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INPLASY

Prompt Engineering with Generative AI for Inclusive and Sustainable Technology-Enhanced Learning in Higher Education: A Systematic Review

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ADMINISTRATIVE INFORMATION

Support - No external funding was received for this study.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 20 June 2026 and was last updated on 10 November 2026.

INTRODUCTION

Review question / Objective RQ1. How is prompt engineering with Generative AI being applied in higher education contexts to support technology-enhanced learning?
RQ2. What educational benefits, limitations, risks, and ethical challenges are reported in relation to the use of prompt engineering practices with Generative AI in higher education?
RQ3. What implications for inclusive education, educational equity, and sustainable educational development, including alignment with SDG 4 and SDG 10, are reported in the literature on prompt engineering with Generative AI in higher education?

Objective
This systematic review aims to examine how prompt engineering with Generative AI is used in higher education to support technology-enhanced learning. The review will synthesize the main educational applications as well as the reported benefits, limitations, risks, and ethical challenges identified in the literature. Particular attention will be given to the implications of these practices for inclusive education, educational equity, and sustainable educational development, including their reported alignment or critically examined relationship with SDG 4 and SDG 10.

Rationale The rapid expansion of Generative AI is reshaping higher education by opening new avenues for teaching, learning, and academic support. At the same time, it raises important questions about how these tools can be integrated meaningfully and responsibly into educational practice (Lee & Palmer, 2025). Central to effective interaction with Generative AI systems is prompt engineering, understood as the deliberate crafting of inputs that shape the quality, relevance, and educational usefulness of AI-generated outputs (Jacobsen & Weber, 2025). Emerging research shows that prompt engineering can be taught as a practical competency that supports autonomous learning, self-regulation, and more intentional use

of AI tools in university contexts (Mzwri & Turcsányi-Szabo, 2025). It is also increasingly viewed as a core element of AI literacy, enabling students to engage critically and strategically with these technologies (Murray, 2025).

Beyond technical skills, the integration of Generative AI is generating growing interest in its potential to enrich technology-enhanced learning. In higher education, Generative AI has been associated with personalized feedback, adaptive learning experiences, content generation, and academic assistance (Nikolopoulou, 2025). In design-based education, prompt engineering has also been explored as a way to support learner-centered activities, creative thinking, and self-evaluation within AI-mediated environments (Lee & Kang, 2025). Moreover, Generative AI applications show promise in advancing accessibility and educational equity by offering personalized support and broadening access to learning resources, particularly for diverse student populations (Pachava et al., 2025).

Nevertheless, the adoption of Generative AI in higher education is not without significant challenges. Ethical concerns around data privacy, algorithmic bias, transparency, and the risk of widening educational inequalities remain pressing issues (García-López & Trujillo-Liñán, 2025). Questions of academic integrity have also intensified, as these tools can simultaneously support learning and enable new forms of misconduct (Bittle & El-Gayar, 2025). University stakeholders have expressed legitimate concerns regarding data protection, fairness, and the need for robust governance frameworks to ensure responsible implementation (Marín et al., 2025).

Although the literature on Generative AI in higher education is expanding rapidly, research specifically focused on prompt engineering as a pedagogical mediator remains fragmented and scattered across different applications. There is a clear need for a systematic synthesis that examines how prompt engineering with Generative AI is being applied in higher education, its reported benefits, limitations, risks, and ethical challenges, as well as its implications for inclusive, equitable, and sustainable educational development. This systematic review seeks to address that gap.

Condition being studied The condition being studied is the educational use of prompt engineering with Generative AI in higher education contexts. In this review, prompt engineering is defined as the design, refinement, and strategic application of prompts to guide Generative AI systems in supporting key learning processes, including personalized learning, academic feedback, content generation, accessibility, student engagement, academic writing, problem-solving, and the development of digital competencies.

The review focuses specifically on how these prompt engineering practices function as pedagogical mediators within technology-enhanced learning environments. It examines their relationship with educational outcomes, reported benefits, limitations, risks, and ethical challenges, with particular attention to their implications for inclusive education, educational equity, and sustainable educational development aligned with SDG 4 and SDG 10.

METHODS

Search strategy The search will be conducted in Scopus, ScienceDirect, EBSCO, and ERIC. The review will cover studies published between 2022 and 2026, capturing the emergence and rapid development of Generative AI tools in higher education. The search strategy will combine terms related to prompt engineering, Generative AI, ChatGPT, large language models, and higher education contexts, while maintaining a broad approach to technology-enhanced learning practices.

To maximize sensitivity and avoid excluding relevant studies, the search equations will not include terms such as “sustainable education”, “SDG 4”, or “SDG 10” as mandatory search terms. These dimensions will be assessed during the screening and data extraction phases, since many studies may discuss inclusion, equity, accessibility, or sustainability without using these exact terms. Additionally, the strategy will not rely exclusively on the term “prompt engineering”. Complementary terms such as “prompt design”, “prompt literacy”, and “prompting strategies” will be incorporated to capture studies addressing the design, refinement, teaching, or educational application of prompts as pedagogical mediators in higher education.

The search equations will be adapted to the syntax and search capacity of each database. Scopus will use a broader structured equation, EBSCO will use a balanced equation, and ScienceDirect and ERIC will use shorter equations to improve retrieval precision.

Scopus

TITLE-ABS-KEY (("prompt engineering" OR "prompt design" OR "prompt literacy" OR "prompting strategies" OR "effective prompting") AND ("Generative AI" OR "generative artificial intelligence" OR ChatGPT OR "large language model*" OR LLM) AND ("higher education" OR universit* OR college*))

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ScienceDirect
"prompt engineering" AND "Generative AI" AND "higher education"

EBSCO
("prompt engineering" OR "prompt design" OR "prompt literacy" OR "prompting strategies")
AND ("Generative AI" OR ChatGPT OR "large language model*" OR LLM)
AND ("higher education" OR universit* OR college*)

ERIC
("prompt engineering" OR "prompt design" OR "prompt literacy" OR prompting)
AND ("Generative AI" OR ChatGPT OR "large language model")
AND ("higher education" OR university OR college)

In addition to database searching, other sources will be explored to identify eligible studies that meet the inclusion and exclusion criteria. These may include manual searches in relevant journals, reference lists of included studies, and citation tracking. Both backward citation tracking and forward citation tracking will be conducted when necessary to locate additional relevant articles.
Where available, database filter functions will be used to restrict records by publication year, document type, and language. If a database does not provide adequate filtering options, these restrictions will be applied manually during the screening process, and records not meeting these criteria will be reported at the exclusion stage according to the predefined eligibility criteria.
All retrieved records will be exported to a reference manager and then imported into Rayyan for screening. Duplicate records will be removed before title and abstract screening. The final selection of studies will be based on predefined inclusion and exclusion criteria.

Participant or population The review will focus on studies conducted in higher education contexts, involving university students, academic staff, instructors, and institutional settings. Studies with undergraduate, postgraduate, or doctoral participants will be eligible.
Studies conducted exclusively in primary, secondary, vocational, corporate training, or non-educational settings will be excluded. Mixed-level studies will only be included if higher education data can be clearly disaggregated and extracted.

Intervention The phenomenon of interest is the educational use of prompt engineering with Generative AI in higher education. This includes the design, refinement, teaching, and strategic application of prompts to guide Generative AI systems in supporting educational processes.
Eligible studies may examine prompt engineering practices applied to personalized learning, academic feedback, academic writing, problem-solving, tutoring, accessibility, student engagement, collaborative learning, digital competence development, AI literacy, content generation, or other technology-enhanced learning activities within higher education environments.

Comparator A comparator will not be required for study inclusion. However, studies that include comparison groups or alternative educational approaches will be considered when available.
Possible comparators may include traditional teaching methods, conventional digital learning environments, unstructured use of Generative AI, educational activities without structured prompt engineering, or technology-enhanced learning interventions not supported by Generative AI.

Study designs to be included This review will include empirical studies employing quantitative, qualitative, mixed-methods, case study, quasi-experimental, descriptive, survey-based, observational, or evaluation research designs.The review will exclude editorials, opinion papers, commentaries, letters to the editor, book chapters, conference papers, preprints, dissertations, theses, conceptual papers without empirical data, and all types of literature reviews, including narrative reviews, scoping reviews, systematic reviews, umbrella reviews, and meta-analyses.

Eligibility criteria Please replace only criteria I3 and E3 with the following wording. All other eligibility criteria remain unchanged.

I3. Outcomes: Studies providing empirical evidence of both an identifiable educational application of prompt engineering with Generative AI in higher education (RQ1) and at least one associated educational benefit, limitation, risk, or ethical challenge (RQ2). Evidence must concern educational use or experiences involving higher education students or instructors. Assessments limited to the correctness or technical quality of model outputs will be insufficient, even when authentic educational materials are used or students or instructors rate those outputs. Positive outcomes or statistically significant improvements will not be required. RQ3-related implications will be examined when available but will not be mandatory for inclusion.

E3. Insufficient Relevant Outcomes: Studies lacking empirical evidence jointly addressing an

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identifiable educational prompting application (RQ1) and at least one associated educational benefit, limitation, risk, or ethical challenge (RQ2). This includes evaluations limited to model-output performance or quality without empirical findings concerning educational use or experiences.

Amendment rationale: During full-text eligibility assessment, I3 and E3 were refined to align study selection with the review's central objectives and distinguish educationally evaluated prompting practices from evaluations limited to model-output performance or quality. The refined criteria were applied uniformly to all reports assessed in full text, including those identified through citation searching. The research questions and the five eligibility domains were retained.

Information sources The review will draw evidence from four major bibliographic databases: Scopus, ScienceDirect, EBSCO, and ERIC. These sources were selected for their complementary coverage of research in higher education, educational technology, digital learning, artificial intelligence, and pedagogical innovation.
Scopus provides broad multidisciplinary coverage and strong representation of peer-reviewed literature across education, technology, and social sciences, making it suitable for capturing studies on emerging topics such as Generative AI and prompt engineering. ScienceDirect offers access to journals in educational technology, computer science, and learning sciences, enabling the identification of studies that combine technological and pedagogical perspectives. EBSCO expands coverage across education-focused and interdisciplinary collections, increasing the chances of locating empirical studies that may not appear in broader databases. ERIC, as a leading education-specific database, supports the retrieval of research on teaching, learning, curriculum, and instructional design relevant to prompt engineering practices in higher education.
To address the rapidly evolving nature of Generative AI research and minimize the risk of missing relevant studies, additional identification strategies will be employed. These will include backward and forward citation tracking, as well as manual searches of reference lists from included studies when necessary. This multi-source approach aims to enhance the comprehensiveness and robustness of the review.

Main outcome(s) The review will focus on the main outcomes directly related to the review questions. Primary outcomes include:
• Educational applications of prompt engineering with Generative AI in higher education, particularly those supporting technology-enhanced and personalized learning.
• Reported benefits, limitations, risks, and ethical challenges associated with prompt engineering practices.
• Implications for inclusive education, educational equity, and sustainable educational development, including any explicit or clearly connected references to SDG 4 and SDG 10.

Additional outcome(s) Additional information will be extracted to characterize the included studies and support the interpretation of findings. These data may include:
• Country or geographical context of the study.
• Disciplinary area or field of study.
• Generative AI tool or platform used.
• Type of prompt engineering approach or practice examined.
• Educational modality, such as face-to-face, online, blended, or hybrid.

Data management Data management and study selection will follow PRISMA-P guidance and will be transparently documented using a PRISMA flow diagram. All records retrieved from the databases and additional sources will be exported to a reference management tool and imported into Rayyan for processing.
Rayyan will be used to identify and remove duplicate records. Subsequently, titles and abstracts will be screened to identify potentially relevant studies. Records excluded at this stage will be categorized according to the predefined eligibility criteria (E1–E5).
Full texts of potentially eligible studies will then be retrieved and assessed against the inclusion and exclusion criteria. Studies without accessible full text will be recorded as exclusions. Data extraction from included studies will be conducted using a structured matrix in Microsoft Excel, designed to capture study characteristics, methodological details, and information aligned with the review questions, including educational applications of prompt engineering, reported benefits, limitations, risks, ethical challenges, and implications for inclusion, equity, and sustainable educational development.
This organized approach will facilitate descriptive synthesis, cross-tabulation, and the preparation of summary tables for the final report.

Quality assessment / Risk of bias analysis The methodological quality of the included studies will be appraised using the Mixed Methods Appraisal Tool (MMAT). This tool was chosen because the review is expected to encompass a heterogeneous set of empirical designs, including quantitative,

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qualitative, mixed-methods, case study, quasi-experimental, observational, descriptive, and evaluation studies (Hong et al., 2018).
Quality assessment will be performed independently by two reviewers. Any disagreements will be resolved through discussion and consensus. If consensus cannot be reached, a third reviewer will be consulted. The results of the quality appraisal will inform the interpretation of findings and support sensitivity analyses. However, studies will not be excluded based solely on methodological quality unless they clearly fail to meet the predefined eligibility criteria.

Strategy of data synthesis The findings will be synthesized using a narrative and thematic approach. Evidence will be organized and categorized according to the three review questions and their associated main outcomes.
For RQ1, studies will be grouped by the educational applications of prompt engineering with Generative AI in higher education. For RQ2, the synthesis will examine reported benefits, limitations, risks, and ethical challenges. For RQ3, studies will be analyzed according to their reported or conceptually related implications for inclusive education, educational equity, and sustainable educational development. This includes studies that explicitly reference SDG 4 or SDG 10, as well as those addressing related dimensions such as accessibility, participation, digital inclusion, or equitable and sustainable technology-enhanced learning.
Where appropriate, descriptive statistics, such as frequencies and percentages, will be used to summarize study characteristics and outcome patterns. Cross-tabulations may also be conducted to explore relationships across variables such as disciplinary area, educational modality, or type of prompt engineering approach, when sufficient data are available.
Given the expected methodological and contextual heterogeneity among included studies, a meta-analysis is not anticipated. The synthesis will instead prioritize the identification of key patterns, themes, trends, and areas of convergence or divergence in the evidence base.

Subgroup analysis If the available data are sufficient, subgroup analyses will be conducted to explore whether the findings vary across relevant contextual and methodological characteristics. Potential subgroups may include disciplinary area, country or region, type of Generative AI tool, type of prompt engineering approach, and educational modality, such as face-to-face, online, blended, or hybrid learning.
Additional exploratory comparisons may be considered for studies that explicitly address inclusive education, educational equity, sustainable educational development, SDG 4, or SDG 10, provided that the number and quality of included studies allow meaningful interpretation.

Sensitivity analysis Sensitivity analysis will be conducted to examine whether the main categories and patterns remain stable when studies with lower methodological quality are excluded according to the MMAT 2018 appraisal. The synthesis will compare findings with and without lower-quality studies to assess whether the interpretation of educational applications, reported benefits, limitations, risks, ethical challenges, and implications for inclusion, equity, and sustainability is substantially affected.
This analysis will not be used to remove studies automatically from the review. Instead, it will support a more cautious interpretation of the evidence and help identify whether particular findings depend heavily on studies with weaker methodological quality.

Language restriction Only studies published in English will be included. This restriction is justified by the predominance of recent international publications on Generative AI, prompt engineering, and technology-enhanced learning in English-language academic.

Country(ies) involved The protocol will be developed by authors based in Peru. The review will be conducted from a research context focused on higher education, educational technology, and the responsible integration of.

Other relevant information This protocol will be registered in INPLASY and developed in accordance with PRISMA-P guidance. The final review will be reported following the PRISMA 2020 statement, and methodological quality will be appraised using MMAT 2018.
The review will adopt a critical and balanced approach. Direct contributions to SDG 4 or SDG 10 will not be assumed unless they are explicitly reported or clearly supported by the evidence. When studies address related dimensions such as accessibility, educational equity, digital inclusion, participation, or sustainable technology-enhanced learning, these connections will be interpreted cautiously and reported transparently.

Keywords Generative AI; prompt engineering; higher education; technology-enhanced learning; inclusive education; sustainable education; digital competences.

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Dissemination plans The findings of this systematic review are intended to support the development of a manuscript for submission to Sustainability, specifically to the Special Issue "Technology-Enhanced Education and Sustainable Development." This Special Issue is considered relevant because it welcomes review articles and focuses on the role of educational technology, artificial intelligence, digital learning, and sustainable development in educational contexts.
The extraction of eligible manuscripts is planned to begin on 16 October 2026. The results will be disseminated through a peer-reviewed publication and may also inform future research on prompt engineering, Generative AI, inclusive education, and sustainable technology-enhanced learning in higher education.

Contributions of each author

Author 1 - Maritza Arones - Will contribute to investigation, data curation, resources, visualization, and writing – review & editing.
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