Research Article

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Generative AI & Open Education: Ethical, Inclusive, and Contextually Grounded Pedagogy

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Abstract

Recent research demonstrates that generative artificial intelligence (GAI) is profoundly reshaping educational paradigms, steering teaching and learning systems toward open, inclusive, and contextually grounded practices. This study proposes an integrative model that combines Open Educational Resources (OER), Open Educational Practices (OEP), and GAI to foster an ethical and sustainable pedagogical transformation. A mixed-methods design was implemented with 453 participants in education sciences drawn from 45 secondary, college, and university institutions in Cameroon and Chad. Quantitative findings reveal a significant correlation between OER and equitable accessibility ($\beta = 0.61$; $p < 0.01$), OEP and cognitive justice ($\beta = 0.54$; $p < 0.01$), as well as a positive effect of GAI on personalization ($\beta = 0.49$; $p < 0.01$). The combined influence of these three dimensions strengthens pedagogical resilience ($\beta = 0.65$; $p < 0.01$). Qualitative data highlight the critical role of human mediation, locally collaborative governance, and contextual appropriation. Policy implications include inclusive governance of educational innovations, techno-ethical teacher training, and the territorial anchoring of open education policies. This model positions itself as both a strategic and tactical lever for pedagogical sustainability in response to the challenges of the hypermodern era.

Keywords: Generative Artificial Intelligence, Open Education, Open Educational Resources, Cognitive Justice, Pedagogical Resilience

1. Introduction

Generative artificial intelligence (GAI) is reshaping the very foundations of pedagogy. By producing original content from models trained on vast corpora, it redefines the boundaries between author, tool, and learner (Luccioni, 2023; Floridi & Chiriatti, 2020). This transformation raises technical, ethical, and didactic challenges that are particularly acute in fragile educational contexts characterized by multilingualism, low connectivity, and uneven distribution of resources (Perryman & de los Arcos, 2023; Author, 2025).

Open education seeks to broaden access to knowledge and to foster its reuse. It builds on **Open Educational Resources (OER)**—materials released under open licenses that allow use, adaptation, and redistribution—and on **Open Educational Practices (OEP)**, which make pedagogical design and assessment processes visible and shareable. Transparency, participation, and cooperation constitute its structuring principles (UNESCO, 2021). Yet their adoption remains limited in Francophone Sub-Saharan Africa, where OER and OEP struggle to meet local linguistic, curricular, and infrastructural needs (Carvalho & Redecker, 2024) [6].

GAI offers new levers of adaptation—contextualization, translation, differentiation—and personalization—tutoring, formative feedback. However, when used without safeguards, it can exacerbate digital divides, linguistic inequities, and algorithmic risks such as bias, opacity, and technological dependency (Dignum, 2020; Selwyn, 2023). Hence the necessity of an applied ethics grounded in three key notions.

Cognitive justice: the effective right to understand, produce, and have knowledge recognized in one's own languages and contexts. **Technological sovereignty**: local capacity to choose, adapt, and govern tools, data, and their uses. **Inclusivity**: universal design attentive to accessibility, linguistic diversity, and connectivity constraints, including offline environments (Hilton, Wiley, & Thanos, 2024). The guiding question is thus: **How can an open, ethical, and context-sensitive pedagogy be operationalized in the era of GAI without lapsing into a decontextualized technocentrism?** The objective is to propose and empirically test an operational model combining openness (OER/OEP), inclusivity, cognitive justice, and pedagogical resilience in constrained environments.

Methodologically, the study adopts a mixed strategy. A qualitative investigation using semi structured interviews with teachers, learners, and policy makers documents uses, barriers, and conditions for appropriation. A quantitative survey of 453 respondents from 45 institutions in Cameroon and Chad tests a hybrid model integrating indicators of openness, inclusivity, cognitive justice, and resilience. Operationalization relies on items adapted from validated scales (translation–back translation), measured on five- or seven-point Likert scales, with controls for bias and access conditions (connectivity, equipment).

The expected contribution is threefold. First, it proposes a conceptual framework articulating GAI, open education, and cognitive justice, tailored to multilingual and low-connectivity environments. Second, it presents an implementation model equipped with ethical safeguards—data governance, explainability, inclusion. Third, it offers a set of measurable indicators for monitoring equity, quality, and sustainability of use.

The article unfolds in a logical sequence. The first section clarifies the conceptual foundations of open education, cognitive justice, and GAI. The second details the methodological approach and instruments. The third presents the empirical findings. The fourth discusses their scope, limitations, and operational implications. The fifth concludes with political, institutional, and didactic recommendations. In sum, the aim is to chart a pathway for the appropriation of GAI in support of an open, inclusive, and contextualized education, privileging evidence, safeguards, and the measurement of impacts on learning and equity.

2. Conceptual Foundations

In an era marked by the rapid emergence of generative artificial intelligence (GAI) and the reconfiguration of educational dynamics, it is essential to clarify the conceptual underpinnings of an open, inclusive, and ethically oriented education. This first section establishes the theoretical landmarks guiding our reflection. It begins with an in-depth definition of open education, examining its founding perspectives and the challenges it raises (1.1). It then analyzes the pedagogical transformations induced by GAI, particularly with respect to access, personalization, and the mediation of knowledge (1.2). The third subsection explores the conditions of genuine inclusion through the lenses of cognitive justice and learning ethics in an algorithmic environment (1.3). Finally, the fourth subsection highlights persistent theoretical gaps while laying the groundwork for a rigorous operationalization of shared values that can secure a responsible educational transformation (1.4).

2.1. Open Education: Definitions, Ambitions, and Challenges

Open education is a paradigm centered on free access to knowledge and the active participation of learners (UNESCO, 2021). Its aims include cognitive justice, epistemic equity, and the reduction of educational inequalities (Perryman & de los Arcos, 2023). This model rests primarily on two pillars: **Open Educational Resources (OER)** and **Open Educational Practices (OEP)**. OER consist of educational materials released under open licenses that permit unrestricted use, modification, and dissemination (Hilton & Wiley, 2024). Their transformative potential lies in the global pooling of knowledge.

OEP, by contrast, engage learners in participatory approaches. They valorize situated knowledge and redefine the role of the instructor as a facilitator of learning (Weller, Jordan, & Rolfe, 2022). This pedagogy is designed to be open, reflexive, and contextually grounded. However, its anchoring remains limited in fragile educational systems. Several obstacles hinder its adoption: inadequate digital infrastructure, limited competencies, institutional resistance, and absent or inconsistent policy frameworks. Such deficits of appropriation create a risk: an open education that, if poorly contextualized, reproduces the very inequalities it seeks to overcome. For open education to be genuinely inclusive, it must integrate the linguistic, sociocultural, and material realities of local communities.
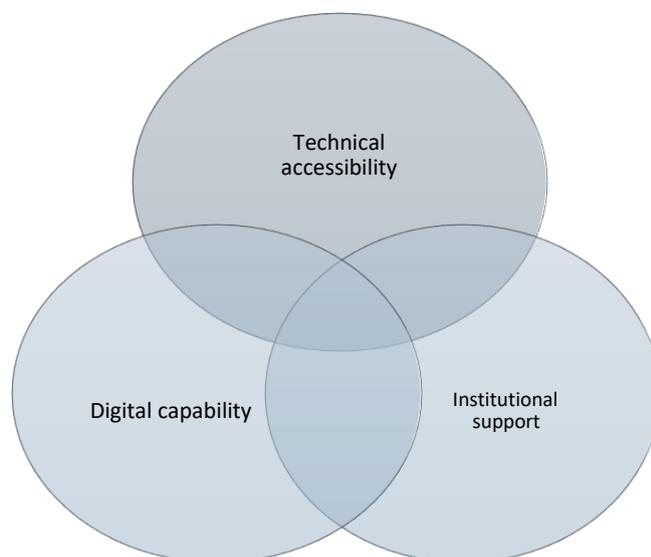
Source: author, production from literature, May 2025

Figure 1: Critical Conditions for the Equitable Implementation of Open Education.

In addition, Tables 1 and 2 compare, respectively, the basic characteristics of OER and PEO. They thus highlight their points of convergence, their dissemination levers and the constraints of implementation in the French-speaking African context.

Table 1: Characteristics of Open Educational Resources (OER)

Dimensions	Definition	Examples	Issues
Open License	Allows use, adaptation, sharing	CC BY, CC BY-SA	Legal certainty
Accessibility	Free digital distribution	MOOCs, open books	Digital divide
Reusability	Content Modularity	Adaptable course modules	Language localization

Source: Author, Compilation of Literature, May 2025

This table presents three fundamental dimensions of OER: open licensing, accessibility, and reusability. The license guarantees rights of use and adaptation, thus ensuring a legal basis conducive to inclusive innovation. Accessibility, facilitated by digital technology, remains hampered by persistent technological divides. Reusability underlines the need for modular content, adapted to local contexts. These elements reflect the tensions between openness and systemic constraints, justifying inclusive governance, as shown in Table 2.

Table 2: Components of Open Educational Practices (PEOs).

Dimensions	Definition	Examples	Challenges
Participatory pedagogy	Co-Author Learner	Forums, collaborative wikis	Teacher training
Social inclusion	Valuing diversity	Intercultural learning	Implicit Prevailing Norms
Contextualisation	Adapting to local realities	Integrated endogenous knowledge	Lack of local resources

Source: Author, Compilation of Literature, May 2025

Table 2 highlights three pillars of Open Educational Practices (OEP): participatory pedagogy, social inclusion, and contextualization.

These dimensions aim to democratize learning by valuing learner engagement, cultural diversity, and the local grounding of knowledge. Their implementation, however, remains constrained by limited teacher training, the persistence of implicit exclusionary norms, and the scarcity of context-specific resources. These limitations call for policies that support the recognition of pluralities and the local co-construction of content.

Far from being a mere technical instrument, open education functions as a political and cultural lever.
It requires a redefinition of the learner's role and a reconfiguration of the relationship to knowledge. Its development demands strong contextual anchoring, structured institutional support, and heightened ethical vigilance in the face of risks such as techno centrism and pedagogical standardization.

2.2. Generative Artificial Intelligence (GAI) and Pedagogical Transformation

Generative artificial intelligence (GAI) encompasses technologies capable of automatically producing diverse types of content from massive datasets (Floridi & Chiriatti, 2020; LeCun, 2024). It is reshaping the functions of teachers, redefining the role of learners, and reconfiguring educational environments. GAI facilitates lesson planning, differentiated content creation, and formative assessment (Luccioni, 2023; Eynon, 2024). Its use supports individualized learning pathways, metacognitive development, and learner autonomy. GAI also enhances educational accessibility by generating adapted resources such as audio summaries, automatic translations, and simplified visual materials (Selwyn, 2023) - a particularly critical function in the multilingual contexts of the Global South.

However, its deployment introduces significant risks: algorithmic opacity, cultural bias, and threats to privacy (Dignum, 2020; Knox, 2023). It may also marginalize the critical role of the teacher (Arola & Mertala, 2024). Integrating GAI therefore requires an ethical alignment with Open Educational Resources (OER) and Open Educational Practices (OEP) to prevent technocentrism while reinforcing cognitive justice and educational sovereignty.

2.3. Inclusion, Cognitive Justice, and the Ethics of Learning in the Era of GAI

Educational inclusion seeks equitable access to learning regardless of social or cultural conditions (UNESCO, 2023). It entails adapting pedagogical environments to learner diversity and is grounded in a broader logic of social justice (Schuelka et al., 2022). **Cognitive justice**, a critical extension of equity, values plural forms of knowledge and marginalized epistemologies (Santos, 2014; Perryman & de los Arcos, 2023). It resists the homogenization imposed by dominant—often Western—models.

The integration of GAI into education generates complex tensions. While it enables personalization (Luckin, 2021), it can also reproduce inequalities. Training corpora, frequently biased and standardized, risk erasing local knowledge (Bender et al., 2021; Weller et al., 2022). Moreover, AI architectures typically designed without the participation of stakeholders from the Global South undermine pedagogical sovereignty (Mignenan & Nkengne, 2024). This dynamic reinforces implicit normativity and limits alternative pathways.

An **educational ethics of GAI** therefore calls for shared governance, local co-design, and algorithmic transparency (Dignum, 2020). Inclusion must move beyond the purely technological dimension to encompass cultural and epistemic registers.
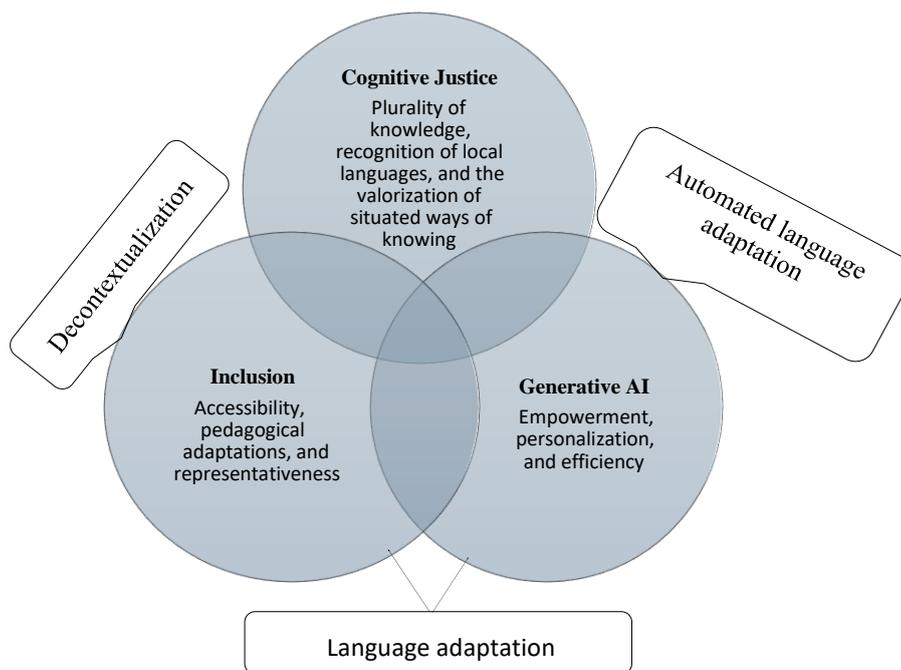
Source: author, production based on literature, September 2025

Figure 2: Tensions and Synergies between Inclusion, Cognitive Justice, and Generative AI.

Figure 2 illustrates the tensions among three essential poles of educational transformation: inclusion, cognitive justice, and generative artificial intelligence (GAI). It highlights potential contradictions—such as cultural erasure or the decontextualization of knowledge—produced when standardized technologies are applied to plural contexts. Yet it also reveals areas of synergy. When properly regulated, GAI can support linguistic adaptation, personalization, and accessibility.

This tripolar model invites the design of an ethical, localized, and inclusive educational technology. The adoption of GAI cannot proceed without a critical, ethical, and epistemological lens. The goal is to move beyond a purely efficiency-driven logic. Cognitive justice and respect for diversity must guide any pedagogical reform. Only under these conditions can GAI become a true lever for open, equitable, and contextually grounded education. Table 3 below provides a structured synthesis of these interrelations.

Table 3: Analytical comparison of the contributions and limitations of AGI in open education

Dimension	Potential contributions	Identified risks
Accessibility	Machine translation, text-to-speech	Contextually biased or inappropriate content
Pedagogy	Instant feedback, adaptation of routes	Technological dependence, loss of teaching staff
Inclusion	Access to tools for marginalized audiences	Reinforcing inequalities in access to technology
Ethics	Support for plagiarism detection, assistance with wording	Lack of transparency of models, data collection

Source: Author, Literature Compilation, September 2025

2.4. Theoretical Gaps and the Operationalization of Shared Values

Despite a growing body of research on open education and generative artificial intelligence (GAI), the integration of inclusive ethical values remains marginal. Most studies adopt a techno-centric orientation, focusing on algorithmic performance at the expense of cultural and contextual concerns (Carvalho & Redecker, 2024; Knox, 2022).

Some investigations treat Open Educational Resources (OER) merely as vectors for dissemination without questioning their pedagogical quality (Hilton, 2023). Others overlook linguistic diversity or the structural constraints of low-resource contexts (Nkengne & Mignenan, 2024).

This fragmentation raises a pressing question: How can cognitive justice, diversity, and technological efficiency be reconciled? Few studies articulate these dimensions within a coherent framework.

Our study addresses this gap by proposing a hybrid model built on four pillars:

1. Recognition of Situated Knowledge – valuing local epistemologies and contextspecific expertise.
2. Techno-Pedagogical Accessibility – ensuring equitable access to both digital infrastructure and pedagogical support.
3. Sociolinguistic Relevance – integrating local languages and cultural specificities into open educational practices.

4. Educational Responsibility-embedding ethical governance, accountability, and transparency in technological design and implementation.

This framework seeks to transcend the divide between technology and equity by offering an evaluative grid anchored in the realities of marginalized educational environments. Table 4 below provides a synthesized representation of these four foundational pillars.

Table 4: Synthetic grid of gaps identified in recent literature

Dimensions analyzed	Common theoretical limitations	Examples of work
Ethics and responsibility	Prescriptive approaches, without real empirical anchoring	Dignum (2020), Knox (2022)
Inclusion and equity	Lack of measurable criteria in the Global South	Schuelka et al. (2022)
Justice cognitive	Invisibilization of situated knowledge	Santos (2014), Perryman & de los Arcos (2023)
Appropriation of the AGI	Non-contextualized technocentric models	Luccioni (2023), Carvalho & Redecker (2024)

Source: Author, compilation from literature, September 2025

This table highlights major gaps in the literature. The discourse often remains theoretical, disconnected from the realities specific to the countries of the South. Situated knowledge is invisibilized. The AGI is not very contextualized. These limits call for an epistemological refoundation. Figure 3 illustrates our model of ethical convergence, combining open education, IAG and territorial anchoring.
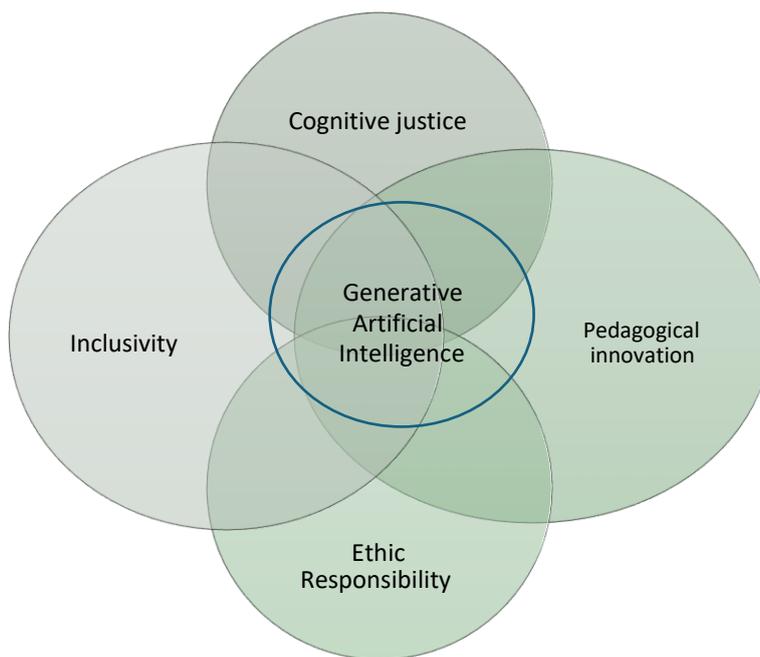
Source: Author, compilation from literature, September 2025

Figure 3: Conceptual framework for the operationalization of open education in the AGI era.

This figure presents the architecture of open education in the era of generative artificial intelligence (GAI). It rests on four foundational pillars: inclusivity, cognitive justice, ethical responsibility, and pedagogical innovation, with GAI functioning as a transversal lever. Inclusivity adapts educational environments to diverse learner needs. Cognitive justice affirms and valorizes local knowledge systems. Ethical responsibility governs the use of technology. Pedagogical innovation ensures flexibility and adaptability in teaching and learning.

GAI is not an end in itself but a tool whose value depends on ethical and contextualized integration. The literature underscores the synergies between GAI and open education.

GAI supports personalization, while OER and OEP strengthen equitable access to knowledge (Luccioni, 2023; UNESCO, 2021). Yet persistent limitations remain. Many studies adopt an instrumental perspective, overlooking issues of cognitive justice and technological sovereignty (Dignum, 2020). Contexts with limited resources are rarely explored (Nkengne & Mignenan, 2024), and research remains fragmented.

No comprehensive evaluative framework currently exists. This study addresses that gap by proposing a model grounded in the realities of marginalized educational settings, combining theoretical rigor with contextual relevance.

3. Conceptual Framework, Research Model, and Hypotheses

3.1. Conceptual Foundations

Contemporary open education rests on the articulation of Open Educational Resources (OER), Open Educational Practices (OEP), and the principles of inclusion and cognitive justice (Hilton & Wiley, 2024; Weller et al., 2022). In the context of Generative Artificial Intelligence (GAI), these elements must be conceived together. While GAI enables personalized learning, it also introduces risks of standardization, opacity, and dependency (Floridi & Chiriatti, 2020; Dignum, 2020).

The proposed model draws on systemic approaches (Redecker & Punie, 2017) and transdisciplinary perspectives (Perryman & de los Arcos, 2023). It seeks to conceptualize a pedagogical transformation that is at once ethical, inclusive, and contextually grounded, along four analytical axes:

- Axis 1 – Inclusive Accessibility to Open Knowledge: Ensuring equitable digital and pedagogical access to open resources.
- Axis 2 – Ethical Responsibility in the Use of GAI: Embedding transparency, accountability, and fairness in AI deployment.

- Axis 3 – Recognition of Local and Plural Knowledge: Valuing situated epistemologies and diverse cultural contributions.
- Axis 4 – Pedagogical Adaptability and Cognitive Justice: Designing flexible learning pathways that respect linguistic, social, and cognitive diversity.

These four axes converge toward a central principle of shared educational value, understood as the capacity of an educational system to meet diverse learner needs equitably through open technologies.

3.2. Integrative Conceptual Model

The conceptual model—illustrated in Figure 4—is built on a logic of dynamic interdependence among four core constructs:

1. Open Educational Resources (OER): levers for opening access to knowledge content.
2. Open Educational Practices (OEP): primary vectors of collaboration and participatory learning.
3. Generative Artificial Intelligence (GAI): an instrument of automation and personalization.
4. Shared Values (SV): anchored in equity, diversity, and contextualization.
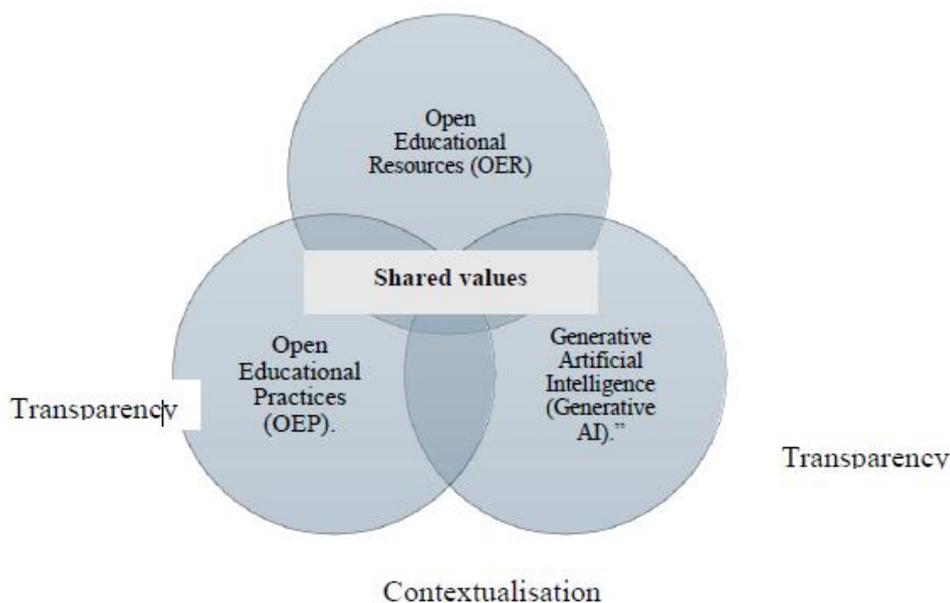
Source: Author, compilation from literature, September 2025

Figure 4. Conceptual Model of Educational Transformation through OER, OEP, and GAI Justice cognitive.

Figure 4 presents a convergent model centered on shared values that integrates OER, OEP, and GAI. Each circle represents an essential educational lever, interconnected with the others through key indicators such as accessibility, cognitive justice, contextualization, and transparency. Together, these components embody a systemic approach that links technology, open resources, and participatory practices in the service of an ethical, inclusive, and contextually grounded education.

Building on this integrative conceptual model illustrated in Figure 4, the following section advances three hypotheses that articulate the interactive dynamics among OER, OEP, and GAI. These hypotheses are formulated within a systemic perspective focused on shared values and on the key indicators of an ethical, inclusive, and context-sensitive education.

3.3. Research hypotheses

The model illustrated in Figure 4 allows us to formulate three research hypotheses in the following lines.

Hypothesis 1 (H1): Learners perceived cognitive justice is influenced by the level of integration of Open Educational Resources (OER) in knowledge production. This hypothesis rests on the premise that inclusively integrated OER valorize forms of knowledge often excluded from dominant curricula. According to Santos (2014), cognitive justice requires the recognition of plural epistemologies, particularly those emerging from the Global South. OER contribute to this

recognition by making local content visible and by enabling translations into minoritized languages (Perryman & de los Arcos, 2023). Hilton (2020) confirms that OER democratize knowledge, provided they are accompanied by critical pedagogies. Weller et al. (2022) show that OER strengthen the legitimacy of situated knowledge. Their strategic integration thus broadens the range of cultural references mobilized and enhances perceived cognitive justice.

Hypothesis 2 (H2): Equitable accessibility to learning depends on the level of adoption of Open Educational Practices (OEP). OEP are grounded in co-construction, inclusivity, and flexibility. They adapt instructional arrangements to learner needs and, in multilingual or resource-constrained contexts, reduce inequalities in access (Nkengne & Mignenan, 2024). According to UNESCO (2021), OEP foster engagement and support equitable learning opportunities. Hodgkinson-Williams and Trotter (2018) demonstrate their effectiveness among marginalized groups, particularly when

paired with localized OER. OEP are therefore pivotal for broadening access to relevant and inclusive educational resources.

Hypothesis 3 (H3): Perceived pedagogical transparency in learning processes is conditioned by the degree of integration of Generative Artificial Intelligence (GAI). GAI—exemplified by tools such as ChatGPT—provides immediate feedback, enhanced traceability, and algorithmic personalization. These functions can increase pedagogical transparency when implemented within ethical safeguards. Eynon (2024) and Luccioni (2023) show that GAI clarifies evaluations, adapts content, and documents interactions. However, Dignum (2020) cautions that such transparency depends on the readability of algorithms and participatory regulation. Thoughtful integration of GAI can thus clarify content and feedback, making learning arrangements more comprehensible.

Table 5: presents a structured synthesis of these three hypotheses.

Hypothesis	Variables and Wording	Indicators / Items	Sources
H1	Explanatory variable: Level of integration of OERVasurable to explain: Perceived cognitive justice Formulation: The strategic integration of OER promotes the recognition of plural knowledge and reinforces cognitive justice.	• Rate of use of OER• Perception of diversity of sources• Recognition of local knowledge	Hilton & Wiley (2024); Perryman & de los Arcos (2023); Santos (2014)
H2	Explanatory variable: Use of PEOsariable to explain: Equitable accessibility Formulation: The active use of PEOs improves access to knowledge for marginalized audiences.	• Perception of accessibility• Participation in open activities• Frequency of use of PEOs	UNESCO (2021); Nkengne & Mignenan (2024); Weller et al. (2022)
H3	Explanatory variable: Integration of the AGIVatable to be explained: Perceived pedagogical transparency Formulation: The reasoned integration of the AGI, improves the clarity and transparency of content and assessments.	• Clarity of feedback• Understanding of evaluation processes• Perceived transparency of algorithms	Selwyn (2023); Dignum (2020); Luckin (2021)

Source: Author, compilation from literature, September 2025

4. Research Methodology
This study employs a mixed-methods design, combining an exploratory qualitative approach with an explanatory quantitative analysis (Creswell & Plano Clark, 2018). The objective is to confront the perceptions of educational stakeholders and to test the hypotheses concerning the integration of OER, OEP, and GAI. Data were collected in two Francophone African countries—Chad and Cameroon—across 44 educational institutions and from 443 respondents (teachers and learners).

4.1. Exploratory Qualitative Methods
The qualitative component explores the experiences and uses of OER, OEP, and GAI in diverse pedagogical contexts. Forty-four semi-structured interviews were conducted in Cameroon and Chad using purposive sampling. The interviews focused on four key dimensions:
1. Accessibility of OER
2. Uses of GAI
3. Collaborative practices
4. Ethical perceptions

All interviews were transcribed and coded in NVivo following the inductive method of Miles, Huberman, and Saldaña (2020). Inter-coder triangulation was applied to ensure the validity of the analysis.

4.2. Explanatory Quantitative Method
The quantitative component tests the three hypotheses through a structured questionnaire administered to 453 respondents (approximately one item per ten participants). The instrument contains 44 items distributed across four dimensions: accessibility, contextualization, cognitive justice, and resilience. Scales were adapted from validated sources (Andrade et al., 2022; Perryman & de los Arcos, 2023) and contextualized after a pretest with 42 respondents.

Data analysis was performed using SPSS v.27 and included an exploratory factor analysis (EFA). Cronbach's alpha coefficients ranged from 0.78 to 0.89, indicating strong internal consistency. A structural equation modeling (SEM) procedure provided partial confirmation of hypotheses H1 through H3 ($p < 0.05$). Table 6 presents a detailed synthesis of the methodological steps.

Table 6: Summary of the methodology implemented

Methodology	Main objective	Techniques used	Analytical tools	References
Exploratory Qualitative	Understanding perceptions and contexts of use	Semi-structured interviews, thematic analysis	NVivo, inductive coding	Miles et al., 2020
Quantitative confirmatory	Testing the assumptions of the integrated model	Structured questionnaire, SEM analysis	SPSS, AFE, SEM, alpha Cronbach	Creswell & Plano Clark, 2018; Andrade et al., 2022

Source: Author, compilation from literature, September 2025

This methodological combination ensures the ecological and statistical validity of the model, while integrating the voices of local actors in the construction of a relevant reference framework for open education in a fragile context.

5. Research Findings

5.1. Qualitative Results

The thematic analysis of interviews conducted with **45 participants** (teachers, instructional leaders, and policy makers) reveals discursive regularities aligned with the three hypotheses formulated.

Hypothesis 1 (H1). Most respondents reported that the strategic integration of Open Educational Resources (OER)—particularly those translated or adapted to local contexts— enhances the recognition of knowledge diversity. Several testimonies illustrate this dynamic:

"Since we started using open resources translated into the local language, students participate more actively, especially those from rural areas."

This finding corroborates the results of Hilton and Wiley (2024) as well as Perryman and de los Arcos (2023), who demonstrate that OER foster cognitive justice when they are both contextualized and accessible.

Hypothesis 2 (H2). Open Educational Practices (OEP) emerged as powerful drivers of equitable participation and sociocultural anchoring. One teacher highlighted this impact:

"Community-based projects integrated into the classroom allow students to narrate their own worlds; it changes everything."

This observation aligns with Weller et al. (2022) and UNESCO (2021), which associate active use of OEP with improved access to knowledge for marginalized and multilingual populations.

Hypothesis 3 (H3). Participants expressed mixed reactions to the introduction of Generative Artificial Intelligence (GAI) in educational settings. On the one hand, many praised its contributions to differentiation, linguistic adaptation, and individualized feedback:

"It's useful because it offers responses tailored to each student."

On the other hand, concerns surfaced regarding algorithmic bias and the provenance of generated content:

"It's convenient, but sometimes I don't know where the content comes from."

These perceptions echo the cautions raised by Selwyn (2023) and Dignum (2020), underscoring the need for algorithmic transparency and critical oversight of AI tools in education.

In summary, the qualitative data support the relevance of the three hypotheses in the conceptual model. They highlight the importance of contextual, ethical, and collaborative incorporation of OER, OEP, and GAI in alignment with the values of cognitive justice, equitable accessibility, and pedagogical transparency.

Table 7 below provides a synthesized summary of the qualitative results by hypothesis.

Table 7: Qualitative Results by Assumption

Hypothesis	Qualitative indicators observed	Illustrative verbatim	Frequency of occurrence
H1	Diversity of sources, recognition of local knowledge, use of OER	"We adapt the content in our local language thanks to OER."	High
H2	Enhanced accessibility, involvement in PEOs, inclusion of situated knowledge	"The students talk about their daily lives through educational projects."	Moderate to High
H3	Perceived clarity, doubt about transparency, differentiated support via AGI	"AI helps, but sometimes I doubt the sources."	Moderate

Source: Author, compilation of interviews, September 2025

5.2. Quantitative results: statistical validation of assumptions

The analysis was conducted with SPSS 27. Descriptive statistics confirm qualitative trends and support all three assumptions of the model. Hypothesis 1 shows a high perceived cognitive justice (mean: 4.3/5). OER are seen as vectors of cultural and linguistic anchoring. Hypothesis 2 presents equitable accessibility (average: 4.1/5), with few differences between Cameroon and Chad. PEOs strengthen inclusion and value local knowledge. They also increase learner engagement. For hypothesis 3, the pedagogical transparency linked to the AGI obtains 3.8/5, with a standard deviation of 1.2. This score reflects shared perceptions. The AGI is considered useful but questioned about the clarity of the content and algorithms. These results support the validity of the hypotheses. However, they reveal limitations related to the ethical framework and contextualization of AGI. Table 8, developed for summary purposes, presents the main trends.

Table 8: Descriptive Statistics of the Main Variables

Hypothesis	Variable Measured	Average (out of 5)	Standard deviation	Observations
H1	Perceived cognitive justice	4,3	0,9	Strong recognition of local knowledge through OER
H2	Equitable accessibility	4,1	0,8	Strengthening Inclusion through PEOs
H3	Perceived Educational Transparency	3,8	1,2	Contrasting perceptions of AGI-related transparency

Source: Author, compilation from surveys, August 2025

5.3. Correlation Analysis

The Pearson correlation analysis reveals significant associations among the components of the conceptual model.

- Equitable accessibility, strongly linked to the use of Open Educational Practices (OEP – H2), shows a high positive correlation with perceived pedagogical resilience ($r = 0.61$, $p < 0.01$), suggesting a decisive contribution of OEP to the adaptability of educational arrangements.
- Cognitive justice, anchored in the integration of Open Educational Resources (OER – H1), is significantly correlated with OEP ($r = 0.55$, $p < 0.01$), reflecting an interdependence between the valorization of local knowledge and the active engagement of learners.

- Generative Artificial Intelligence (GAI – H3), although associated with an intermediate mean score ($M = 3.8$; $SD = 1.2$), displays moderate but statistically significant correlations with other variables, particularly those related to pedagogical transparency and learning-path differentiation.

These findings support the hypothesis of a structuring effect of GAI, provided that its integration is accompanied by strong ethical safeguards and cultural contextualization. Overall, the correlation patterns confirm the relevance of the proposed integrative model, in which the interactions among inclusion, cognitive justice, and technopedagogical innovations enhance the resilience of open educational environments.

Table 9: Pearson Correlation Matrix.

Variables	Accessibility	Contextualisation	IAG	Resilience
Accessibility	1			
Contextualisation	0,52**	1		
IAG	0,47**	0,43**	1	
Resilience	0,61**	0,58**	0,49**	1

Source: Author, Survey Compilation, September 2025
*Grades: *$p < 0.01$

The correlation coefficients presented in Table 4 statistically confirm the dynamics identified during the qualitative analysis. Equitable accessibility, correlated with pedagogical resilience to the tune of $r = 0.61$, underlines the structuring effect of open educational practices on the continuity and adaptability of learning systems (H2). Contextualization, a reflection of cognitive justice reinforced by OER (H1), also has a strong relationship with resilience ($r = 0.58$) and accessibility ($r =$ 0.52), illustrating the importance of local anchoring in educational success.

The integration of AGI (H3), while perceived in a more ambivalent way, shows moderate but significant correlations with all variables (r varying from 0.43 to 0.49), confirming its potential as a cross-cutting lever, provided that an adequate ethical and contextual framework is provided.

Table 10: Multiple regression

Predictor variable	Standardized Beta (β)	Meaning (p)
REL (H1)	0,42	< 0.001
PEO (H2)	0,31	< 0.01
IAG (H3)	0,25	< 0.05
Adjusted R²	0,48	–

Source: Author, compilation from surveys, September 2025

The convergence of qualitative and quantitative data confirms all three hypotheses. Their combination promotes educational resilience, especially in precarious contexts. These findings form the basis of an ethical and integrated framework for open education in the AGI era. The next section will discuss their practical implications.

6. Discussion of Results

The findings confirm the validity of an integrative conceptual model grounded in the articulation of Open Educational Resources (OER), Open Educational Practices (OEP), and Generative Artificial Intelligence (GAI) within an ethical, inclusive, and contextually anchored framework for educational transformation. The convergence of empirical data and theoretical assumptions strengthens the credibility of the proposed framework and echoes recent analyses in the literature.

OER as Drivers of Cognitive Justice (H1). OER emerge as powerful vectors of cognitive justice, with a high mean score (M = 4.3; SD = 0.9) attesting to their role in reinforcing the linguistic and cultural anchoring of knowledge content, consistent with Hilton and Wiley (2024) and Perryman and de los Arcos (2023). Their adoption contributes to the visibility of local knowledge and the pursuit of epistemic justice. However, their impact remains dependent on the digital competencies of educational actors, underscoring the need for structured capacity building (Andrade et al., 2022).

OEP and Equitable Accessibility (H2). OEP strengthen equitable access by fostering learner engagement and the integration of situated knowledge. Their strong evaluation (M = 4.1; SD = 0.8) and significant correlation with pedagogical resilience (r = 0.61) support the idea that active participation promotes inclusion. These findings confirm the work of Weller et al. (2022) and Nkengne & Mignenan (2024), highlighting the importance of local anchoring in multilingual and vulnerable environments.

GAI and Ethical Integration (H3). GAI yields more nuanced perceptions (M = 3.8; SD = 1.2). While its potential for personalization is acknowledged, ethical concerns persist, particularly regarding algorithmic opacity, as anticipated by Floridi & Chiriatti (2020) and Dignum (2020). Its moderate but significant effect on resilience ($\beta = 0.25$) calls for integration framed by ethical principles and contextual adjustments (Selwyn, 2023).

Relative Influence of the Three Levers. Multiple regression analysis (adjusted $R^2 = 0.48$) clarifies the order of influence: OER stand out as the most impactful ($\beta = 0.42$), followed by OEP ($\beta = 0.31$) and GAI ($\beta = 0.25$). This hierarchy illustrates the complementarity of cultural anchoring, active participation, and technological flexibility in building sustainable educational resilience.

Overall, the results validate hypotheses grounded in cognitive justice, equitable accessibility, and pedagogical transparency. They demonstrate that open education extends far beyond mere digitization: it requires a transformation of governance logics and knowledge production processes. The integrated model proposed here offers a fruitful pathway for inclusive and sovereign educational policies adapted to African contexts.

7. Conclusion and Practical Implications

This research contributes to a transdisciplinary reconfiguration of open education in the era of generative artificial intelligence. Rather than treating GAI as a simple technical innovation, it conceives of it as part of a systemic transformation that interweaves inclusion, cognitive justice, transparency, and educational resilience.

Empirical results confirm that OER constitute the principal lever for cognitive justice, OEP reinforce equitable accessibility, and GAI, despite ambivalent perceptions, supports pedagogical differentiation when rigorously governed by ethical and cultural safeguards. Regression analysis highlights the complementary yet convergent contributions of these three levers to pedagogical resilience, corroborating the relevance of the proposed model.

On the theoretical level, the study enriches the paradigm of open education by integrating underexplored dimensions such as cognitive sovereignty, situated epistemology, and technopedagogical governance. It extends the work of Weller et al. (2022) on "situated openness" while providing a novel analytical perspective on the critical regulation of AI in educational practices.

Practical implications are substantial. Educational institutions should invest in digital training and the development of open infrastructures, while supporting the adaptation of OER and OEP to local realities. Policymakers must regulate the use of GAI through standards of transparency, cultural diversity, and inclusive participation, embedded from the design to the deployment stages. Researchers and practitioners, for their part, need to develop evaluation tools sensitive to local dynamics to measure the systemic impact of openness on educational resilience.

In sum, this research advocates a refoundation of pedagogical practices based on the equitable co-construction of knowledge, the synchronization of educational stakeholders, and a critical governance of GAI. GAI is not an end in itself but a lever for cognitive empowerment, the recognition of plural knowledge systems, and the shared educational resilience required to confront the uncertainties of the hypermodern world.

Conflict of Interest

The author declares that there is no conflict of interest related to the conduct of this research project, the writing, or the publication of this article.

Author's Contributions

The overall conception of the study, the development of the theoretical framework, and the analysis of the results were carried out by the sole author, Dr. Victor Mignenan. The formatting and final harmonization of the manuscript were performed by Mr. Éric Bayock, whose contribution ensured methodological rigor and compliance with academic publishing standards.

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