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Transformative Roles of Generative Artificial Intelligence as a Co-Instructor: A PRISMA-Guided Systematic Literature Review for Personalized and Sustainable Higher Education

Montadzah A. Abdulgani[1], Jonathan M. Mantikayan[2]

[1]Cotabato State University

[2]Bangsamoro Information and Communications Technology Office (BICTO)

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ABSTRACT

The rapid advancement of Generative Artificial Intelligence (GenAI), particularly Large Language Models (LLMs) such as ChatGPT, has significantly transformed instructional practices in higher education. Beyond serving as instructional support tools, GenAI systems are increasingly conceptualized as collaborative co-instructors capable of assisting educators in curriculum planning, personalized instruction, formative assessment, and learning analytics. Despite growing scholarly interest, existing reviews often examine these applications independently and provide limited integration of pedagogical, ethical, governance, and sustainability perspectives. This study addresses this gap through a PRISMA-guided systematic literature review of 20 empirical and evidence-based scholarly publications published between 2023 and 2025. Articles were retrieved from Scopus, Web of Science, ERIC, and Google Scholar using predefined search protocols and were analyzed through directed qualitative content analysis. The synthesis identified three dominant instructional functions of GenAI: co-planning, co-instruction, and co-assessment, each demonstrating measurable improvements in instructional efficiency, learner engagement, personalized learning, and formative feedback. Simultaneously, the review highlights significant challenges related to academic integrity, algorithmic bias, data privacy, teacher autonomy, and student overreliance on AI-generated content. Comparative analysis across studies indicates that effective implementation consistently depends on sustained human oversight through a Teacher-in-the-Loop (TiTL) framework, which positions educators as pedagogical decision-makers while leveraging AI to augment instructional effectiveness. The review further demonstrates that responsible GenAI integration contributes to sustainable higher education by improving resource efficiency, reducing faculty workload, expanding equitable access to learning, and supporting resilient digital education ecosystems. The study contributes a synthesized conceptual perspective that integrates pedagogical, ethical, governance, and sustainability dimensions into a unified framework for responsible AI-augmented higher education. The findings provide evidence-based guidance for educators, institutional leaders, and policymakers seeking to implement GenAI responsibly while preserving academic quality, educational equity, and human-centered teaching.

Keywords: Generative Artificial Intelligence (GenAI); Artificial Intelligence in Higher Education; Teacher-in-the-Loop; Personalized Learning; Sustainable Higher Education; AI-Augmented Pedagogy; Systematic Literature Review; PRISMA

INTRODUCTION

Generative Artificial Intelligence (GenAI), particularly Large Language Models (LLMs) such as ChatGPT, has rapidly emerged as one of the most transformative technologies in higher education. Unlike earlier educational technologies that primarily automated administrative processes or delivered static digital content, GenAI can generate context-aware instructional materials, engage in natural language dialogue, provide personalized explanations, and support educators throughout the teaching and learning process (Lo (2023). These capabilities have accelerated the integration of artificial intelligence into curriculum design, instructional delivery, assessment, and academic support, fundamentally changing how universities approach teaching and learning.

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The growing adoption of GenAI has shifted educational practice from technology-assisted instruction toward human–AI collaborative pedagogy, where artificial intelligence functions as a co-instructor rather than a replacement for educators. Within this emerging paradigm, GenAI assists faculty in lesson planning, content development, personalized tutoring, formative assessment, and learning analytics while educators retain responsibility for pedagogical judgment, ethical decision-making, and learner development (Gimpel et al., 2025). This collaborative model has attracted increasing attention as higher education institutions seek innovative approaches to address rising student enrollment, increasing faculty workload, and demands for personalized and flexible learning environments (Magrill et al., 2024).

Despite these opportunities, integrating GenAI into higher education raises significant pedagogical, ethical, and governance challenges. Concerns regarding academic integrity, algorithmic bias, transparency, data privacy, intellectual property, and excessive dependence on AI-generated content continue to shape discussions about responsible implementation (Franco et al., 2024; Neupane et al., 2024). These challenges highlight the need for institutional governance frameworks that ensure AI enhances rather than diminishes educational quality. Consequently, the Teacher-in-the-Loop (TiTL) approach has emerged as a guiding principle, emphasizing that educators remain the final authority over instructional planning, assessment, and ethical oversight while AI serves as a supportive instructional partner.

Existing research has documented numerous applications of GenAI across teaching, learning, and assessment. However, much of the literature examines these domains independently or focuses primarily on technical capabilities or ethical concerns. Comparatively few systematic reviews synthesize empirical evidence across pedagogical, governance, and sustainability dimensions while examining how GenAI collectively influences instructional practice, institutional resilience, and responsible AI adoption. Furthermore, sustainability particularly its relationship to educational quality, equity, institutional resilience, and lifelong learning has received comparatively limited attention despite its growing importance in higher education policy.

To address these gaps, this study employs a PRISMA 2020-guided systematic literature review to synthesize evidence from 20 peer-reviewed empirical studies published between 2023 and 2025. Using directed qualitative content analysis, the review identifies recurring instructional roles of GenAI, examines emerging implementation frameworks, compares converging and diverging findings across studies, and evaluates the pedagogical, ethical, governance, and sustainability implications of AI-supported teaching.

Specifically, this review seeks to:

1. Identify and synthesize the principal instructional roles of Generative Artificial Intelligence as a co-instructor in higher education, particularly in curriculum planning, instructional delivery, and assessment.
2. Critically examine the pedagogical, ethical, and governance challenges associated with responsible GenAI implementation.
3. Analyze implementation approaches that support effective human–AI collaboration, with particular emphasis on the Teacher-in-the-Loop framework.
4. Evaluate how responsible GenAI integration contributes to personalized learning and sustainable higher education through instructional efficiency, educational equity, institutional resilience, and resource optimization.

Unlike previous reviews that primarily summarize technological applications, this study integrates pedagogical, ethical, governance, and sustainability perspectives into a unified analytical framework. By comparatively synthesizing recent empirical evidence, it advances understanding of GenAI as a collaborative educational partner operating within a human-centered instructional ecosystem. The findings provide evidence-based insights for educators, institutional leaders, policymakers, and researchers seeking to implement Generative Artificial Intelligence responsibly while preserving academic quality, educational equity, and the human values that underpin higher education.

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RESEARCH METHODOLOGY

Research Design

This study employed a PRISMA 2020-guided Systematic Literature Review (SLR) to synthesize current evidence on the transformative roles of Generative Artificial Intelligence (GenAI) as a co-instructor in higher education. The PRISMA framework provides a transparent and reproducible approach for identifying, screening, selecting, and synthesizing relevant literature (Page et al., 2021). To analyze the selected publications, Directed Qualitative Content Analysis (Hsieh & Shannon, 2005) was employed, allowing predefined theoretical concepts to guide coding while permitting new themes to emerge inductively.

The review focused on empirical and evidence-based scholarly publications published between 2023 and 2025, reflecting the rapid advancement of Generative AI following the widespread adoption of Large Language Models (LLMs) such as ChatGPT. Evidence-based publications included empirical studies, systematic literature reviews, framework and guideline papers, consensus studies, and other peer-reviewed scholarly works that provided substantive evidence relevant to the instructional roles, implementation, governance, or sustainability of GenAI in higher education.

Search Strategy

A comprehensive literature search was conducted between January and

February 2026 using four major academic databases:

- Scopus
- Web of Science
- ERIC
- Google Scholar

The search combined keywords related to Generative AI and higher education using Boolean operators. The primary search string was:

("Generative Artificial Intelligence" OR "Generative AI" OR ChatGPT OR "Large Language Model*" OR LLM) AND ("Higher Education" OR University OR College) AND (Teaching OR Learning OR Assessment OR Instructor OR "Co-instructor")

Additional keywords, including Teacher-in-the-Loop, AI-Augmented Teaching, Personalized Learning, and AI Ethics, were used to improve retrieval. Reference lists of eligible studies were also manually examined to identify additional relevant publications.

Eligibility Criteria

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Published between 2023–2025	Published before 2023
Peer-reviewed empirical or evidence-based scholarly publications (e.g., journal articles, systematic reviews, framework papers, consensus studies, and refereed conference papers)	Editorials, opinion papers, blogs, theses, unpublished manuscripts
Written in English	Non-English publications

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Conducted within or directly relevant to higher education	Primary or secondary education studies
Focused on Generative AI or Large Language Models	Traditional AI without GenAI
Reported empirical findings, synthesized evidence, or evidence-informed frameworks relevant to the review objectives	Publications lacking sufficient methodological transparency or relevance

Study Selection

The literature search identified 182 records. After removing 34 duplicate records, 148 publications underwent title and abstract screening. A total of 102 records were excluded because they did not address higher education, did not focus on Generative AI, or lacked sufficient relevance or methodological rigor. The remaining 46 full-text publications were assessed for eligibility, resulting in 20 empirical and evidence-based scholarly publications included in the final qualitative synthesis.

The complete screening process is illustrated in Figure 1.

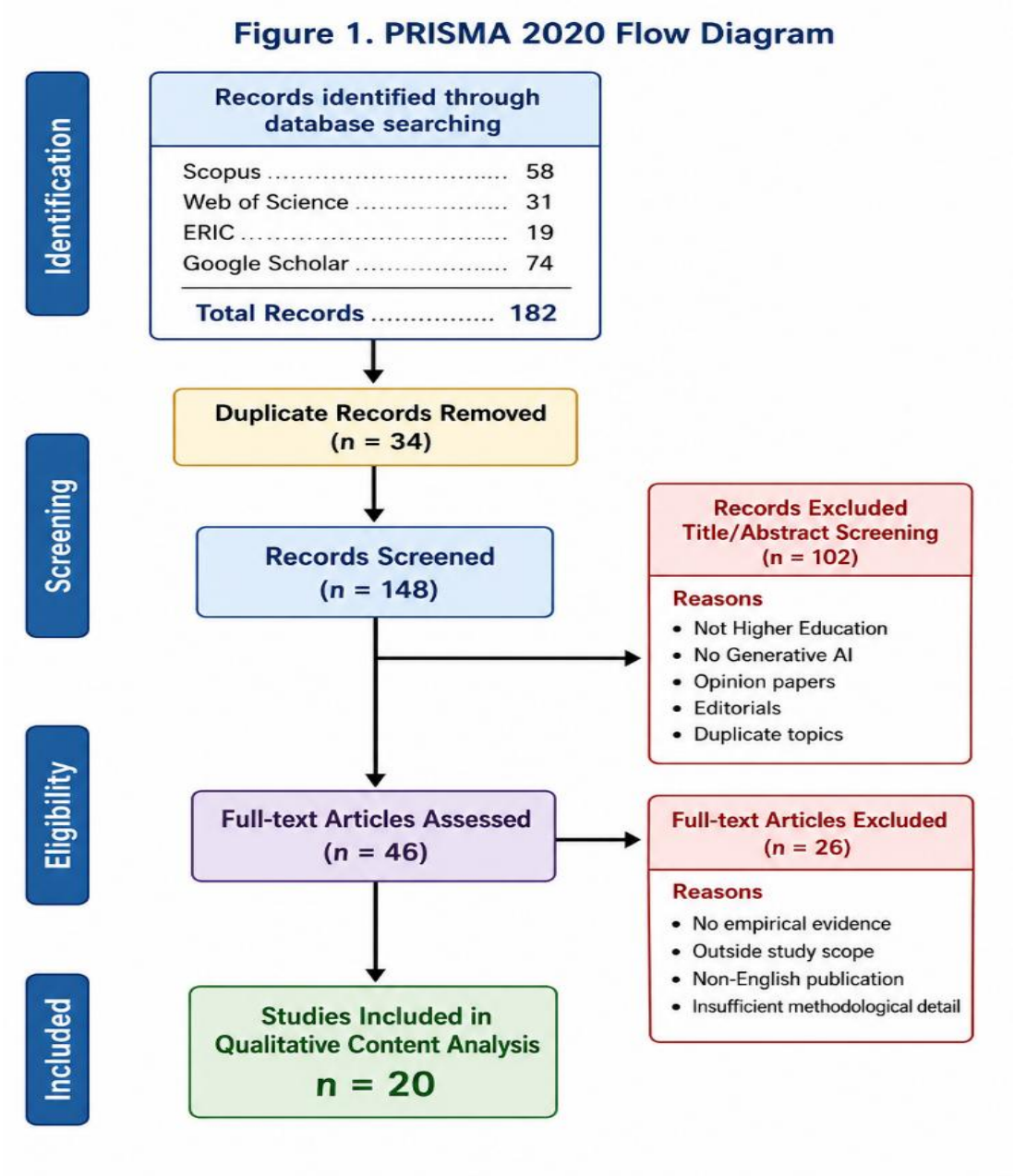


Figure 1. PRISMA 2020 Flow Diagram

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Data Extraction and Quality Assessment

A standardized data extraction form was developed to ensure consistency across the review. For each publication, the following information was extracted:

- author(s);
- publication year;
- country or educational context;
- publication type;
- research design or scholarly approach;
- GenAI application;
- instructional role;
- principal findings; and
- reported limitations.

Methodological quality and scholarly rigor were assessed using criteria appropriate to the publication type. Empirical studies were appraised using the Critical Appraisal Skills Programme (CASP) checklist, while systematic reviews, framework papers, and evidence-based scholarly publications were evaluated based on methodological transparency, scholarly credibility, and relevance to the review objectives. Only publications meeting acceptable quality standards were retained for synthesis.

Data Analysis

The selected studies were analyzed using Directed Qualitative Content Analysis. Initial coding categories were informed by the emerging Teacher-in-the-Loop (TiTL) framework and contemporary AI-augmented pedagogy literature. Through iterative coding and constant comparison, findings were synthesized into three recurring instructional roles:

1. Co-Planning – curriculum design, lesson planning, instructional resource development, and assessment preparation;
2. Co-Instruction – personalized tutoring, adaptive learning, instructional support, and content clarification; and
3. Co-Assessment – formative feedback, rubric-assisted grading, and learning analytics.

Cross-cutting themes related to academic integrity, algorithmic bias, data privacy, governance, and sustainability were also identified and integrated into the subsequent discussion.

Methodological Rigor

The review enhances methodological rigor through three complementary strategies:

- PRISMA 2020, ensuring transparent and reproducible study selection;
- Directed Qualitative Content Analysis, providing systematic thematic synthesis; and
- Comparative Cross-Study Analysis, enabling identification of converging findings, divergent perspectives, and research gaps.

Together, these approaches provide a rigorous foundation for synthesizing current evidence on GenAI as a collaborative co-instructor in higher education.

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Table 2. Summary of Empirical Studies Included in the Systematic Literature Review (N = 20)

No.	Author (Year)	Country / Context	Method	GenAI Application	Key Findings	Limitations
1	Lo (2023)	International	Multidisciplinary review	ChatGPT	Teaching, assessment, and research support	Ethical and governance concerns
2	Doménech (2023)	Spain	Conference study	ChatGPT	Authentic assessment redesign	Limited empirical validation
3	Pereira et al. (2024)	Portugal	Faculty survey	GenAI	Positive faculty perception	Single-country sample
4	Jamie et al. (2024)	Data Structures Course	Experimental	ChatGPT TA	Improved learning outcomes	Single-course study
5	Joon et al. (2024)	Cybersecurity Education	Case study	AI-Augmented Teaching	Enhanced cybersecurity learning	Discipline-specific
6	Xiao et al. (2024)	Higher Education	Experimental	AI Essay Scoring	Improved grading consistency	Human validation required
7	Franco et al. (2024)	Brazil	Framework development	Responsible GenAI	Proposed ethical governance framework	Conceptual study
8	Guerschberg et al. (2024)	Latin America	Systematic Review	AI Copilots	Personalized learning support	Limited empirical comparison
9	Magrill et al. (2024)	International	Literature Review	AI in Education	Enhanced adaptive learning	Limited longitudinal evidence
10	Neupane et al. (2024)	International	Literature Review	GenAI	Opportunities and implementation risks	Few experimental studies
11	Zhang (2025)	China	Experimental	RAG-based AI	Improved instructional efficiency	Single institution
12	Tlili et al. (2023)	International	Conceptual	Teacher-in-the-Loop	Human–AI collaboration model	Needs empirical validation
13	Silva et al. (2025)	Brazil	PRISMA Review	Faculty GenAI	Improved planning and assessment	Limited longitudinal studies
14	Kotsis (2025)	International	Review	AI Curriculum	Constructivist AI integration	Limited empirical evidence

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15	Sajja et al. (2025)	Engineering Education	Mixed Methods	AI Assistant	Increased engagement	Engineering context only
16	Symeou et al. (2025)	Europe	Consensus Study	University AI	Institutional AI guidelines	Requires implementation studies
17	Wajeed (2025)	International	Book Chapter	AI Teaching Assistant	Scalable personalized learning	Limited empirical data
18	Chaves et al. (2025)	Spain	Case Analysis	AI Pedagogical Partner	Enhanced curriculum planning	Small educational setting
19	Gimpel et al. (2025)	International	Practical Guide	GenAI	Responsible instructor use	Practice-oriented
20	Izquierdo-Álvarez et al. (2025)	International	PRISMA Review	GenAI Integration	Opportunities and governance	More empirical research needed

Table 3. Cross-Study Synthesis of Major Themes

Theme	Studies (n)	Overall Finding
Co-Planning	12	Improved curriculum design and instructional preparation
Co-Instruction	18	Enhanced personalized learning and student engagement
Co-Assessment	11	Faster formative feedback with human oversight
Teacher-in-the-Loop	15	Human oversight essential for responsible AI use
Academic Integrity	16	Assessment redesign required
Data Privacy	13	Institutional governance needed
Algorithmic Bias	11	Human verification remains necessary
Sustainable Higher Education	14	Supports efficiency, equity, and institutional resilience

RESULTS

The systematic review synthesized findings from 20 empirical and evidence-based scholarly publications published between 2023 and 2025. Directed qualitative content analysis identified three recurring instructional roles of Generative Artificial Intelligence (GenAI) in higher education: co-planning, co-instruction, and co-assessment. Across diverse institutional contexts, the evidence consistently indicates that GenAI functions most effectively as a collaborative instructional partner that enhances, rather than replaces, educator expertise.

Co-Planning: Supporting Curriculum Design and Instructional Preparation

Twelve reviewed studies identified co-planning as a major application of GenAI. AI-supported tools assist educators in curriculum mapping, lesson planning, instructional material development, assessment design, and alignment of learning outcomes. These capabilities substantially reduce preparation time while improving the consistency and quality of instructional resources.

Several studies reported that AI-generated content serves as an effective starting point for instructional design, enabling faculty to devote greater attention to pedagogical refinement and student engagement. GenAI also

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supports administrative tasks such as organizing course materials and developing assessment rubrics, contributing to improved instructional efficiency.

Despite these advantages, the literature consistently emphasizes that AI-generated instructional materials require educator validation to ensure factual accuracy, contextual relevance, and alignment with curricular objectives. Accordingly, the Teacher-in-the-Loop (TiTL) framework positions educators as the final authority in curriculum design while AI functions as a collaborative planning assistant.

Co-Instruction: Enhancing Personalized Learning

Co-instruction emerged as the most frequently reported application, appearing in 18 of the 20 reviewed studies. GenAI supports instructional delivery through conversational tutoring, adaptive explanations, personalized learning pathways, and continuous academic assistance.

Across multiple disciplines, AI-assisted instruction was associated with higher learner engagement, increased accessibility, and improved opportunities for self-directed learning. Students benefited from immediate feedback and individualized support, while educators were able to focus on mentoring, discussion, and higher-order learning activities.

However, the reviewed studies also caution that excessive dependence on AI may reduce critical thinking and independent problem-solving. Consequently, effective implementation requires instructional designs that encourage students to evaluate and critique AI-generated outputs rather than accept them uncritically.

The evidence indicates that GenAI is most effective when integrated into a collaborative instructional model in which educators guide learning while AI provides scalable and personalized academic support.

Co-Assessment: Improving Feedback and Learning Analytics

Eleven studies identified co-assessment as a significant contribution of GenAI to higher education. AI-assisted assessment supports automated formative feedback, rubric-based evaluation, learning analytics, and early identification of students requiring additional academic support.

The reviewed literature consistently reports that AI enhances grading efficiency and feedback timeliness, enabling instructors to provide more frequent and individualized formative assessment. Learning analytics further support evidence-based teaching by identifying patterns in student engagement and performance. Nevertheless, researchers emphasize that high-stakes assessment should remain under educator supervision. Concerns regarding algorithmic bias, transparency, contextual interpretation, and fairness reinforce the importance of maintaining human oversight in grading and academic decision-making. Accordingly, AI should be viewed as an assessment support tool rather than a replacement for professional academic judgment.

Synthesis of the Three Instructional Roles

Across the reviewed literature, GenAI consistently supports the instructional process through complementary roles in planning, teaching, and assessment (Table 4).

Table 4. Summary of the Three Instructional Roles of GenAI

Instructional Role	Primary AI Functions	Educator Responsibilities
Co-Planning	Lesson planning, curriculum design, instructional materials, assessment preparation	Curriculum validation, pedagogical alignment, instructional decisions
Co-Instruction	Personalized tutoring, adaptive explanations, learning support	Facilitation, mentoring, critical thinking, ethical guidance
Co-Assessment	Automated feedback, rubric support, learning analytics	Final grading, contextual judgment, academic integrity

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The synthesis demonstrates that GenAI contributes computational efficiency, scalability, and personalization, whereas educators provide contextual understanding, ethical reasoning, disciplinary expertise, and meaningful human interaction. This complementary relationship consistently supports the Teacher-in-the-Loop framework, reinforcing that AI enhances instructional practice without replacing the educator's central role.

DISCUSSION

The findings of this systematic review demonstrate that Generative Artificial Intelligence (GenAI) is reshaping higher education through its complementary roles in co-planning, co-instruction, and co-assessment. Across the twenty reviewed studies, the evidence consistently indicates that GenAI enhances instructional efficiency, learner engagement, personalized learning, and formative assessment. However, these educational benefits are realized only when AI is implemented within appropriate pedagogical and institutional frameworks. Thus, the review suggests that the effectiveness of GenAI depends less on technological capability than on the quality of human-centered instructional design and governance.

Converging Evidence Across Studies

Despite differences in methodology, discipline, and institutional context, the reviewed studies demonstrate strong agreement regarding the educational value of GenAI. AI-assisted instructional planning reduces preparation time, conversational tutoring enhances learner engagement, and automated feedback improves the timeliness of formative assessment. Collectively, these findings indicate that GenAI has evolved from a productivity tool into an instructional partner capable of supporting multiple stages of the teaching and learning process.

Equally important, the literature consistently reports that AI is most effective when supporting—not replacing—educator expertise. Across planning, instruction, and assessment, educators remain responsible for pedagogical judgment, contextual interpretation, ethical decision-making, and quality assurance. This shared conclusion represents the strongest point of convergence among the reviewed studies.

Diverging Perspectives and Remaining Challenges

Although the literature broadly supports GenAI integration, several differences remain.

Firstly, studies vary considerably in how educational effectiveness is measured. Experimental investigations frequently report improvements in academic performance, whereas survey-based studies primarily capture positive perceptions of AI rather than objective learning outcomes. Consequently, stronger longitudinal and experimental evidence remains necessary.

Secondly, while many studies emphasize personalized learning and increased accessibility, others caution that excessive reliance on AI may reduce critical thinking, learner autonomy, and independent problem-solving. These contrasting findings suggest that educational outcomes depend largely on instructional design rather than technology alone.

Finally, the current evidence base remains concentrated in technology-oriented disciplines and institutions from developed countries. Research involving the humanities, social sciences, teacher education, and developing-country contexts remains comparatively limited, reducing the generalizability of existing findings.

Responsible AI Integration Through the Teacher-in-the-Loop Framework

One of the most important findings of this review is the consistent support for the Teacher-in-the-Loop (TiTL) framework. Although different studies use terms such as *human oversight*, *AI-assisted teaching*, or *collaborative intelligence*, they describe the same educational principle: AI should augment, rather than replace, educator expertise.

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Within this framework, responsibilities are clearly differentiated. GenAI contributes computational efficiency through content generation, adaptive tutoring, automated feedback, and learning analytics, while educators retain responsibility for instructional planning, assessment, ethical judgment, contextual adaptation, and student mentorship. This complementary relationship preserves the human dimensions of education—including empathy, professional judgment, creativity, and disciplinary expertise—that current AI systems cannot replicate.

Rather than viewing AI and educators as competing entities, the evidence supports a collaborative instructional ecosystem in which each contributes distinct strengths. This synthesis reinforces the Teacher-in-the-Loop framework as the most appropriate model for responsible AI integration in higher education.

Governance and Ethical Considerations

The review further demonstrates that successful GenAI adoption requires institutional governance alongside pedagogical innovation. Academic integrity, algorithmic bias, transparency, data privacy, and intellectual property emerged as the most frequently reported concerns across the literature.

Rather than advocating restrictive AI policies, most studies recommend redesigning assessment toward authentic, higher-order learning activities that emphasize critical thinking, creativity, collaboration, and real-world application. At the institutional level, responsible implementation requires comprehensive AI governance policies, faculty development, ethical guidelines, and continuous evaluation to ensure that technological innovation aligns with educational values.

These findings indicate that AI integration should be viewed not solely as a technological initiative but as an institutional transformation requiring coordinated leadership, policy, and professional capacity building.

Sustainability and Future Research

Although instructional effectiveness dominates current research, sustainability remains comparatively underexplored. The reviewed evidence suggests that GenAI contributes to sustainable higher education by improving instructional efficiency, expanding personalized learning opportunities, supporting institutional resilience, and optimizing educational resources. These outcomes align with broader goals of inclusive and equitable education, particularly within increasingly digital learning environments.

Nevertheless, important research gaps remain. Most studies employ cross-sectional designs, focus on technology-oriented disciplines, and originate from developed countries. Future investigations should prioritize longitudinal and experimental research, evaluate AI governance frameworks, and examine implementation within diverse educational and cultural contexts, particularly in developing countries.

Theoretical and Practical Contribution

This review extends existing scholarship in several important ways. First, it integrates pedagogical, ethical, governance, and sustainability perspectives into a single analytical framework, providing a more comprehensive understanding of GenAI in higher education. Second, by comparatively synthesizing evidence across twenty empirical studies, it identifies areas of convergence, divergence, and methodological limitation rather than merely summarizing previous work. Finally, the review strengthens the Teacher-in-the-Loop framework by demonstrating consistent empirical support for human-centered AI integration across diverse educational settings.

Collectively, these contributions provide an evidence-based foundation for educators, institutional leaders, and policymakers seeking to implement Generative Artificial Intelligence responsibly while preserving educational quality, academic integrity, and the central role of the educator.

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Sustainable Higher Education and Research Contribution

Generative AI for Sustainable Higher Education

Although previous studies primarily emphasize the instructional benefits of Generative Artificial Intelligence (GenAI), this review demonstrates that its significance extends to the broader objective of sustainable higher education. Consistent with Sustainable Development Goal 4 (Quality Education), responsible AI integration contributes to educational systems that are more inclusive, efficient, resilient, and learner-centered.

The synthesis indicates that sustainability is reflected in four interconnected dimensions (Table 5). Collectively, these dimensions show that GenAI supports long-term educational transformation when implemented within appropriate pedagogical and governance frameworks.

Table 5. Sustainability Dimensions of GenAI in Higher Education

Dimension	Contribution
Instructional	Personalized learning, adaptive instruction, timely formative feedback
Institutional	Improved instructional efficiency, workload optimization, organizational resilience
Social	Inclusive learning, equitable access, learner support, lifelong learning
Technological	Ethical AI governance, human oversight, transparency, responsible innovation

The reviewed studies consistently indicate that GenAI enables educators to devote greater attention to mentoring, curriculum innovation, and learner engagement by reducing repetitive instructional tasks. At the institutional level, AI-assisted planning, assessment, and learning analytics improve operational efficiency while supporting flexible and resilient educational delivery. Furthermore, conversational AI systems expand access to academic support for diverse learners, contributing to greater educational inclusion.

However, sustainable implementation requires responsible governance. Institutions must establish policies addressing academic integrity, privacy, transparency, algorithmic fairness, and educator capacity building to ensure that technological innovation remains aligned with educational values. Consequently, sustainability should be understood not only as technological advancement but also as the balanced integration of pedagogy, ethics, institutional governance, and human oversight.

Research Contribution

This review contributes to the literature in four significant ways.

Firstly, it synthesizes empirical evidence from 20 peer-reviewed studies using a PRISMA-guided systematic review, providing a transparent and comprehensive overview of current research on GenAI as a co-instructor.

Secondly, it integrates pedagogical, ethical, governance, and sustainability perspectives into a unified analytical framework. Unlike previous reviews that examine these dimensions independently, this study demonstrates how they collectively influence responsible AI implementation in higher education.

Third, the review provides strong empirical support for the Teacher-in-the-Loop (TiTL) framework, showing that successful AI adoption consistently depends on maintaining educator responsibility for instructional decisions, ethical judgment, and learner development while AI augments instructional processes.

Finally, the study extends current scholarship by explicitly positioning GenAI within the broader agenda of sustainable higher education, highlighting its contributions to instructional quality, institutional resilience, educational equity, and responsible digital transformation.

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Practical Implications

The findings generate several practical implications.

- Educators should adopt GenAI as a collaborative instructional assistant while maintaining responsibility for curriculum design, assessment, and ethical decision-making.
- Higher education institutions should establish AI governance frameworks, invest in faculty AI literacy, and strengthen policies on privacy, academic integrity, and responsible AI use.
- Policymakers should develop national guidelines that support ethical, equitable, and sustainable AI integration aligned with broader digital transformation initiatives.

This review demonstrates that the greatest educational value of GenAI lies not in automating teaching but in strengthening human-centered, responsible, and sustainable higher education.

CONCLUSION

This PRISMA-guided systematic literature review synthesized evidence from 20 empirical and evidence-based scholarly publications published between 2023 and 2025 to examine the transformative roles of Generative Artificial Intelligence (GenAI) as a co-instructor in higher education. The review identified three interconnected instructional functions—co-planning, co-instruction, and co-assessment—demonstrating that GenAI enhances curriculum design, personalized learning, formative assessment, and instructional efficiency across diverse higher education contexts.

The findings further indicate that the educational value of GenAI depends not solely on technological capability but on its responsible integration within pedagogical and institutional frameworks. Across the reviewed studies, the Teacher-in-the-Loop (TiTL) framework consistently emerged as the most appropriate model for implementation, emphasizing that educators retain responsibility for instructional decision-making, ethical judgment, and learner development while AI augments teaching and learning processes.

This review also extends current scholarship by integrating pedagogical, ethical, governance, and sustainability perspectives into a unified framework for AI-augmented higher education. The synthesis demonstrates that responsible GenAI adoption contributes to sustainable higher education through improved instructional quality, institutional efficiency, educational equity, and organizational resilience, while highlighting the importance of robust governance to address challenges related to academic integrity, privacy, transparency, and algorithmic bias.

The review concludes that the future of higher education is not defined by replacing educators with artificial intelligence, but by fostering responsible human–AI collaboration that strengthens teaching, supports student learning, and advances sustainable educational transformation. As AI technologies continue to evolve, higher education institutions should prioritize human-centered implementation strategies that balance technological innovation with educational quality, ethical responsibility, and institutional sustainability.

Recommendations

Based on the findings of this systematic literature review, the following recommendations are proposed to support the responsible and sustainable integration of Generative Artificial Intelligence (GenAI) in higher education.

Educators

- Integrate GenAI as a collaborative instructional assistant rather than a replacement for teaching.
- Redesign assessments to emphasize critical thinking, problem-solving, creativity, and authentic learning.
- Strengthen AI literacy, prompt engineering, and ethical AI competencies to enhance instructional practice.

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- Maintain educator oversight in curriculum design, assessment, and student mentoring through the Teacher-in-the-Loop approach.

Higher Education Institutions

- Develop comprehensive AI governance policies addressing academic integrity, data privacy, transparency, and responsible AI use.
- Invest in continuous faculty development and institutional AI literacy programs.
- Strengthen digital infrastructure and learning support systems to ensure equitable access to AI-enabled education.
- Establish mechanisms for continuous monitoring and evaluation of AI implementation.

Policymakers

- Formulate national and institutional policies that promote ethical, responsible, and sustainable AI adoption in higher education.
- Support investments in digital infrastructure, educator capacity building, and AI research.
- Encourage collaboration among government, higher education institutions, industry, and technology providers.
- Align AI initiatives with national digital transformation strategies and Sustainable Development Goal 4 (Quality Education).

Future Researchers

- Conduct longitudinal and experimental studies to evaluate the long-term impact of GenAI on teaching and learning outcomes.
- Investigate AI integration across diverse disciplines and educational contexts, particularly in developing countries.
- Examine institutional AI governance, educator readiness, and organizational transformation.
- Develop and validate frameworks for responsible, human-centered, and sustainable AI implementation in higher education.

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