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Generative AI for Learning Individualization and Student Support in Sustainable Higher Education: A Systematic Review of Creative Agency, Equitable Learning, and Implications for SDG 4 and SDG 10

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ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 4 June 2026 and was last updated on 4 June 2026.

INTRODUCTION

Review question / Objective Objective
This systematic review aims to analyze how Generative AI is being used in higher education to support learning individualization and student support. At the same time, it will examine, in a balanced way, both positive and negative outcomes associated with the broader outcome areas of creative agency and equitable learning, even when these are reported through related concepts such as autonomy, creativity, participation, accessibility, inclusion, or digital equity. Finally, the review will explore how the identified approaches and reported findings connect to SDG 4 and SDG 10, especially within broader discussions on sustainable and inclusive higher education.
Review Questions
RQ1. How does Generative AI enable learning individualization and student support in sustainable higher education?
RQ2. What positive and negative outcomes related to creative agency and equitable learning emerge from studies on Generative AI-supported higher education?
RQ3. How are the approaches and outcomes identified in the literature connected to the goals of SDG 4 and SDG 10?
PICo Framework
This review is conceptually guided by the PICo framework. The population includes higher education students and educational contexts. The main interest lies in Generative AI-supported learning individualization and student support. The context centers on sustainable higher education.

Rationale The rapid expansion of Generative AI has reshaped discussions around teaching, learning, assessment, and student support in higher education. Tools such as ChatGPT have made AI-mediated assistance far more visible, yet they have also sharpened concerns about academic integrity, privacy, misinformation, bias, copyright, and equity (Bobula, 2024). In response, universities are actively developing policies and guidelines as they seek to balance innovation with

academic integrity, equity, privacy, and the growing demand for AI literacy (Jin et al., 2025).

Learning individualization stands out as one of the most compelling promises of these technologies. Evidence suggests that GenAI can enable adaptive learning pathways, deliver real-time feedback, and generate tailored content suited to varied student needs. Still, important questions linger around equity, educator readiness, infrastructure limitations, and longer-term effectiveness (Fortuna et al., 2025). Similar patterns emerge in broader conversations about adaptive instruction, student engagement, and individualized support, where initial enthusiasm is tempered by ongoing concerns over data privacy, equitable access, and adequate teacher preparation (Merino-Campos, 2025).

Beyond personalization, researchers are increasingly examining GenAI as a practical tool for student support. Applications range from boosting engagement and offering academic assistance to providing performance insights and targeted interventions. At the same time, studies consistently highlight persistent challenges related to scalability, data quality, transparency, and real-world usefulness (Pang & Wei, 2025). These tensions appear clearly in research on ChatGPT, where potential benefits for writing feedback, coding help, and personalized learning coexist with risks of academic misconduct, student overreliance, and privacy issues (Naznin et al., 2025).

Equity concerns remain especially prominent. The advantages of Generative AI are unlikely to spread evenly without deliberate effort. Without careful design and governance, these tools may deepen existing divides related to digital access, algorithmic bias, and institutional resources (Mimoudi, 2025). The reality becomes particularly tangible for students with disabilities, who may gain meaningful support through writing assistance, proofreading, and interactive features, even as barriers such as inaccurate outputs, subscription costs, and limited participation in policy decisions continue to exist (Zhao et al., 2025).

Emerging work is also beginning to link Generative AI with notions of sustainable higher education. Discussions often explore how personalized approaches, automated feedback, and improved accessibility could foster more inclusive and resource-conscious learning environments (Nikolopoulou, 2025). In a similar vein, large language models feature in explorations of adaptive ecosystems that may enhance engagement and real-time support, provided ethical deployment, privacy safeguards, and responsible integration are prioritized (Sharma et al., 2025).

Even with this expanding literature, clear gaps remain. Many studies still focus heavily on technical features, isolated benefits, or standalone risks. Fewer efforts integrate learning individualization, student support, creative agency, and equitable learning while considering their potential links to SDG 4 and SDG 10 in sustainable higher education contexts.

This systematic review therefore seeks to address that need through a balanced synthesis of current approaches and reported outcomes, without assuming direct contributions to the Sustainable Development Goals beyond the evidence provided by the included studies.

Condition being studied This review focuses on the use of Generative AI in higher education, particularly how it is applied to support learning individualization, student support, creative agency, and equitable learning. These dimensions are not viewed as separate features, but as interconnected educational processes that shape how students engage with learning tasks, receive support, participate creatively, and access more inclusive opportunities.

In this review, creative agency refers to the student's capacity to actively participate, make decisions, generate ideas, and maintain ownership over creative and learning processes while interacting with Generative AI-supported educational environments.

The phenomenon is examined primarily through a pedagogical and educational lens. Rather than emphasizing purely technical or algorithmic dimensions of Generative AI, the review prioritizes its role within actual teaching and learning contexts. Special attention is paid to its relationships with inclusion, accessibility, educational sustainability, digital equity, and personalized learning, as these elements are essential for understanding the wider implications of these technologies in higher education.

METHODS

Search strategy The search strategy will use Boolean operators and broad search equations designed to retrieve a sufficiently wide set of studies on Generative AI in higher education. The equations will be adapted to the syntax and limitations of each database. The core concepts will remain consistent across sources: Generative AI, higher education, personalized learning, student support, creative agency, inclusion, accessibility, and sustainability.

In Scopus, the search will be conducted using the TITLE-ABS-KEY field. The proposed search equation is:
TITLE-ABS-KEY ("generative AI" OR "generative artificial intelligence" OR ChatGPT OR "large language model*" OR LLM OR "AI tutor*" OR "conversational AI") AND TITLE-ABS-KEY ("higher education" OR universit* OR college* OR "tertiary education") AND TITLE-ABS-KEY ("personalized learning" OR "learning individualization" OR "student support" OR "creative agency" OR "equitable learning" OR inclusion OR accessibility OR sustainability)

For ERIC, the search equation will be adapted to educational indexing:
("generative AI" OR "generative artificial intelligence" OR ChatGPT OR "large language model*" OR "conversational AI") AND ("higher education" OR universit*) AND ("personalized learning" OR "student support" OR "creative agency" OR inclusion OR accessibility OR sustainability)

For ScienceDirect, a shorter equation will be used because the platform restricts the number of Boolean connectors allowed in a single search field:
("generative AI" OR ChatGPT) AND ("higher education" OR university) AND ("creative agency" OR creativity)

For the MDPI Journals Platform, a concise equation will also be used to avoid excessive restrictions and improve retrieval through its search interface:
("generative AI" OR ChatGPT) AND ("higher education" OR university) AND ("creative agency" OR creativity)

If the initial database searches retrieve limited evidence for any predefined outcome area, particularly creative agency or equitable learning, complementary academic searches may be conducted to improve coverage. Any additional records identified through these complementary sources will be considered only if they meet the same predefined inclusion criteria.
Database filters will be applied whenever available to restrict results to publications from 2022 to 2026, English-language records, and peer-reviewed journal articles. These filters will be used to exclude, at the database level where possible, studies published outside the selected period, studies written in languages other than English, and publication types other than scientific journal articles.

Conference papers, book chapters, editorials, letters, commentaries, preprints, and other non-peer-reviewed materials will be excluded through database filters when available and verified again during screening. To strengthen comprehensiveness, backward and forward citation tracking and manual examination of reference lists from included studies will also be used.
The complete search process, including the final date of each search, database-specific equations, filters applied, and any complementary eligible records identified, will be documented transparently to support reproducibility.

Participant or population This review focuses on higher education students and the educational contexts in which Generative AI is used to support learning processes, academic assistance, and student engagement. The population of interest therefore centers on university students, tertiary-level learners, and learning experiences that take place within higher education institutions.
Studies carried out in primary education, secondary education, corporate training, or other non-university settings will be excluded. Where studies include mixed educational levels, they will only be considered if the data specific to higher education can be clearly separated and analyzed independently.

Intervention This review examines the educational application of Generative AI tools and systems in higher education. The central phenomenon involves how these technologies support learning individualization, adaptive student support, feedback generation, personalized learning pathways, creative participation, and educational assistance.
Rather than studying the tools in isolation, the emphasis lies on how they are integrated into real teaching and learning practices and how they shape student experiences. Common examples include widely used platforms such as ChatGPT, Gemini, and Claude, as well as AI tutors, conversational AI systems, and emerging multimodal Generative AI environments.

Comparator No specific comparator is required for study inclusion in this review.
That said, many individual studies naturally compare Generative AI-supported approaches with more traditional methods. These may include conventional teaching practices, non-AI digital platforms, standard learning formats, or general digital tools that do not incorporate Generative AI capabilities.

Study designs to be included This review will include a broad range of empirical study designs to capture the multifaceted nature of Generative AI use in higher education. Eligible studies include qualitative, quantitative, and mixed-methods research, along with case studies, quasi-experimental designs, descriptive studies, and survey-based investigations.Excluded designs include editorials, theoretical essays, opinion papers, conference proceedings, systematic or narrative reviews, and any non-peer-reviewed literature. This strategy ensures the synthesis is grounded in original empirical evidence while respecting the m.

Eligibility criteria The eligibility criteria for this review have been defined to ensure a clear, consistent, and reproducible selection process aligned with the scope established in previous sections.

Inclusion Criteria

IC1. Higher Education Context: Eligible studies must be conducted in higher education settings involving university students, higher education institutions, tertiary-level learners, or learning experiences situated within postsecondary education.

IC2. Generative AI Focus: Eligible studies must explicitly examine the educational use of Generative AI tools or systems, including conversational AI, large language models, AI tutors, or multimodal Generative AI platforms.

IC3. Relevant Educational Outcomes: Eligible studies must report outcomes related to at least one of the following areas: learning individualization, student support, creative agency, equitable learning, or sustainability-related educational implications.

IC4. Eligible Empirical Design: Eligible studies must be empirical peer-reviewed journal articles using qualitative, quantitative, mixed-methods, descriptive, case study, survey-based, experimental, or quasi-experimental designs.

IC5. Eligible Publication Characteristics: Eligible studies must meet the predefined publication filters, including the period from 2022 to 2026, English language, peer-reviewed status, and full-text accessibility.

Exclusion Criteria

EX1. Not Higher Education Context: Studies conducted outside higher education settings will be excluded, including those focused on primary education, secondary education, corporate training, non-formal education, or other non-university contexts.

EX2. Not Generative AI Focus: Studies will be excluded if they are not centered on Generative AI or do not present an explicit educational application of Generative AI tools or systems.

EX3. Not Relevant Educational Outcomes: Studies will be excluded if they do not report outcomes related to learning individualization, student support, creative agency, equitable learning, or sustainability-related educational implications.

EX4. Ineligible Empirical Design: Studies corresponding to reviews, editorials, commentaries, letters, book chapters, conference papers, preprints, theoretical essays, opinion papers, or other non-empirical publication types will be excluded.

EX5. Ineligible Publication Characteristics: Studies will be excluded if they are published outside the predefined time range, written in languages other than English, lack full-text accessibility, or do not meet the predefined publication filters.

Information sources This review will draw on four main academic information sources: Scopus, ERIC, ScienceDirect, and the MDPI Journals Platform. These databases were chosen for the complementary strengths they bring to covering higher education research, educational technology, artificial intelligence in learning, and interdisciplinary work related to inclusion, accessibility, and sustainability.

Scopus serves as the central multidisciplinary resource thanks to its broad indexing of peer-reviewed literature across education, social sciences, computer science, and sustainability-related fields. ERIC adds depth through its strong specialization in educational research and higher education contexts. ScienceDirect offers targeted access to high-quality studies from Elsevier journals, especially those exploring educational technology and innovation in teaching and learning. Meanwhile, the MDPI Journals Platform contributes valuable open-access publications focused on sustainability, digital learning, and emerging technologies.

To strengthen comprehensiveness, the search will also include manual reference checking as well as backward and forward citation tracking. These supplementary strategies help uncover relevant studies that might otherwise be missed in the initial database searches while still meeting the review's eligibility criteria.

Main outcome(s) The main outcomes of this review are organized according to the three research questions. To keep the synthesis focused and feasible, two main outcome areas will be considered for each research question. The interpretation will remain strictly linked to what is reported in the included studies.

Outcomes for RQ1
The first outcome area will identify the types and characteristics of Generative AI-supported approaches used for learning individualization in higher education.
The second outcome area will examine student support practices facilitated by Generative AI, including academic assistance, feedback, guidance, tutoring-like interactions, or other forms of AI-mediated support reported in the included studies.

Outcomes for RQ2
The first outcome area will examine positive and negative outcomes related to creative agency, including autonomy, idea generation, divergent thinking, problem-solving, creative participation, and ownership of creative processes.
The second outcome area will examine positive and negative outcomes related to equitable learning, including accessibility, inclusion, digital equity, bias, exclusion, and unequal access.

Outcomes for RQ3
The first outcome area will examine explicit or conceptually relevant connections with SDG 4, particularly findings related to quality education, inclusive learning opportunities, digital competencies, and sustainable learning.
The second outcome area will examine explicit or conceptually relevant connections with SDG 10, particularly findings related to equity, accessibility, reduction of educational inequalities, and support for vulnerable or underrepresented groups.
All main outcomes will be interpreted strictly according to the evidence reported in the included studies, without assuming causal relationships, direct SDG contributions, or broader impacts beyond what the original studies support.

Additional outcome(s) In addition to the main outcomes, the review will extract a limited set of descriptive variables to characterize the included studies without expanding the scope of the synthesis unnecessarily.
The additional outcomes will include year of publication, country, study population and sample size, and study design. These variables will be used only to describe the evidence base and contextualize the main findings.

Data management The data management process for this review will be designed to ensure transparency, consistency, and traceability across the stages of study selection and data extraction.
References retrieved from the databases will first be exported and managed using reference management software. Duplicate records will then be identified and removed before the screening process begins.
The title and abstract screening will be carried out using Rayyan, which will support the organization of records and the documentation of preliminary inclusion and exclusion decisions. Full-text assessment will be conducted as a separate stage, with eligibility decisions recorded according to the predefined inclusion and exclusion criteria.
Data extraction will be organized through a customized Excel matrix specifically designed for this review. This matrix will capture the main outcomes aligned with the research questions, along with the predefined complementary variables.
To maintain methodological rigor, all records, screening decisions, full-text assessment notes, and extraction files will be stored securely. Version control will be applied to the Excel matrix and related working files to preserve traceability across revisions.

Quality assessment / Risk of bias analysis The methodological quality of the included studies will be assessed using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). This instrument was selected because the review is expected to include heterogeneous empirical designs, including qualitative, quantitative, and mixed-methods studies commonly reported in research on Generative AI in higher education.
Two independent reviewers will conduct the quality assessment by applying the MMAT checklist corresponding to each study's methodological design. The assessment will consider both the initial MMAT screening questions and the design-specific criteria established by the instrument.
Reviewer agreement during the appraisal process will be examined using Cohen's Kappa coefficient. For this purpose, the MMAT responses will be coded categorically (e.g., Yes, No, and Can't tell) to evaluate consistency between reviewers rather than to generate numerical quality scores.
Disagreements identified during the appraisal process will first be discussed between reviewers. If consensus cannot be reached, a third reviewer will participate in the evaluation.
The MMAT results will not be transformed into an overall numerical score or ranking system. Instead, the appraisal outcomes will support quality-informed interpretation of the evidence, guide the narrative synthesis, and help identify methodological limitations that may influence the robustness or consistency of the reported findings. Studies will not be excluded solely on the basis of MMAT results, although methodological limitations identified during appraisal will be considered during interpretation of the evidence.

Strategy of data synthesis The synthesis of findings will be conducted primarily through narrative methods, with interpretation informed by the methodological quality of the included studies. This approach is well suited to the expected diversity of study designs, educational contexts, Generative AI applications, and reported outcomes.
The process will combine descriptive and thematic elements. Descriptive synthesis will summarize key characteristics of the included studies, such as publication year, country, study population and sample size, and study design. Where relevant, simple frequencies and percentages will be used to highlight patterns in the evidence base.
Thematic synthesis will organize the main findings according to the three research questions and their associated outcome areas. This will involve grouping and categorizing Generative AI-supported approaches, student support practices, creative agency outcomes, equitable learning outcomes, and reported connections to SDG 4 and SDG 10.
Depending on the data, simple cross-tabulations or frequency charts may be used to clarify patterns, for example by showing distributions across research questions or relationships between study characteristics and outcomes. All such analyses will remain purely descriptive and will not be interpreted as evidence of causal relationships.
No meta-analysis is planned, given the anticipated heterogeneity in study designs, educational contexts, Generative AI applications, and outcome measures.

Subgroup analysis Subgroup analyses will be conducted in an exploratory manner, depending on the number, characteristics, and heterogeneity of the included studies. Potential subgroups may include disciplinary area, geographical region, type of Generative AI tool, educational modality, sustainability-oriented studies, inclusion-oriented studies, and studies involving vulnerable or underrepresented student groups.
These analyses will serve only to describe possible patterns across the evidence base and will not be interpreted as confirmatory findings.

Sensitivity analysis Sensitivity analyses may be conducted to examine the robustness of the review findings. Where appropriate, studies presenting greater methodological limitations according to the MMAT assessment may be considered separately from the rest of the evidence base.
This may involve comparing the narrative synthesis before and after their exclusion, with particular attention to whether the main patterns, thematic categories, or overall interpretations remain consistent.
Any sensitivity analysis performed will be exploratory in nature and will be used only to support a more cautious interpretation of the findings.

Language restriction Only studies published in English will be included. This decision reflects the predominance of recent research on Generative AI.

Country(ies) involved This review is being conducted by researchers based in Peru, within the context of higher education and educational technology research focused on sustainable education, inclusion, and innovation.

Other relevant information The review will be conducted and reported following the PRISMA 2020 statement, while the protocol has been prepared according to PRISMA-P guidelines and registered in INPLASY.
A critical and balanced perspective will be maintained, giving attention to both potential benefits and risks of Generative AI. Connections with SDG 4 and SDG 10 will be interpreted cautiously, considering both explicit references and conceptually relevant educational outcomes reported in the included studies.

Keywords Generative AI; learning individualization; student support; creative agency; equitable learning; sustainable higher education.

Dissemination plans The data extraction process is planned to be conducted between 21 and 25 September 2026. The findings of this systematic review are intended for submission during 2026 to the Special Issue “Generative Artificial Intelligence for Sustainable Education: Learning Individualization and Student Support” in the journal Sustainability (MDPI). Publication is expected in 2026 or 2027, depending on the editorial review and publication process.
Additional dissemination may include academic conferences and institutional presentations, where appropriate.

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