Review protocol: The impact of generative AI on transformative education in developing countries: A systematic literature review

Background

Generative Artificial Intelligence (Generative AI) refers to AI systems capable of producing original content, including text, images, audio, and code, by learning patterns from vast datasets (Dwivedi & Elluri, 2024). Unlike traditional AI, which primarily follows pre-programmed rules, Generative AI employs deep learning models such as transformers, generative adversarial networks (GANs), and diffusion models to create human-like responses and creative outputs (Balasubramaniam et al., 2024). Prominent examples include OpenAI's GPT (Generative Pre-trained Transformer), Google's Bard, and AI-powered image-generation tools like DALL·E and Stable Diffusion (Bengesi et al., 2024; Daraqel et al., 2024). These technologies have been widely adopted across various domains, including healthcare, business, and, increasingly, education (Alqahtani et al., 2023).

Integrating AI in education transforms teaching and learning methodologies by automating content generation, personalising learning experiences, and improving student engagement (Alotaibi, 2024). AI-driven tools are now assisting educators in creating interactive digital learning materials, adaptive assessments, and intelligent tutoring systems that cater to diverse learning needs (Ahmad et al., 2024; Celik et al., 2024; Taşkın, 2025). In developed countries, where digital infrastructure and AI adoption are more advanced (Chun et al., 2024), Generative AI is leveraged to provide real-time feedback, automate administrative tasks, and enhance interdisciplinary education through AI-powered simulations and problem-solving exercises (Balkrishna Yadav, 2024; Lee & Moore, 2024).

While Generative AI has demonstrated immense potential in transforming education globally, its application in developing countries remains an underexplored area of research. Many nations in the Global South face persistent challenges, such as limited access to quality education, teacher shortages, inadequate learning resources, and digital divide issues (Mason, 2024; UNESCO, 2022, 2023). With the rapid expansion of AI technologies, there is a growing interest in how Generative AI can be leveraged to bridge these gaps and improve educational accessibility (Lim et al., 2023). Generative AI can automate the creation of textbooks, learning modules, and assessments, reducing dependency on physical educational resources (Chen & Wu, 2024; Hashmi & Bal, 2024; Mittal et al., 2024). Furthermore, AI-powered language models can facilitate multilingual content generation, ensuring that students in non-English-speaking regions can access educational materials in their native languages (Dahal, 2024; Kwak & Pardos, 2024).

Despite its potential, the use of Generative AI in education within developing countries raises several critical questions. How effectively does Generative AI enhance educational accessibility for marginalised and underserved communities? What are the implications of AI-driven interdisciplinary learning, and how can it be optimised for diverse educational contexts?

This systematic review aims to synthesise existing literature on the impact of Generative AI on transformative education in developing countries, focusing on accessibility and interdisciplinary learning. By reviewing current applications, benefits, and challenges, this study seeks to provide a comprehensive understanding of AI's role in education and identify key research gaps that need to be addressed. The findings will contribute to the global discourse on equitable AI adoption in education, offering insights for policymakers, educators, and researchers working to ensure that AI-driven educational innovations benefit learners in all socio-economic contexts.

Objective

This systematic review's objective is to analyse the impact of generative AI on transformative education in developing countries, focusing on accessibility and interdisciplinary learning. Specifically, the review will assess how AI-driven tools enhance learning opportunities, address educational disparities, and facilitate cross-disciplinary approaches in resource-limited settings.

Full review question	
What is the impact of generative AI on accessibility and interdisciplinary learning in transformative education in developing countries?	
Population	Students, educators, and institutions in developing countries engage with AI-driven educational tools.
Intervention	Application of generative AI in education, including AI-driven content creation, adaptive learning platforms, and automated tutoring systems.
Comparison	Traditional education methods or non-AI digital education tools.
Outcome	Improvement in accessibility to educational content, the effectiveness of interdisciplinary learning approaches, and challenges encountered in implementation.

Search strategy

Databases

- PubMed
- Scopus
- IEEE Xplore
- Google Scholar
- ERIC (Education Resources Information Centre)

Search terms

("Generative AI" OR "Artificial Intelligence in education" OR "AI-driven learning") AND ("Transformative education" OR "Digital education" OR "Education technology") AND

(“Developing countries” OR “Global South” OR “Low-income education”) AND (“Accessibility” OR “Interdisciplinary learning” OR “Equity in education”)
Identifying other useful sources
1. Hand-searching relevant journals 2. Reviewing references and citations in key articles 3. Grey literature (e.g., policy reports, government publications, and NGO reports)

Eligibility criteria

PICO	Inclusion Criteria	Exclusion Criteria
Population	Studies that focus on students, educators, or institutions in developing countries utilising AI-driven educational tools.	Studies focusing on education in developed countries without specific application to developing contexts.
Intervention	Studies that assess the use of generative AI in education, including AI-driven content creation, adaptive learning, automated tutoring, or other AI-supported learning interventions.	Studies on non-generative AI applications, such as rule-based AI, traditional e-learning platforms, or learning management systems without AI-driven content generation.
Comparison		Studies that focus on non-digital educational approaches.
Outcomes	Studies evaluating accessibility improvements, interdisciplinary learning outcomes, or challenges and limitations of AI adoption in education. Additionally, studies assessing improvements in class or examination performance due to generative AI applications in education.	Research that does not assess accessibility, interdisciplinary learning, or challenges but instead focuses on general educational technology or AI ethics unrelated to learning outcomes.

Additional limits

1. Only studies published in English will be considered due to translation resource limitations.
2. Only peer-reviewed journal articles, conference proceedings, and systematic reviews will be included.
3. Books, dissertations, working papers, and unpublished manuscripts will be excluded.

4. Opinion pieces, theoretical papers, and purely conceptual studies without empirical data will be excluded.

Study quality assessment

What criteria will you use to assess methodological quality? How will quality assessment be performed?

The CASP (Critical Appraisal Skills Programme) checklist will be used to evaluate study reliability and validity, bias risk assessment and relevance to the research question

Data extraction & synthesis

Study Selection and Data Extraction

Two independent reviewers will screen the search results to identify relevant studies based on the predefined inclusion and exclusion criteria. In the first phase, titles and abstracts will be reviewed to eliminate duplicates and studies that do not meet the eligibility criteria. If an article's relevance remains unclear after the abstract screening, it will be carried forward for full-text review. In the second phase, the full text of each potentially eligible article will be independently assessed to ensure it meets all inclusion criteria.

Following the full-text review, the two reviewers will discuss the selection of studies to reach a consensus on which papers should be included in the systematic review. In cases where discrepancies arise, a third reviewer will independently assess the article(s) and make the final decision. A Kappa coefficient will be calculated to measure inter-rater agreement, ensuring a transparent and reproducible selection process.

Once the final set of articles is determined, data extraction will be conducted using a structured data extraction form. The extracted data will include study details (author, year, country, and study type), the type of generative AI intervention used, the level of education (primary, secondary, higher education, vocational training), key outcomes related to accessibility and interdisciplinary learning, and any reported challenges of AI implementation in education.

Strategy for Data Synthesis

The extracted data will be organised into structured spreadsheets for further analysis. A narrative synthesis will summarise and compare findings across studies, identifying key themes, trends, and gaps in the literature. If the included studies present sufficiently homogenous data, a meta-analysis may be performed to quantify the overall impact of generative AI on transformative education in developing countries. The synthesised results will be presented in the results section and further interpreted in the discussion to provide insights into the role of generative AI in enhancing accessibility and interdisciplinary learning.

REFERENCES

Ahmad, K., Iqbal, W., El-Hassan, A., Qadir, J., Benhaddou, D., Ayyash, M., & Al-Fuqaha, A. (2024). Data-Driven Artificial Intelligence in Education: A Comprehensive Review. *IEEE Transactions on Learning Technologies*, *17*, 12–31. https://doi.org/10.1109/TLT.2023.3314610

Alotaibi, N. S. (2024). The Impact of AI and LMS Integration on the Future of Higher Education: Opportunities, Challenges, and Strategies for Transformation. *Sustainability*, *16*(23), 10357. https://doi.org/10.3390/su162310357

Alqahtani, T., Badreldin, H. A., Alrashed, M., Alshaya, A. I., Alghamdi, S. S., bin Saleh, K., Alowais, S. A., Alshaya, O. A., Rahman, I., Al Yami, M. S., & Albekairy, A. M. (2023). The emergent role of artificial intelligence, natural learning processing, and large language models in higher education and research. *Research in Social and Administrative Pharmacy*, *19*(8), 1236–1242. https://doi.org/10.1016/j.sapharm.2023.05.016

Balkrishna Yadav, A. (2024). The Development of AI with Generative Capabilities and Its Effect on Education. *International Journal of Science and Research (IJSR)*, *13*(5), 854–860. https://doi.org/10.21275/SR24509232318

Bengesi, S., El-Sayed, H., Sarker, M. K., Houkpati, Y., Irungu, J., & Oladunni, T. (2024). Advancements in Generative AI: A Comprehensive Review of GANs, GPT, Autoencoders, Diffusion Model, and Transformers. *IEEE Access*, *12*, 69812–69837. https://doi.org/10.1109/ACCESS.2024.3397775

Celik, I., Gedrimiene, E., Siklander, S., & Muukkonen, H. (2024). The affordances of artificial intelligence-based tools for supporting 21st-century skills: *Australasian Journal of Educational Technology*. https://doi.org/10.14742/ajet.9069

Chen, X., & Wu, D. (2024). Automatic Generation of Multimedia Teaching Materials Based on Generative AI: Taking Tang Poetry as an Example. *IEEE Transactions on Learning Technologies*, *17*, 1327–1340. https://doi.org/10.1109/TLT.2024.3378279

Chun, Y., Hur, J., & Hwang, J. (2024). AI technology specialization and national competitiveness. *PLOS ONE*, *19*(4), e0301091. https://doi.org/10.1371/journal.pone.0301091

Dahal, C. (2024). Revolutionizing Education through AI-Powered Inclusive Learning Systems. *Proceedings of the AAAI Conference on Artificial Intelligence*, *38*(21), 23736–23737. https://doi.org/10.1609/aaai.v38i21.30546

Daraqel, B., Wafaie, K., Mohammed, H., Cao, L., Mheissen, S., Liu, Y., & Zheng, L. (2024). The performance of artificial intelligence models in generating responses to general orthodontic questions: ChatGPT vs Google Bard. *American Journal of Orthodontics and Dentofacial Orthopedics*, *165*(6), 652–662. https://doi.org/10.1016/j.ajodo.2024.01.012

Dwivedi, R., & Elluri, L. (2024). Exploring Generative Artificial Intelligence Research: A Bibliometric Analysis Approach. *IEEE Access*, *12*, 119884–119902. https://doi.org/10.1109/ACCESS.2024.3450629

Hashmi, N., & Bal, A. S. (2024). Generative AI in higher education and beyond. *Business Horizons*, *67*(5), 607–614. https://doi.org/10.1016/j.bushor.2024.05.005

Kwak, Y., & Pardos, Z. A. (2024). Bridging large language model disparities: Skill tagging of multilingual educational content. *British Journal of Educational Technology*, *55*(5), 2039–2057. https://doi.org/10.1111/bjet.13465

Lee, S. S., & Moore, R. L. (2024). Harnessing Generative AI (GenAI) for Automated Feedback in Higher Education: A Systematic Review. *Online Learning*, *28*(3). https://doi.org/10.24059/olj.v28i3.4593

Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *The International Journal of Management Education*, *21*(2), 100790. https://doi.org/10.1016/j.ijme.2023.100790

Mason, R. (2024). Challenges of Transnational Education in the Global South. *Contemporary Arab Affairs*, *17*(1), 119–142. https://doi.org/10.1163/17550920-bja00029

Mittal, U., Sai, S., Chamola, V., & Sangwan, D. (2024). A Comprehensive Review on Generative AI for Education. *IEEE Access*, *12*, 142733–142759. https://doi.org/10.1109/ACCESS.2024.3468368

Balasubramaniam, S. , Chirchi, V., Kadry, S., Agoramoorthy, M., Gururama, S., Satheesh, K., & Sivakumar, T. A. ,. (2024). The Road Ahead: Emerging Trends, Unresolved Issues, and Concluding Remarks in Generative AI—A Comprehensive Review. *International Journal of Intelligent Systems*, *2024*(1). https://doi.org/10.1155/2024/4013195

Taşkın, M. (2025). Artificial Intelligence in Personalized Education: Enhancing Learning Outcomes Through Adaptive Technologies and Data-Driven Insights. *Human Computer Interaction*, *8*(1), 173. https://doi.org/10.62802/ygye0506

UNESCO. (2022). *UNESCO strategy on education for health and well-being*. https://unesdoc.unesco.org/ark:/48223/pf0000381728/PDF/381728eng.pdf.multi

UNESCO. (2023). *Global education monitoring report, 2023: technology in education: a tool on whose terms?* https://unesdoc.unesco.org/ark:/48223/pf0000385723/PDF/385723eng.pdf.multi