedagogical debate, raising the risk of uncoordinated implementation of educational practices.

In Angola, the absence of a clear national strategy for AI in education (Ministério da Economia e Planeamento [MEP] 2018) and high levels of digital exclusion (Barbante and Oliveira 2025) hinder adoption. While the literature recognizes efforts supported by international organizations (UNESCO 2021), it underscores that these often occur in a fragmented manner, heavily reliant on NGOs, and lacking strong state coordination circumstances that undermine sustainability and equity. Comparative evidence from other African countries (Farooqi et al. 2024) suggests that advances tend to depend more on isolated projects than on structured policies.

Brazil, through the Brazilian Artificial Intelligence Strategy (EBAI) (Ministério da Ciência, Tecnologia e Inovações [MCTI] 2021) and the National Education Plan (PNE) (Law No.

13,005/2014), has set explicit goals for personalized learning and reducing regional inequalities. The literature (Salas-Pilco and Yang 2022) identifies an innovative ecosystem driven by startups and university–industry partnerships. Nonetheless, persistent shortcomings in teacher training and significant regional disparities—exacerbated by the concentration of technological resources in the private sector—remain. Moreover, authors such as Yan et al. (2023) and Selwyn (2019) caution against excessive student monitoring practices, which raise ethical concerns, are yet to be fully regulated.

A comparative analysis of these three contexts reveals three central tensions: (1) Robust policies versus regulatory gaps: Portugal and Brazil have national strategies but lack specific legislation for AI in education, whereas Angola remains in a preparatory phase; (2) Innovation potential versus exclusion risk: AI can enhance the quality and personalization of learning, but without strong digital inclusion policies, it risks reinforcing structural inequalities; (3) Technological advances versus pedagogical readiness: There is consensus in the literature that teacher training is a neglected critical factor (Lukin and Issroff 2018; Zawacki-Richter et al. 2019), and is indispensable for converting technological potential into tangible educational impact.

Overall, the literature highlights not only the heterogeneity of progress but also common gaps such as limited algorithmic transparency, the absence of independent audits, the use of student data without informed consent, and insufficient integration of ethical and pedagogical considerations into public policy (Floridi et al. 2018). This landscape reinforces the need for national strategies that balance technological innovation, human capacity development, and ethical safeguards, adapted to the specificities of each Lusophone context.

Methodology

This study employs a comparative and exploratory analysis of AI adoption in education in Portugal, Angola, and Brazil. The countries' socioeconomic and technological differences enable examining how contextual conditions shape policy responses, implementation capacity, and ethical governance. The analysis focuses on public policy frameworks, technological infrastructure, teacher capacity-building, and digital inclusion, drawing on secondary sources and aligning the interpretive lens with UNESCO and OECD principles for ethical, inclusive, human-centered AI in education.

Justification and Research Problem

The integration of AI in education represents one of the most significant transformations in contemporary educational systems, enabling personalized learning, expanding access to information, optimizing management processes, and supporting pedagogical decision-making. However, its effective adoption depends on multiple factors such as technological infrastructure, teacher training, regulation, and context-sensitive public policies. Within the

Community of Portuguese Language Countries (CPLP), Portugal, Angola, and Brazil share Portuguese as their official language and a commitment to education as a strategic national priority. Nonetheless, they represent markedly different socioeconomic and technological contexts. This diversity provides a unique opportunity to investigate how distinct conditions influence AI integration in education.

Despite the global progress in developing AI-related policies and strategies, Portuguese-speaking countries exhibit significant disparities in infrastructure, teacher preparation, and digital inclusion. These asymmetries reflect differences in resource availability, political priorities, and technological maturity, which affect the implementation and ethical use of AI in education. The resulting challenges include unequal access to digital technologies, limited professional development opportunities, and the absence of coherent regulatory frameworks to ensure transparency, data privacy, and ethical standards.

Therefore, understanding how these three Lusophone countries, each representing a different continent, adopt and regulate AI in education is essential to identify patterns of convergence and divergence, highlight good practices, and reveal structural barriers. This analysis also aligns with the principles advocated by UNESCO and the OECD for an ethical, inclusive, and human-centered approach to AI in education.

Research Question and General Objective

This study seeks to understand how Portugal, Angola, and Brazil integrate AI in education, and to analyze and compare the main public policies, strategies, and challenges observed in each context. The analysis considers the socioeconomic, political, and institutional specificities of the three countries, aiming to identify patterns of convergence and divergence in AI adoption and to highlight factors that facilitate or hinder its effective implementation within Lusophone educational systems.

Materials and Methods

This study adopts a comparative and exploratory approach, predominantly qualitative, supported by secondary quantitative data. Three countries from the CPLP were analyzed, each representing a different continent: Portugal (Europe), Angola (Africa), and Brazil (America). The selection was intentional, considering the official language, geopolitical relevance, and diversity of contexts. The methodological process included case selection, document and literature review, statistical data collection, thematic analysis, and comparative analysis with data triangulation, as shown in Table 1:

Table 1: Methodological Framework of the Study

Stage	*Objective*	*Sources/Data*	*Procedures*	*Expected Results*
Case selection	Select representative CPLP countries	Inclusion criteria: Portugal, Angola, and Brazil	Intentional sampling	Ensure geographic and socioeconomic diversity
Document and literature review	Analyze policies and literature on AI in education	National strategies, legislation, UNESCO and OECD reports	Research and categorization	Map normative and strategic landscape
Statistical data collection	Identify comparable indicators	UNESCO, World Bank, Eurostat	Extraction and organization	Obtain metrics common to all countries
Thematic analysis	Identify core themes	Official documents and academic studies	Categorization into key areas	Theme systematization
Comparative analysis	Contrast national realities	Qualitative and quantitative data	Result synthesis	Identify convergences and divergences
Data triangulation	Validate findings	Multiple sources	Cross-referencing data	Increase robustness of results

Results and Discussion

The analysis of AI integration in education in Portugal, Angola, and Brazil reveals stark differences in policy, infrastructure, and ethics. Portugal leads with teacher training and digitalization, though algorithmic bias and regulatory gaps remain. Angola faces limited infrastructure and fragmented initiatives, while Brazil combines national strategies and partnerships but struggles with inequality and student surveillance. These findings highlight that effective AI adoption depends on context-specific policies promoting equity, transparency, and human-centered practices, in line with UNESCO and OECD guidelines.

Public Policies: Guidelines

UNESCO's (2021) document, "AI and Education: Guidance for policy-makers," addresses the integration of AI into higher education, emphasizing the need for public policies that maximize the benefits and mitigate the associated risks. The report essentially highlights that AI has the potential to address significant challenges in education, innovate teaching and learning

practices, and accelerate progress toward Sustainable Development Goal 4 (UNESCO 2021). For effective implementation of AI in higher education, this study recommends:

- Skills Development: Train educators and students to interact critically and ethically with AI, ensuring a deep understanding of its capabilities and limitations (UNESCO 2021).
- Technological Infrastructure: Invest in adequate infrastructures that support the integration of AI, ensuring equitable access to the necessary technologies (UNESCO 2021).
- Inclusion and Equity Policies: Develop policies that ensure that the implementation of AI does not widen existing inequalities, promoting the inclusion of all students, regardless of their socioeconomic background (UNESCO 2021).
- Ethics and Transparency: Establish clear ethical guidelines for the use of AI in education, ensuring transparency in algorithms and protection of student data (UNESCO 2021).

The report also emphasizes the importance of collaboration between governments, educational institutions, and the private sector to create an AI ecosystem that benefits higher education in a sustainable and responsible way (UNESCO 2021); that is, it underlines that, although AI offers significant opportunities to transform higher education, it is crucial that public policies are carefully designed to ensure that this transformation is equitable, ethical, and human-centered.

Portugal has been a leader in the integration of AI in education in the European context. The National Strategy for Artificial Intelligence—"AI Portugal 2030"—establishes specific guidelines for the ethical and effective use of AI in areas such as education, science, and economics (FCT 2019). The main initiatives in Portugal focus on the digital training of teachers, the development of personalized educational content, and the implementation of AI tools to improve teaching-learning processes. The Digital Transition Action Plan (DTP) highlights the importance of digital skills training, with significant investments in the technological modernization of schools and the digital inclusion of students (European Commission 2019). These actions position Portugal as a model of educational innovation with AI, influencing other nations.

On the other hand, in Angola, the use of AI in education is still in its early stages, with challenges related to infrastructure and digital inequality. The National Development Plan (PND) emphasizes improving technological infrastructure and increasing digital literacy, particularly in the most deprived rural and urban regions (MEP 2018). International organizations, such as UNESCO, have supported the country in promoting technological solutions that expand access to quality education through AI (UNESCO 2021). However, the scarcity of financial and human resources, as well as inequality in access to technology, limit

more comprehensive implementation of AI, highlighting the need for greater structural support (Barbante and Oliveira 2025).

In turn, Brazil adopts a comprehensive approach with EBAI, which sets goals for personalizing teaching, analyzing school performance, and identifying learning gaps (MCTI 2021). The PNE complements these goals, promoting the use of digital technologies to democratize access to education and reduce regional inequalities. In addition, partnerships between startups, universities, and technology companies have favored the creation of ecosystems focused on the development of AI-based educational tools (Reddy et al. 2023). Despite this, Brazil faces challenges in terms of inequality in access to technological infrastructure and teacher training, issues that still require more robust public policies (UNESCO 2021).

As concrete examples of ethical risks and policy implementation failures across these different contexts, it is notable that in Portugal, ethical concerns are particularly evident in algorithmic bias within assessment systems, especially in pilot projects using AI to evaluate student performance through adaptive learning systems. At the policy level, a key issue is the lack of specific regulation for the ethical and transparent use of AI in schools, particularly regarding data protection and accountability for potential system errors. In Angola, a significant ethical risk lies in the marked digital exclusion, where a substantial portion of the student population lacks regular access to the internet or digital devices, thus becoming marginalized. It is also important to highlight that, along with the absence of a clear national strategy for integrating AI into the education system, for example a structured plan aligned with the educational infrastructure, various isolated projects have emerged. These are often supported by NGOs or external entities but lack state coordination, which compromises the sustainability and equity of such initiatives. In Brazil, in a manner in contrast to the Angolan example, what is observed in many contexts is excessive monitoring and surveillance of students. Some private schools and startups have adopted AI technologies to monitor student behavior, attendance, and even facial expressions during online or in-person classes. These practices raise serious concerns regarding privacy, informed consent, and abusive surveillance. Although Brazil launched its National Artificial Intelligence Strategy in 2021, there is still a lack of concrete measures to ensure that public schools, particularly in the North and Northeast regions, have equitable access to such technologies. The shortage of resources and teacher training significantly contributes to this situation, reinforcing a clear inequality in access to AI-based educational technologies.

To better assess this issue, a summary in Table 2 is provided, contrasting the progress made on each of UNESCO's guidelines in the three countries.

Table 2: Progress on UNESCO Guidelines for AI in Education

UNESCO Guideline	*Portugal*	*Angola*	*Brazil*
1. Develop inclusive AI policies in education	Comprehensive digital policies, but lacking specific focus on inclusive AI.	No specific guidelines; limited focus on general digitalization.	National strategies exist, but significant regional inequality remains.
2. Ensure equity and inclusion in access to AI	Some programs target disadvantaged areas, but coverage is limited.	Severe digital exclusion; major regional and social disparities.	Marked regional inequality; better coverage in private sector.
3. Prepare teachers and develop competencies	Few digital training initiatives, but limited on AI and ethics.	Teacher training in technology is almost nonexistent.	Lack of systematic training; isolated initiatives in private schools.
4. Ensure ethical, transparent, and auditable use of AI	Compliant with General Data Protection Regulation (GDPR); lacks specific guidelines for educational AI.	Weak data protection and no auditing mechanisms.	General Personal Data Protection Law (LGPD) in place, but poor enforcement in school practices.
5. Promote research and innovation in AI for education	Active research centers; limited pedagogical focus.	Nascent initiatives, often dependent on external NGOs.	Startups foster innovation; limited public coordination.

Table 2 allows for the attribution of scores ranging from 0 to 2 to each UNESCO guideline, reflecting the level of compliance observed in Portugal, Angola, and Brazil. The results indicate that Portugal has the highest overall alignment (average score of 1.4), benefiting from comprehensive digital policies, compliance with the General Data Protection Regulation (GDPR), and an active research ecosystem, although gaps remain in inclusion and in the pedagogical integration of AI. Brazil ranks second (average score of 1.2), combining a robust national strategy and innovative dynamism with persistent regional inequalities and shortcomings in teacher training. Angola records the lowest average score (0.4), reflecting the absence of specific AI guidelines, severe digital exclusion, virtually non-existent teacher training, and weak data protection. The overall pattern shows that, while progress has been made in policies and innovation, all countries require more consistent action in the areas of inclusion, teacher preparation, and ethical AI governance.

Public Policies Aimed at Integrating AI into Education

Legislation on the integration of AI in education in the three countries—Portugal, Angola and Brazil—has evolved, albeit in distinct ways, with each seeking to adapt to technological innovations according to their socioeconomic realities and legislative contexts.

In Portugal, legislation on the integration of AI in education is strongly aligned with European policies and national strategies for the responsible and ethical use of new technologies. The main standards and legislative documents include (Table 3):

Table 3: Portugal—Legislative Documents/Guidelines

Legislative Documents	*Guidelines*
National Artificial Intelligence Strategy—"AI Portugal 2030" (FCT 2019)	The strategy sets out national guidelines for the use of AI, with a particular focus on sectors such as education. The document proposes initiatives to promote the development of digital skills, create technological solutions for teaching, and use AI to personalize learning. The strategy also highlights the importance of an ethical and inclusive approach to the use of AI, in line with EU standards.
Digital Transition Action Plan (DTP) (European Commission 2019)	This plan, which is part of the EU's digital agenda, establishes actions for the digitalization of the Portuguese education system, with an emphasis on modernizing technological infrastructure in schools and teacher training. AI, in this context, is seen as a tool for personalizing teaching and improving the effectiveness of pedagogical processes.
General Data Protection Regulation (GDPR) (EU 2016/679)	European privacy legislation, which also applies in Portugal, has direct implications for the use of AI in education. The GDPR sets strict rules on the collection and processing of personal data, including educational data, requiring AI technologies used in schools to ensure the protection of students' privacy.

Angola is still in the development phase, and public policies and legislation are adapting to the new challenges of digitalization of education. As we can see in Table 4, the main legal initiatives include:

Table 4: Angola—Legislative Documents/Guidelines

Legislative Documents	*Guidelines*
National Development Plan (PND) 2018–2022 (MEP 2018)	The PND is one of the key documents for the country's development and includes objectives related to the modernization of education and the improvement of technological infrastructure and digital literacy. Although it does not directly address AI, this plan lays the foundations for the integration of emerging technologies, such as AI, into the education system, with a special focus on rural and urban areas.
Personal Data Protection Act (Law No. 22/11 of June 17)	This law addresses the protection of personal data in Angola and establishes a legal framework for data processing, which directly impacts the use of AI in education. The law ensures that the use of AI in schools respects the privacy of students and their personal data, although there are challenges in implementing and monitoring its application.

UNESCO initiatives and international support	UNESCO has been supporting Angola in developing AI-based solutions to expand access to education, especially in the most remote regions. Although there is no specific legislation on AI in education, international partnerships have been key to advancing this field.

Brazil has more advanced legislation regarding public policies aimed at integrating AI into education, with more robust documents and strategies. The main legislation and policies include (Table 5):

Table 5: Brazil—Legislative Documents/Guidelines

Legislative Documents	*Guidelines*
Brazilian Artificial Intelligence Strategy (EBAI) (MCTI 2021)	The EBAI sets goals and guidelines for the use of AI in various sectors, including education. The strategy proposes the use of AI to personalize teaching, improve performance analysis, and reduce educational inequalities. The EBAI also highlights the need for teacher training, the creation of technological infrastructure, and ensuring privacy and security in the use of AI.
National Education Plan (PNE) (Law No. 13,005/2014)	The PNE sets goals for Brazilian education until 2024 and includes guidelines for the implementation of digital technologies in teaching. The use of AI is mentioned as a tool to promote equity in access to education and to improve learning, with a special emphasis on teacher training and the development of digital skills.
Legal Framework for Artificial Intelligence (PL 21/2020)	Currently being processed by the National Congress, Bill 21/2020 proposes a regulatory framework for AI in Brazil, addressing issues such as ethics, transparency, security, and the protection of personal data. Although it is not specific to education, its implications are significant, as it establishes general guidelines for the use of AI in various sectors, including education.
General Personal Data Protection Law (LGPD) (Law No. 13,709/2018)	The LGPD is the Brazilian legislation that regulates the processing of personal data, including student data. It establishes principles and rules for the collection, storage, and use of personal data, which are crucial for the use of AI in education. The LGPD ensures that any application of AI in the education system respects the privacy of student data.

Although Portugal, Angola, and Brazil are at different stages of development when it comes to integrating AI into education, they all recognize the importance of legislation and public policies that ensure ethical, inclusive, and safe use of emerging technologies. While Portugal is already advanced in implementing national strategies, with strong alignment with EU guidelines, Angola still faces challenges related to infrastructure and capacity building. This pertains to legislation enacted under the auspices of the EU, which, in practice, initiated legislative processes and strategic projects well in advance of the other countries considered

in this study. Within this framework, the prescribed guidelines are required to be transposed and enforced promptly, uniformly, and comprehensively across all EU Member States. Such an arrangement not only facilitates but also strengthens the mechanisms for implementation, oversight, regulation, and periodic evaluation of both practices and legislative measures in this and analogous policy domains.

Brazil, in turn, already has a regulatory framework in place for AI, in addition to public policies aimed at personalizing education and reducing educational inequalities. International collaboration and the strengthening of local legislation are essential to ensure that AI makes a positive contribution to improving education in these countries.

In Angola, beyond national planning documents such as the PND (MEP 2018), a number of localized initiatives illustrate both the opportunities and constraints of AI adoption in education. For example, pilot projects supported by the UNESCO's "ICT in Education" program in Luanda and Huambo have introduced adaptive learning platforms in selected secondary schools, aiming to improve mathematics and science performance. While initial reports indicate increased student engagement, the lack of stable internet connectivity and the absence of trained technical staff have hindered scalability. Similarly, partnerships between the Agostinho Neto University and local start-ups have explored the use of AI-powered chatbots to assist first-year students in academic orientation, showing potential for reducing dropout rates. However, these initiatives remain isolated, highly dependent on external funding, and are yet to be integrated into a cohesive national AI strategy for education. This underscores the need for a coordinated policy framework that can consolidate local successes and extend their benefits to rural and underserved communities.

Finally, a brief assessment is provided (Table 6), outlining the strengths and weaknesses of each country in the implementation of their respective policies.

Table 6: Comparative Table: AI in Education—Portugal, Angola, Brazil

Country	*Strengths*	*Weaknesses*
Portugal	Strong alignment with the GDPR, ensuring high standards of data privacy and security. Structured plans for digital transformation in education.	Lack of specific legislation on AI in education. Insufficient systematic teacher training in AI and digital ethics. Overemphasis on technology, with limited focus on pedagogy and ethics.
Angola	Growing recognition of the importance of technological innovation in education. Digital transformation included in national plans (in a general way).	Absence of an updated legal framework for AI in education. Significant digital exclusion, especially in rural areas. Isolated pilot projects with no consistent state coordination. Weak legal protection of personal educational data.

Brazil	National strategies explicitly mention education and AI. LGPD provides a solid legal basis for data protection, similar to the GDPR. Strong presence of startups developing AI-based educational solutions.	Marked regional inequality in access to technology. Public policies remain mostly theoretical, with limited concrete implementation in schools. Ethical risks due to unregulated student surveillance using AI tools.

Table 6 shows that Portugal presents the most balanced set of strengths and weaknesses, standing out for its strong compliance with the GDPR and structured plans for digital transformation, but with gaps in specific legislation on AI in education, systematic teacher training, and pedagogical integration. Brazil has a solid legal basis (General Personal Data Protection Law [LGPD]) and a dynamic innovation ecosystem driven by startups, yet is hindered by significant regional inequalities, public policies that remain largely theoretical, and ethical risks stemming from unregulated student surveillance practices. Angola reveals a more incipient scenario: while there is growing recognition of the importance of technological innovation and a general inclusion of digital transformation in national plans, serious structural deficits persist, including the absence of an updated legal framework, severe digital exclusion, isolated initiatives, and weak data protection. Overall, the synthesis shows that Portugal and Brazil possess more consolidated institutional foundations but face challenges related to implementation and equity, whereas Angola requires urgent structural interventions to establish the minimum conditions for the sustainable adoption of AI in education.

AI in Higher Education: Strategies for Sustainable Adoption

The integration of AI in Higher Education increasingly represents a challenge and an opportunity for the transformation of teaching–learning processes, academic management, and scientific research. The potential of AI to personalize learning, optimize resource management, and support strategic decision-making has been widely recognized (Holmes et al. 2019; Luckin et al. 2016); however, the sustainable adoption of these technologies requires strategies that consider not only pedagogical innovation, but also ethical, equity, and digital literacy issues (Selwyn 2019).

The definition of clear guidelines for the implementation of AI in the context of Higher Education must be articulated with institutional policies that promote the development of critical skills in teachers and students, ensuring responsible and inclusive use (Zawacki-Richter et al. 2019). The sustainable integration of AI, therefore, implies not only the adoption of emerging technologies, but also the creation of guidelines that ensure their ethical and socially responsible use.

In this sense, the interdisciplinary perspective presented by Isaacson (2014) in *The Innovators: A Biography of the Digital Revolution*, offers a relevant framework, highlighting that technological progress does not result from the isolated efforts of individuals, but rather from networks of collaboration, knowledge sharing, and sociopolitical contexts conducive to experimentation. Thus, just as the great innovations of the past emerged from synergies between different areas of knowledge, the sustainable adoption of AI in Higher Education must be guided by collaborative practices that integrate different disciplinary perspectives and promote an institutional culture of co-creation and social responsibility. The Universities, Students and the Generative AI Imperative (2023) report, published by Quacquarlli Symonds (QS 2023), examines the impact of Generative AI on higher education, based on a survey of 1,663 participants, including academics and students. Key findings included:

1. Influence on Academic Decisions: More than one-third of students indicated that Generative AI influenced their choice of course, institution, and career path.
2. Use of AI in Studies: Four out of five students use Generative AI platforms, with OpenAI's GPT-3 being the most widely used.
3. Changing Academic Preferences: The advancement of AI has driven interest in computer science and information systems, which have overtaken engineering as top course choices.
4. Familiarity Among Academics: 92% of academics are familiar with Generative AI platforms, but only 30% consider themselves highly familiar.
5. Perceived Cognitive Impact: More than 40% of students say AI improves their ability to concentrate, 43% report cognitive gains, and 28% report a reduction in screen time (QS 2023).

The report also analyzes student and academic perceptions of Generative AI and presents recommendations for its ethical and effective integration into higher education.

The QS World Future Skills Index, published in January 2025, is a comprehensive assessment of countries' ability to adapt to the dynamic demands of the global labor market. This report aims to guide policymakers in formulating strategies that align education systems and skills development with emerging needs, promoting innovation, sustainable competitiveness, and economic growth. Four main indicators result from this:

- Skills Fit: Assesses the degree of correspondence between the skills provided by education systems and the demands of the labor market. It is based on data from the QS Global Employer Survey, which collects employers' perceptions of the suitability of graduates' skills (QS 2025).
- Academic Readiness: Examines the effectiveness of higher education in preparing students for changing work contexts, considering the quality and diversity of programs in emerging areas such as AI, digital skills, and sustainable technologies (QS 2025).

- Future of Work: Assesses the capacity of labor markets to absorb and foster critical skills for the future, with an emphasis on technological and digital areas that drive the transition to knowledge-based economies (QS 2025).
- Economic Transformation: Analyzes country's structural readiness to support skills development and sustainable economic growth, using data from international organizations such as the World Bank and UNESCO (QS 2025).

It highlights imbalances between the supply and demand of skills, compares international performance, and provides recommendations for curricular alignment, reducing the risk of mismatches between academic training and labor market needs. The index results show significant disparities between leading countries and emerging economies, with the United States occupying the first position, followed by the United Kingdom, Germany, Australia and Canada, classified as "pioneers in future skills." The QS World Future Skills Index (QS 2025) is therefore a strategic tool for governments and higher education institutions, promoting the formulation of future-oriented educational and economic policies, with a view to creating more resilient, innovative, and competitive societies on the global stage.

Liu and Bates recently published their book *Generative AI in Higher Education: Current Practices and Ways Forward* in January 2025, which provides a comprehensive analysis of the integration of generative AI into higher education, with a special focus on universities in the Asia-Pacific region. They state that "the widespread availability of generative AI represents a watershed moment for higher education that goes far beyond accommodating yet another technological innovation. It fundamentally challenges our assumptions about teaching, learning, research, and the very purpose of universities" (Liu and Bates 2025, 6). They also add that "current approaches are typically fragmented and reactive, focusing on immediate concerns such as academic integrity, while students already questioning the value of traditional higher education are embracing AI tools regardless of institutional readiness" (6). Faced with such challenges, they propose the "CRAFT" framework, composed of five essential elements ("culture, rules, access, familiarity, and trust") for the successful integration of generative AI.: (1) Culture: Addresses regional and institutional differences in the acceptance of AI and fundamental questions about the role of the university; (2) Rules: Emphasizes the need to move from constraint to enablement, with effective governance structures; (3) Access: Highlights the importance of equitable access to AI tools and infrastructure; (4) Familiarity: Highlights the need for systematic development of understanding of AI by all stakeholders; and (5) Transparency: Underlines the importance of transparent practices in the use of AI.

> There are three core areas of focus for universities to enable work towards the goal of productively and responsibly integrating generative AI into their education, research, and operational functions. A combination of and balance between (1)

> Rules, (2) Access, and (3) Familiarity is needed to enable appropriate adoption. A lack, or incompatibility, of one or more of these areas can lead to ethics, privacy, security, academic integrity, or other challenges. These three areas are underpinned by a foundational layer of: (4) Trust between students, educators, leaders, vendors, partners (industry, government, and community), and AI itself. Rules, access, familiarity, and trust are then situated in, and influenced by, an institution's local, regional, and even global; (5) Culture that includes attitudes, philosophies, and perspectives of individuals and groups of society, academia (universities and subunits), and governments. (Liu and Bates 2025, 14)

Therefore, this framework offers a holistic approach to integrating AI into higher education, recognizing the complexity and diversity of academic institutions. Furthermore, while the "CRAFT" framework is comprehensive, its practical application may vary significantly across different institutional contexts, which would require careful adaptation to the specificities of each institution.

In this context, higher education faces the pressing need to reformulate its pedagogical models, curricula, and assessment methods. The transition from teaching based on content transmission to competency-centered approaches becomes essential, prioritizing active learning, problem-solving, critical thinking, and creativity. In addition to technical skills, the development of soft skills, such as communication, collaboration, and digital literacy, assumes a strategic role. The incorporation of emerging technologies redefines not only content but also learning dynamics, allowing for more flexible and personalized educational trajectories. This advance aligns with the demands of a changing job market, requiring adaptable and innovative professionals.

The availability and resistance of faculty and students toward the adoption of AI in higher education are key factors determining the success of its integration. On one hand, many faculty members and students are willing and interested in exploring the potential of AI to improve teaching and learning processes, personalize content, and facilitate academic management (Zawacki-Richter et al. 2019). On the other hand, there is significant resistance driven by concerns related to the replacement of the human role (Selwyn 2019), ethical issues (An et al. 2024; Farooqi et al. 2024; Yan et al. 2023), lack of adequate training, and worries about privacy and the use of personal data (European Commission 2019).

This duality requires targeted awareness and training strategies that promote a critical and ethical understanding of AI (Jodi et al. 2025; Farooqi et al. 2024; European Commission 2019), while valuing the irreplaceable role of human agents in the educational context (Selwyn 2019). Understanding the dynamics of acceptance and resistance is crucial, and frameworks like the Unified Theory of Acceptance and Use of Technology (UTAUT) provide useful insights into these behavioral factors (Venkatesh et al. 2003). The findings of this comparative study highlight a set of strategic priorities for the effective integration of AI in

education. These recommendations, organized by key policy areas and expected impacts, are summarized in Table 7.

Table 7: Summary of Policy Recommendations for AI Integration in Education (Portugal, Angola, Brazil)

Strategic Area	*Specific Recommendation*	*Justification*	*Expected Impact*
Ethical and Legal Framework	Develop specific national standards, regulations, or laws governing the use of AI in education, focusing on ethics, privacy, and equity.	Existing legislation does not specifically address AI in education, creating gaps in protection and transparency.	Increased public trust, reduced ethical risks, and alignment with international standards.
Teacher Training	Invest in continuous professional development for teachers and technical staff on the pedagogical and ethical use of AI, integrating digital skills and data literacy.	Lack of teacher preparation is identified as one of the main barriers to effective implementation.	Improved pedagogical quality and meaningful integration of AI in learning.
Technological Infrastructure	Ensure universal connectivity and adequate equipment before implementing AI-based solutions.	Inequality in technological access undermines digital inclusion.	Reduction of inequalities and equitable access to digital education.
Monitoring and Evaluation	Implement independent audits and continuous monitoring systems to assess impact, effectiveness, and potential algorithmic biases.	The absence of robust data limits the capacity to adjust and improve policies.	Evidence-based decision-making and identification of best practices.
International and Regional Cooperation	Strengthen partnerships among CPLP countries and with international organizations for joint solution development and resource sharing.	Shared language and common goals facilitate collaboration and policy adaptation.	Greater technical capacity, shared innovation, and strategic alignment among Lusophone countries.

Conclusion and Recommendations

The effective integration of AI in education depends on a strategic vision that promotes equity, development of digital skills, and technological adaptation (UNESCO 2023). For Portugal, Angola, and Brazil, it is crucial to invest in three primary axes: human resource training,

technological infrastructure, and international collaboration. Regarding human resource capacity building, continuous teacher training is a central pillar for the effective integration of AI in education, since digital technologies should be introduced based on evidence of their relevance, equity, scalability, and sustainability (Luckin and Issroff 2018; UNESCO 2023).

In Portugal, the focus should be on advanced teacher training programs, such as those promoted by DTP. In Angola and Brazil, training programs that reduce technological mismatch need to be expanded, especially in less favored regions. Regarding investment in technological infrastructure, inequality in access to technology still represents a significant obstacle, especially in Angola and Brazil, where many schools lack connectivity and adequate equipment. The literature highlights that public policies should prioritize the democratization of access to technology as a way to reduce educational inequalities. In Brazil, public-private partnerships can be strengthened to ensure the equitable distribution of technological resources. In Angola, the expansion of high-speed internet networks is a priority for schools in remote areas.

Regarding international and regional collaboration, international collaboration, such as that promoted by UNESCO and the EU, is essential to maximize the impact of AI in education, especially in countries with more limited resources such as Angola (UNESCO 2021). However, regional partnerships between Portuguese-speaking countries can facilitate the exchange of experiences and the development of educational solutions adapted to local needs.

It is essential to create ethical and responsible regulations for the use of AI in education. Principles such as transparency, privacy, and inclusion should guide government policies. Portugal has made progress in creating policies aligned with EU guidelines (FCT 2019), while Angola and Brazil still need to strengthen their regulations to protect student data and ensure digital inclusion.

Following the analysis presented in "Public Policies: Guidelines," it can be concluded, in general terms, that the main gaps in the area of AI applied to education include: (1) Insufficient algorithmic transparency; (2) Lack of ethical training for teachers and technical staff; (3) Use of students' personal data without informed consent; (4) Depersonalization of learning.

To reverse, improve, or enhance common public policies in the countries under analysis, action is proposed along four essential and decisive axes: (1) Create specific national standards, regulations, or laws regarding the use of AI in education, with a focus on ethics, privacy, and equity; (2) Invest in the critical training of teachers and technical staff on the use of AI; (3) Ensure basic technological infrastructure and universal connectivity before implementing AI-based solutions; and (4) Implement independent audits of educational AI systems to detect bias and abuse.

Although notable progress has been made, significant challenges persist, including the urgent need for robust ethical regulation, the mitigation of risks associated with automation in education, and the removal of economic and institutional barriers. Strengthened cooperation among governments, academic institutions, and the private sector remains

essential to designing and implementing policies that are both sustainable and inclusive. Moreover, despite the presence of comprehensive policy frameworks, there is a marked shortage of robust, comparable, and systematically collected data to evaluate the measurable impacts and effectiveness of AI integration in education across the three countries. In Portugal, monitoring mechanisms remain in their infancy and lack AI-specific indicators; in Angola, data collection is constrained by infrastructural and institutional limitations; and in Brazil, the available evidence is fragmented, often restricted to isolated local initiatives. This absence of consistent evaluation mechanisms limits the capacity to identify best practices, track progress, and adapt policies based on empirical evidence, which in itself constitutes a key finding of this study and highlights the urgent need for policy instruments embedding continuous monitoring and rigorous impact assessment.

This study presents certain limitations that must be acknowledged. It relies exclusively on secondary sources, without primary data collection, which may restrict the depth of analysis and limit the interpretation of country-specific nuances. Differences in data quality and availability among the selected countries—Portugal, Angola, and Brazil—also pose challenges to comparability. Moreover, the research adopts a macro-level analytical perspective, focusing on national policies and frameworks rather than on the micro-level implementation within individual institutions. The limited and still emerging body of academic literature on AI in education within Lusophone contexts further constrains the scope of evidence available, although it simultaneously highlights the novelty and relevance of the topic.

In terms of delimitation, the research is geographically restricted to three Portuguese-speaking countries from different continents: Portugal (Europe), Angola (Africa), and Brazil (America). The temporal scope extends from 2018 to 2025, covering the main national strategies and international guidelines relevant to AI integration in education. Thematically, the study focuses on aspects related to public policies, teacher training, technological infrastructure, digital inclusion, and ethical and regulatory frameworks associated with educational uses of AI. Regarding ethical considerations, the study exclusively employs publicly available and secondary data, ensuring compliance with relevant data protection regulations: GDPR (EU), LGPD (Brazil), and Law No. 22/11 (Angola). All information sources are duly cited and referenced. No personal data were collected, no conflicts of interest exist, and therefore, formal approval from an ethics committee was not required.

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Informed Consent

The authors declare that informed consent was not required as there were no human participants involved.

Conflict of Interest

The authors declare that there is no conflict of interest.

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