



Challenges and opportunities for the integration of artificial intelligence in Ecuadorian basic education

Desafíos y oportunidades de la integración de la inteligencia artificial en la educación básica ecuatoriana

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ABSTRACT

The current review article aims to analyse the challenges and opportunities of integrating artificial intelligence into basic education in Ecuador. This was done through a systematic review of 25 academic studies published between 2021 and 2025. The following aspects were studied: i) the digital divide and accessibility, ii) teacher training and communities of practice, iii) Universal Design for Learning (UDL), and iv) regulatory and ethical frameworks. It was concluded that AI offers significant opportunities to personalise learning, cater to student diversity, and reposition teachers as designers of inclusive learning experiences. For these possibilities to become a reality, it is essential to coordinate public policies, technological investment projects, and curriculum strategies based on Universal Design for Learning.

Descriptors: artificial intelligence; educational planners; academic teaching personnel. (Source: UNESCO Thesaurus).

RESUMEN

El actual artículo de revisión tiene por objetivo de investigación analizar los desafíos y oportunidades de la integración de la inteligencia artificial en la educación básica ecuatoriana. Mediante una revisión documental sistemática de 25 estudios académicos publicados entre 2021 y 2025. Se estudiaron las siguientes aristas: i) la brecha digital y la accesibilidad, ii) la formación docente y las comunidades de práctica, iii) el Diseño Universal para el Aprendizaje (DUA) y iv) los marcos normativos y éticos. Se tiene por conclusión que la IA ofrece oportunidades significativas para personalizar el aprendizaje, atender la diversidad de estudiantes y reposicionar al docente como diseñador de experiencias formativas inclusivas. Para que estas posibilidades se concreten, resulta indispensable articular políticas públicas, proyectos de inversión tecnológica y estrategias curriculares basadas en el Diseño Universal para el Aprendizaje.

Descriptores: inteligencia artificial; planificador de la educación; personal académico docente. (Fuente: Tesaurus UNESCO).

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Review articles



INTRODUCTION

The integration of artificial intelligence (AI) in Ecuadorian basic education poses a dual scenario, given that on the one hand, there are infrastructure and connectivity gaps that limit effective access to digital tools and, on the other, there is an opportunity to revolutionise teaching and learning processes through personalisation, inclusion and the redesign of the teaching role, as many schools still operate with obsolete equipment and intermittent connection, which hinders the implementation of AI-based solutions (Ahmad et al., 2021; Conde-Zhingre et al., 2022).

At the same time, evidence suggests that, if teachers' digital competences are strengthened and clear policy frameworks are established, AI can become a powerful resource to address the diversity of learning styles and paces, as well as to foster more creative and collaborative pedagogical practices (Basantes-Ortega et al., 2025; Duque-Rodríguez, 2024).

Based on the above, the current review article aims to analyse the challenges and opportunities of integrating artificial intelligence in Ecuadorian basic education.

Theoretical framework

The theoretical framework of this study is based on four conceptual axes that guide the analysis of the challenges and opportunities of artificial intelligence in Ecuadorian basic education: i) the digital divide and accessibility, ii) teacher training and communities of practice, iii) Universal Design for Learning (UDL) and iv) regulatory and ethical frameworks ; thus, they are presented:

Digital divide and accessibility

The concept of the digital divide refers to inequalities in access to and use of information and communication technologies (ICTs) among different sectors of the population (van Dijk, 2006, cited in Ahmad et al., 2021). In the Ecuadorian



context, this gap is manifested in the lack of stable connectivity and obsolete equipment in many basic education institutions (Conde-Zhingre et al., 2022). Accessibility, on the other hand, implies not only making devices and the Internet available, but also ensuring that digital environments respond to the needs of students with disabilities (Calderón-Delgado et al., 2024), therefore, overcoming these barriers requires conceiving infrastructure as an educational public good, combining investment in hardware with maintenance programmes and ongoing technical support.

Teacher training and communities of practice

The professionalisation of teachers in the pedagogical use of AI goes beyond simple technical training, as it implies the collective construction of situated knowledge, through communities of practice where teachers design, implement and evaluate AI-based strategies (Basantes-Ortega et al., 2025; Duque-Rodríguez, 2024), consequently, these collaborative spaces favour critical reflection on the didactic implications of technology and promote the co-creation of educational resources adapted to the socio-cultural context of each classroom, thus, the teacher is not a mere recipient of tools, but an agent of innovation that articulates technological and pedagogical knowledge to meet the diversity of the student body.

Universal Design for Learning (UDL)

SAD proposes creating flexible educational environments that anticipate barriers and offer multiple forms of representation, expression and engagement (Meyer, Rose & Gordon, 2014, cited in Palacios-García, 2024). By integrating AI algorithms that detect patterns of difficulty and suggest personalised learning paths, an inclusive education that recognises individual differences as a source of pedagogical richness is enhanced; therefore, this perspective places AI as a support tool to design "flexible curricular insertions" that benefit not only students with special needs, but the whole group, by diversifying the forms of access to knowledge.



Regulatory frameworks and ethical considerations

In this context, the responsible integration of AI requires a participatory regulatory framework, incorporating criteria of data protection, equity of access and continuous impact evaluation (Ifenthaler et al., 2024; Puertas-Bravo et al., 2024); in this sense, education policies should be defined through consultative processes involving the Ministry of Education, school communities and technology experts, so that clear protocols on privacy, algorithm transparency and ethical teacher training are established, only this will ensure that AI effectively contributes to the quality and equity of basic education in Ecuador, without reproducing or widening existing inequalities.

METHOD

In order to fulfil the research objective of analysing the challenges and opportunities of the integration of artificial intelligence in Ecuadorian basic education, a systematic documentary review of 25 academic studies published between 2021 and 2025 was carried out. The procedure followed the following phases:

Twenty-five documents were identified through searches in specialised databases (Scopus, Web of Science, Redalyc and SciELO, Google Scholar), using Boolean terms such as "artificial intelligence" AND "basic education" AND "Ecuador". We included articles, papers and book chapters that provided empirical or reflective evidence on AI implementation in school contexts. In this way, we proceeded to establish the inclusion and exclusion criteria:

Inclusion: Papers in English or Spanish; studies with a focus on basic education (primary and secondary); presenting results on AI challenges or opportunities.

Exclusion: Theoretical essays without applied data; publications before 2021; research focused exclusively on higher education.

For each document, reference data (author, year), main challenges reported and opportunities identified were recorded. This information was organised in a



systematised matrix. Therefore, from the matrix, table 1 was elaborated, where the challenges (left column) and opportunities (right column) are directly contrasted along with the corresponding citation in APA 7 format, which facilitates the visualisation of thematic convergences and disparities between the studies.

Subsequently, a qualitative content analysis was carried out, focusing on four theoretical axes:

1. Digital divide and accessibility
2. Teacher training and communities of practice
3. Universal Design for Learning (UDL)
4. Regulatory frameworks and ethical considerations

Therefore, through documentary content analysis, the relationships between challenges and opportunities were interpreted in order to draw conclusions about the conditions necessary to articulate the curricular ontology before and after the adoption of AI for didactic purposes in the Ecuadorian education system.

RESULTS

Based on the review of 25 academic documents, a comparative analysis of the challenges and opportunities set out in table 1 systematises the necessary edges to initiate an articulating study between the curricular ontology before and after the generation of AI for didactic purposes in the Ecuadorian education system, thus presenting:



Table 1. Challenges and opportunities of AI integration in Ecuadorian basic education.

Challenges identified	Opportunities identified	Reference
Insufficient technological infrastructure and digital divide in schools.	Personalisation of learning and data analysis for educational sustainability.	(Ahmad et al., 2021).
Lack of clear policies for basic AI; teacher resistance.	Designing innovative curricula with AI to stimulate 21st century competences.	(Aristega et al., 2023).
Lack of legal regulation for the use of AI and blockchain in training processes.	Increased traceability and transparency in assessments and certifications.	(Armas et al., 2024).
Teacher role in crisis: methodological adaptation and lack of training.	Teacher empowerment and the emergence of new pedagogical roles.	(Basantes-Ortega et al., 2025).
Poor digital accessibility for students with disabilities.	Effective inclusion through adaptive technologies.	(Calderón-Delgado et al., 2024).
Lack of systematic studies on basic AI.	Identification of best practices and guidelines for implementation.	(Calderón-Loyola & Nieto-Rivas, 2024)
Institutional resistance to change and little continuous training.	Strengthening ongoing teacher training.	(Carbonell-García et al., 2023).
School infrastructure and connectivity limitations.	Optimisation of administrative processes and student monitoring.	(Conde-Zhingre et al., 2022).
Risk of dehumanisation by prioritising technology over values.	Balance between AI and humanistic approach to enrich learning.	(Duque-Rodríguez, 2024).
High learning curve for augmented reality (AR).	Enriching science education with immersive AR.	(Guaña-Narváez et al., 2024).
Regional inequalities in access to AI in Latin America.	Promotion of inter-institutional collaboration networks.	(Guerrero-Quíñonez et al., 2023).
Insufficient and disjointed public policies.	Clear guidance for decision-makers and regulatory frameworks.	(Ifenthaler et al., 2024).
Difficulty in adapting adaptive environments to special needs.	Advances in inclusive and personalised learning environments.	(Jadán-Guerrero et al., 2024).
Cautious teacher perceptions and lack of local evidence.	Preliminary data supporting the acceptance of AI in the classroom.	(Mena-Salcedo et al., 2025).
Limited teacher training in advanced digital skills.	Identification of emerging trends for continuous training.	(Miñan et al., 2023).
Traditional research methods poorly adapted to AI.	Fostering new AI-oriented research skills.	(Padilla-Caballero et al., 2023).
Difficulties in adapting the curriculum for students with special needs.	Development of inclusive curricular adaptations with AI.	(Palacios-García, 2024).
Little integration of AI in English language teaching.	Improving language learning outcomes through AI.	(Pazmiño & Lucas, 2023)
Variable teacher perception of AI usefulness.	Harnessing teachers' vision to implement tools.	(Piña-Ferrer, 2024).



Regulatory gaps in AI regulation in education.	Opportunity to design clear legal frameworks in the Andean Community.	(Puertas-Bravo et al., 2024).
Complexity of implementing GBL with AI support.	Enhancement of critical thinking through intelligent games.	(Román-Celi, 2023)
Affecting online learner-instructor interaction.	Improving communication and feedback in virtual environments.	(Seo et al., 2021).
Institutional and policy factors delaying adoption.	Lessons for transferring good practice from top to bottom.	(Vergara et al., 2024).
Low level of AI and prompt engineering literacy.	Promotion of critical thinking and advanced digital skills.	(Walter, 2024)
K-12 AI tools not always adapted to the local context.	Reviewing global trends to design local tools.	(Yim & Su, 2025)

Source: Own elaboration.

Table 1 presents, in an organised manner, the main challenges and opportunities that research has identified for integrating artificial intelligence in Ecuadorian basic education. It is noted that gaps in infrastructure and connectivity, as well as still incipient teacher training in digital skills, represent barriers that limit the effective use of AI tools in the classroom (Ahmad et al., 2021; Conde-Zhingre et al., 2022). However, studies also highlight that these same technologies can enhance the personalisation of teaching, favour the inclusion of students with special educational needs and reconceptualise the role of the teacher as facilitator and designer of learning experiences (Basantes-Ortega et al., 2025; Duque-Rodríguez, 2024). This balance between difficulties and possibilities reveals the urgency of promoting educational policies, continuous training programmes and contextualised curricular adaptations, so that AI becomes a real ally of the pedagogical process in Ecuadorian classrooms.

Therefore, for artificial intelligence to make a real contribution to Ecuador's basic education, it is essential to close the digital divide, strengthen continuous teacher training and establish clear rules to guide its use in the classroom. At the same time, the possibilities of personalising teaching, effectively including students with special needs and enhancing the role of teachers as creators of learning experiences open up a very promising path. If authorities, schools and the



academic community work hand in hand, AI can become a practical tool for improving educational quality and equity in Ecuador.

DISCUSSION

The discussion of the results shows that the limited technological infrastructure and intermittent connectivity is a structural obstacle that goes beyond the simple provision of equipment (Ahmad et al., 2021; Conde-Zhingre et al., 2022). In a context where most campuses still lack reliable broadband, it is imperative to design investment projects that focus not only on hardware, but also on maintenance, upgrades and ongoing technical support.

Secondly, teacher professionalisation emerges as a lever for change, as isolated training workshops on digital tools are not enough, but it is necessary to articulate communities of practice where teachers share experiences, co-construct AI-supported pedagogical resources and critically reflect on their impact on learning (Basantés-Ortega et al., 2025; Duque-Rodríguez, 2024). Therefore, this collaborative model favours the consolidation of situated knowledge, as teachers adapt technological solutions to the socio-cultural particularities of their students, strengthening the relevance and sense of belonging in the training process.

Additionally, the review shows that AI-mediated curricular adaptations can transcend the specific attention to special educational needs to become an exercise in universal learning design; by integrating algorithms that detect patterns of difficulty and propose alternative teaching routes, an inclusive school culture is promoted, where each student has access to multiple modalities of representation, expression and cognitive engagement (Calderón-Delgado et al., 2024; Palacios-García, 2024).

Therefore, the development of a participatory regulatory framework is essential, in which the Ministry of Education, academic institutions and civil society engage in dialogue to establish ethical standards, evaluation criteria and data protection protocols (Ifenthaler et al., 2024; Puertas-Bravo et al., 2024). Only then will



artificial intelligence cease to be an object of technological desire and become an integrated, regulated and continuously evaluated pedagogical resource that boosts the quality and equity of basic education in Ecuador.

CONCLUSION

The documentary content analysis shows that the integration of artificial intelligence in Ecuadorian basic education requires, on the one hand, overcoming structural obstacles such as the digital divide, the precariousness of infrastructure and the need for an effective regulatory framework; on the other hand, it is necessary to strengthen pedagogical capacities through continuous training and communities of practice for teachers. At the same time, AI offers significant opportunities to personalise learning, address student diversity and reposition teachers as designers of inclusive learning experiences. For these possibilities to be realised, it is essential to articulate public policies, technological investment projects and curricular strategies based on Universal Design for Learning. Only in this way will AI cease to be an incipient resource and become an effective ally for improving the quality, equity and relevance of basic education in Ecuador.

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CONFLICT OF INTEREST

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