Research on generative AI within university teaching contexts a methodological analysis

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***Abstract*— This article presents the results of a systematic literature review aimed at identifying methodological trends in empirical and review studies concerning generative artificial intelligence (GenAI) within higher education institutions. The review was conducted in accordance with PRISMA guidelines, by using a corpus of peer-reviewed articles indexed in Scopus and Web of Science, published between 2021 and early 2024. Most studies are conducted within undergraduate and teacher education settings, with a primary focus on assessment processes and academic performance. A qualitative matrix was applied to 30 selected studies, considering variables such as type of research, methodological approach, educational level, data collection techniques, and ethical-pedagogical approach. The findings show the predominance of quantitative, cross-sectional designs based on surveys with limited validation procedures. The study concludes with an insight: the need to enhance methodological rigor and ethical alignment in future research on generative artificial intelligence within the university context.**

Keywords: generative artificial intelligence, higher education, methodology, systematic literature review

I. INTRODUCTION

Generative artificial intelligence (GenAI) is defined as "a branch of artificial intelligence that automatically creates content in response to written prompts" [1]; its applications are employed in the development of products and services and are significantly impacting the educational line of work, to the extent of representing a transformative turning point in the teaching-learning process [2]. Currently, "all fields of study have considered the possibility of introducing AI to improve processes and increase efficiency" [3].

Tools such as ChatGPT, Copilot and other platforms based on large-scale language models (LLM) have expanded possibilities by redefining the evaluation and production of knowledge within academic settings. As asserted by Belkina et al., "Generative Artificial Intelligence (GenAI) is transforming higher education, by challenging traditional teaching approaches, improving student support systems, and reshaping the educational ecosystem" [4]. Additionally, UNESCO highlights that AI "has the capacity to address some of the biggest challenges facing education today and to develop innovative teaching and learning practices" [5]. This disruptive impact has generated both enthusiasm and uncertainty, underscoring an accelerated evolution that, in many cases, surpasses institutional capacities for curricular, regulatory, and ethical adaptation [6], [7].

Although some international contexts have begun implementing training frameworks for GenAI use, in Latin America —and particularly in Ecuador— the integration process is progressing unevenly and it lacks a common framework of reference.

Reeves Huapaya et al. warn that formal education lags behind other sectors in incorporating emerging technologies and "urgently requires a rapid review of what is taught and how it is presented" [8]. In this context, artificial intelligence emerges as a technology with significant potential to contribute towards social sustainability, promote educational innovation and equip students to meet the challenges of the current digital age [9]. However, this potential must be accompanied by a critical analysis that transcends optimistic technological narratives and rigorously addresses the methodological, pedagogical and ethical implications of its implementation in university teaching [10].

Therefore, challenges persist indeed concerning digital literacy, equitable access, data privacy and the adaptation of institutional regulatory frameworks. The rapid penetration of GenAI into educational environments contrasts sharply with the slow development of clear policies and sustainable pedagogical strategies. Hence, several authors emphasize the urgent need for more systematic research grounded in strong empirical evidence to understand the actual effects of this technology on teaching practice, university curricula and the development of professional skills [7], [11].

Yet, despite the exponential growth of studies on generative artificial intelligence in higher education, most of this research exhibits limitations in its methodological design. Much of the fresh literature concentrates on describing student or teacher perceptions, specific usage experiences, or

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proposals for technological integration, often lacking rigorous designs that enable evaluation of their impact based on validity and replicability criteria. Deng et al. address that "although cross-sectional studies have highlighted correlations between ChatGPT use and academic performance, they fail to establish causal relationships" [12]. Similarly, Lee and Palmer emphasize that a "knowledge gap remains concerning the performance of prompt engineering compared to existing methods" [6], which reveals a widespread tendency to adopt exploratory approaches at the expense of systematic and controlled research.

In this context, a critical shortcoming is identified: the absence of analysis regarding the research methodologies employed to investigate the phenomenon of generative AI within university settings. Belkina et al. point out that "there is still a lack of focus on their actual implementation within educational settings" [4], although the growing use of these tools has been documented as we do know. This methodological omission limits not only the interpretation of results but also the capacity to build robust, replicable and comparable theoretical frameworks across studies. Furthermore, as suggested by Hariyanti et al., many studies ignore strategies for explicitly linking AI tools to specific skills —such as statistical literacy— thereby hindering precise determination of which learning aspects are being enhanced [9].

The scarcity of studies that critically assess the design, type and quality of employed methodologies has resulted in a miscellaneous and fragmented body of academic output. The use of unvalidated questionnaires, single case studies and qualitative analyses lacking triangulation is prevalent, undermining the robustness of conclusions and diminishing the scientific contribution of the field. This situation generates an epistemological vacuum that hinders informed pedagogical decision-making and the development of coherent institutional policies. Consequently, a systematic analysis that critically examines existing research practices is both relevant and imperative, aiming to contribute to the consolidation of a methodologically mature field.

Several recent studies have sought to systematize the existing evidence on the use of generative artificial intelligence in higher education. Although these studies differ in their objectives and approaches, they converge on the need to advance toward more robust and methodologically consistent research. Baig and Yadegaridehkordi, in a review of 57 studies, emphasized that the field remains in its childhood and "requires further exploration to be used effectively in education" [10]. In the same vein, Liu et al. identify five major emerging areas of research —ranging from assessment design to patients' use of ChatGPT— yet caution that significant gaps persist in specific disciplinary applications, customization, and the critical analysis of methodological quality [13].

Existing reviews have addressed the phenomenon from various perspectives. For instance, López Chacón et al. highlight that most of the reviewed studies employ exploratory methodologies utilizing unvalidated questionnaires and lack formal academic supervision [14]. Others, such as in the review by Jin et al., concentrate on analyzing institutional policies for GenAI adoption, concluding that despite widespread interest in ethics and academic integrity, "gaps remain in holistic policies, effective communication, and equitable access" [15]. Even reviews centered on practical applications, like the one by Marchena Sekli et al., indicate that despite GenAI's versatility across multiple educational domains, there remains no "consolidated knowledge about its practical effectiveness and real impact" [16].

Nonetheless, it is noteworthy that these works—while valuable for understanding trends, perceptions, and applications of AI—rarely undertake a detailed examination of the research methodologies employed in the studies reviewed. Unlike traditional systematic reviews that prioritize results or outcomes, this paper adopts a distinct approach by critically analyzing the methodological approaches, their epistemological foundations, and their alignment with research objectives. In that regard, this study represents an original contribution to the discourse on scientific quality within a rapidly expanding field characterized by significant conceptual assortment.

II. METHODOLOGY

Based on this theoretical framework, we wish to outline the systematic review process, detailing the phases of searching, selection, coding, and analysis of the documents. However, our focus is on critically analyzing the methodologies employed in thirty empirical studies concerning generative artificial intelligence in higher education. Employing a qualitative-descriptive approach. Hence, the analysis seeks to identify methodological trends, dominant approaches, methodological contributions, and recurring limitations that characterize the quality of research in this emerging field.

The review aims to identify, organize, and analyze recent academic literature on the use of generative artificial intelligence (GenAI), particularly ChatGPT, within university contexts. To ensure rigor and transparency, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were employed as a methodological reference, following the phases: (1) research questions; (2) search strategy; (3) choosing criteria; (4) selection process and data extraction; and (5) data synthesis [14] and adapting them to the exploratory nature of qualitative analysis. This type of study is particularly relevant due to the emerging nature of the phenomenon, enabling the identification of trends, methodologies, and critical perspectives surrounding the application of these tools in higher education.

The documentary corpus was obtained through a systematic search of two high-impact academic databases: Scopus and Web of Science (WOS). The review was carried out by three researchers specializing in education, journalism and information, according to UNESCO. The search strategy was constructed using a combination of keywords related to generative artificial intelligence and the university context, employing Boolean operators to refine the results. Specific filters were applied to restrict the search to academic publications in Spanish or English, with open access, delving within the period from 2021 to 2025. The detailed design of the search queries and the terms used in each database are presented in TABLE I, ensuring the traceability and replicability of the procedure employed.

In selecting the corpus, inclusion and exclusion criteria were established to ensure the relevance, quality and critical focus of the analyzed materials. Empirical studies (qualitative, quantitative, or mixed) and systematic reviews examining the use of artificial intelligence in higher education were included,

with a particular emphasis on its impact on teacher-student interaction, the humanization or dehumanization of educational processes and the analysis of communication, assessment or AI-mediated social interaction. Only publications in Spanish or English, published between 2021 and 2025, were considered.

Conversely, studies addressing AI from a general perspective without direct relevance to higher education were excluded, as were those mentioning these technologies without analyzing their human or pedagogical impact; studies focused solely on technical or functional benefits lacking critical perspective were also discarded.

It's important to note that there are systematic reviews of literature that study the presence of AI in education [15]. There are also bibliometric studies of scientific literature on the acceptance of AI in university education [16].

TABLE I. TABLE TYPE STYLES

Question:	1. Does the educational model of the higher education institution incorporate mechanisms for AI employment? 2. What regulations exist within universities to support the integration of AI mechanisms? 3. Do the curricula address the appropriate use of AI tools and mechanisms?
Inclusion criteria:	1. Empirical studies (qualitative, quantitative, or mixed methods) and systematic reviews. 2. Studies focusing on AI in higher education and its impact on teacher-student interaction. 3. Research exploring the humanization or dehumanization of education through AI. 4. Studies examining communication, assessment, or social interaction in AI-mediated educational contexts. 5. Publications dated between 2021 and 2025, written in Spanish or English in open access.
Exclusion criteria:	(1) General studies on AI with no connection to higher education, (2) studies that mention AI without analyzing its human or pedagogical impact, (3) Research focused exclusively on technological benefits, lacking a critical perspective, (4) Publications in languages other than Spanish or English, without accessible translation.
Search equations:	- ("curriculum planning" OR "curriculum design") AND ("artificial intelligence") AND ("appropriate use" OR "responsible use") - "curriculum" AND "artificial intelligence" AND "appropriate use" - "higher education AND artificial intelligence" AND "curriculum" - ("higher education OR university) AND "artificial intelligence" AND use AND competencies - ("higher education OR university) AND "artificial intelligence" AND competencies - ("higher education OR university) AND "artificial intelligence" AND educational planning - ("higher education" OR university) AND ("artificial intelligence" AND "latin america") AND (pedagogic OR curriculum OR regulations) AND integrate "Artificial Intelligence" AND "Educational Technology" AND "Curriculum Development"

[a] Own elaboration based on the PRISMA methodology (*Table I*)

The selection procedure was implemented in accordance with the PRISMA 2020 guidelines, incorporating specific modifications to align with the aims and scope of this systematic review. In the identification phase, a total of 1,368 records were collected: 1,263 from Scopus and 105 from Web of Science (WoS). After removing 18 duplicate records, 1,350 documents remained for the screening process. At this stage, 1,099 records were excluded for failing to meet the predefined thematic and methodological criteria. A total of 251 articles were selected for full-text review, of which 13 were unavailable. During the eligibility assessment, 238 full-text documents were evaluated, resulting in the exclusion of 208 studies due to their focus on artificial intelligence applications outside the context of higher education. Ultimately, the corpus of analysis consisted of 30 studies that met the inclusion criteria. Figure 1 graphically summarizes this process, structured into the stages of identification, screening, eligibility, and inclusion.

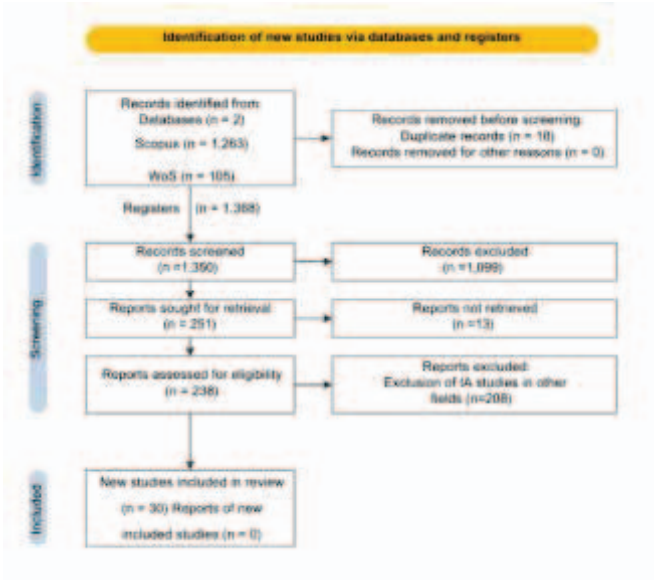

Fig. 1. Flow diagram of the source selection, evaluation, and screening process.

Given the exploratory nature of the review, qualitative analysis based on thematic content analysis was chosen. To this end, an *ad hoc* analysis matrix was designed to organize the information from the 30 selected articles (The final data collection sample can be viewed at the following link: https://bit.ly/cribado30). The variables analyzed encompassed: research type (empirical or review), methodological approach (quantitative, qualitative, or mixed methods), level of applicability (undergraduate, graduate, instructional), domain of impact (assessment, communication, social interaction), and the characterization of approaches as humanizing or dehumanizing in relation to the application of artificial intelligence. Each article underwent a thorough manual review, with findings systematically documented in a double-entry matrix constructed within a spreadsheet, which subsequently served as the foundation for interpretative analysis (the complete matrix can be reviewed at the following link: https://bit.ly/analysism30).

A. Limitations and criteria for strictness

The research conducted exhibits certain limitations which are indeed inherent to any systematic review design, particularly the absence of automated bibliometric analysis tools. The selection, reading and coding of texts were performed manually, introducing then the potential risk of interpretative bias. Nonetheless, to ensure methodological rigor, clear inclusion and exclusion criteria were established *a priori*, a reproducible systematic search protocol was implemented (Table 1). Thus, the screening process was transparently documented, as illustrated in the corresponding figure. Furthermore, the development of a structured analysis

matrix facilitated consistency and traceability of the findings. These measures contribute to enhancing the internal validity of the study, despite the lack of specialized software tools.

III. Results

A. General characterization of the corpus in terms of methodology

Within the selected corpus, 86.6% of the studies were classified as empirical research, whereas 13.4% constituted systematic reviews. The majority of excluded articles were omitted due to the absence of an empirical design or systematic review framework, indicating a prevailing tendency to approach the phenomenon of generative artificial intelligence through descriptive, exploratory, or essayistic perspectives lacking explicit methodological rigor. This finding underscores a significant characteristic of the field: despite the increasing volume of academic output on generative AI in higher education, the fact is only a limited proportion of studies employ methodological frameworks that facilitate comparison, systematization, or replicability. The ratio between the total number of articles identified and those ultimately included (2.2%) raises concerns regarding the methodological rigor of a substantial portion of the published literature and underscores the need to foster research that adheres to verifiable scientific standards.

B. Methodological Typology Employed

Regarding methodological approach, most studies employed mixed-method research (36%), followed by qualitative (34%) and quantitative (30%) studies. In quantitative studies, data collection and analysis commonly involved the use of structured questionnaires, Likert scales, and basic statistical tests such as the Mann-Whitney U test, chi-square test, and correlation analysis. Some of these studies incorporated multivariate analysis techniques; however, they did not employ controlled experimental designs.

The mixed-method studies were predominantly structured as sequential exploratory designs, integrating quantitative instruments with qualitative elements such as discourse analysis or open-ended questions aimed at capturing perceptions. Within this group, several studies indicated a predominance of the quantitative component, with the qualitative dimension serving primarily to support the interpretation of results.

In turn, qualitative research primarily centered on content analysis, document review, and case studies, with no application of statistical tools. These studies frequently utilized thematic coding, critical evaluation of AI tool performance and analysis of institutional documents, often in the absence of direct participant involvement in certain research designs.

Regarding study type, although all articles were categorized as either empirical research or systematic reviews, notable terminological variations were observed within these categories. Some empirical studies were described as exploratory research, quasi-experimental designs, or performance evaluations, while systematic reviews were structured based on thematic analysis frameworks or documentary approaches without incorporating meta-analytical procedures. *Yet, t*his variation in nomenclature *and naming* was not consistently supported by an explicit epistemological foundation.

C. Educational levels and contexts

The analyzed studies encompassed various levels within higher education, with 13.9% concentrating exclusively on the university teaching level, addressing both initial teacher training and ongoing professional development. Meanwhile, 7.6% focused solely on undergraduate students and an additional 7.6% incorporated both faculty and undergraduate students within the same research framework, examining shared teaching-learning activities, indicating also an institutional perspective on the phenomenon.

Furthermore, one study (1.3%) focused on a postgraduate population, while another (1.3%) included both faculty and students at the postgraduate level. Additionally, a single study (1.3%) examined the phenomenon from a general perspective of "higher education," without specifying participant academic level or roles.

62% of the studies did not explicitly specify the educational level within their methodological descriptions. In these instances, the analysis predominantly concentrated on institutional policies, university governance plans, or regulatory frameworks. This lack of specification complicates the definitive classification of educational levels, although the broader context of higher education consistently serves as the overarching reference.

In terms of context, most studies were conducted within institutional academic settings; however, some investigations relied on documentary analysis, autoethnographic methodologies or simulations, without direct application in actual classroom environments.

D. Addressed areas of educational impact

The thematic analysis facilitated the classification of studies based on the educational domains influenced by the integration of generative artificial intelligence, delineating three primary categories: assessment, communication, and social interaction.

This classification revealed that the predominant focus within the analyzed research pertains to the assessment of learning outcomes, digital competencies or the usage of generative artificial intelligence tools. In the majority of cases, such assessments were conducted employing structured instruments, including surveys, rubrics and knowledge tests.

Of the records analyzed, 27.8% of the articles focused explicitly on the field of assessment, both of learning and of skills or performance associated with the use of AI tools. This approach includes studies that used questionnaires, surveys, rubrics or structured tests to measure the impact of GenAI on specific training processes.

In 25.3% of cases, the focus was on social interaction, conceptualized as the collaborative dynamics between educators and students, alongside the communicative mediation processes facilitated or altered by artificial intelligence. This body of research encompassed both the observation of classroom interactions and the analysis of digital communication networks.

17.7% of studies incorporated the dimension of communication, addressing contexts such as content creation, the application of AI-generated natural language, and the transformation of discursive practices within educational settings. This category encompasses research examining the

role of ChatGPT and similar tools as mediators in the production and dissemination of academic knowledge.

Additionally, 62% of studies did not explicitly specify an area of impact corresponding to the assessment, communication, and social interaction. These cases primarily pertain to research addressing curricular, structural, ethical or institutional dimensions of AI integration in higher education. Rather than focusing directly on interpersonal training processes, such studies approach the phenomenon indirectly through the redesign of pedagogical practices, professional development initiatives or the incorporation of AI within university policies.

Some studies that simultaneously encompassed assessment, communication, and social interaction were also identified, without clearly delineating among these dimensions. These investigations adopted an integrated approach, addressing learning assessment, AI-mediated communication, and the social implications of generative technologies within university classrooms in a coordinated manner.

This distribution reveals a tendency to prioritize assessment as the primary analytical focus, while relational and communicational components, though present, are addressed with less conceptual systematization within research designs.

E. Methodological contributions, scope and limitations

The cross-analysis of the fields *"methodological contributions"* and *"methodological limitations",* within the reviewed studies, revealed, in a complementary manner, both the strengths and weaknesses of current research approaches concerning the use of generative artificial intelligence within university contexts.

Among the contributions, there is evidence of a growing interest in tailoring methodological designs to specific educational contexts, either through the customization of data collection instruments or the development of user experiences that replicate real-life application conditions. Some studies incorporate authentic assessment rubrics, control mechanisms involving differentiated groups, or structured pedagogical simulations guided by observation criteria. These elements enable a more in-depth exploration of the didactic and formative impact of AI tools in higher education.

Also noteworthy are research proposals that, while not formally classified as mixed-method approaches, integrate qualitative and quantitative techniques in a coordinated manner to examine the phenomenon from multiple dimensions. The emergence of AI as a subject of study has prompted the development of novel methodological combinations, in which new forms of measurement, analysis, and interpretation are being tested transcending conventional research models.

Despite these advancements, structural weaknesses persist in many of the studies reviewed. This trait becomes notable among the works with absence of formal validation of the instruments employed, the lack of methodological triangulation and the limited scope and representativeness of the samples. In some cases, the research designs do not support the establishment of interpretive inferences beyond the analysis group, thereby limiting the transferability and generalizability of the findings.

Another significant weakness is the fragmentation observed between research objectives, design, and interpretation. Several studies don't justify the selected methodological approach or exhibit a disconnect between the stated research problem and the analytical tools employed. This misalignment restricts the potential for cumulative knowledge generation and impedes the replicability of findings.

F. Relevant Observations and Exceptional Cases

Of the 30 studies analyzed, 23.3% featured methodological characteristics notable for their internal consistency among objectives, design and applied instruments. These studies are distinguished by the utilization of questionnaires validated through Cronbach's alpha or expert review, the implementation of pilot testing, and a coherent alignment among the components of the research design. In six examples, the authors explicitly state that their designs are replicable or adaptable to other university contexts, underscoring a commitment to methodological transferability.

Additionally, 13.3% of the studies involved the direct application of generative AI tools in authentic learning environments, including the integration of ChatGPT in academic activities within classroom settings. These investigations extended beyond perception surveys to document interactive processes among students, educators, and technology, thereby providing empirical evidence on specific AI-mediated teaching and learning practices.

In terms of geographical and institutional context, 16.6% of the studies focused on the realities of developing countries, institutions with limited technological resources or culturally diverse (multidiverse and multicultural) environments. These investigations reveal methodological adaptation strategies tailored to local conditions, including the employment of free platforms, readily accessible digital tools, and the design of activities that do not necessitate specialized infrastructure.

Furthermore, three studies proposed mechanisms for evaluating AI-generated outputs through the use of specific rubrics, critical content analysis or comparative assessments between human and automated results. These contributions advance the establishment of pedagogical and ethical criteria for integrating AI into academic evaluation processes.

The observations here shown partially complement the broader analysis and highlight the presence of specific methodological contributions which, although not representative of the majority, offer valuable avenues for future research development in the field of generative artificial intelligence applied to higher education.

Nevertheless, an examination of the reported methodological contributions reveals consistent patterns in the construction and adaptation of research designs addressing the use of generative artificial intelligence within university contexts. Despite evident conceptual and technical heterogeneity, recurrent practices can be identified across multiple studies.

IV. Conclusions

The field of research on generative AI and its implications for academia remains relatively nascent within the educational domain. Yet, we have been observing that since pospandemic (2022-2023), its use has become widespread, driven mainly by ChatGPT. The analysis of the 30 selected studies indicates

a growing trend in higher education. While the studies often emphasize that data collection was grounded in specific educational contexts, it is evident that generative AI is being utilized across higher education institutions in diverse areas of academic practice.

Regarding the methodology employed to examine this phenomenon, combinations of qualitative and quantitative methods are also evident. Although the studies are not always formally structured as mixed-method approaches, these combinations enable a more comprehensive examination of the subject under study. This practice tends to emerge in studies aiming to capture both performance outcomes and perceptions associated with the use of AI. However, these are limited studies using exploratory instruments that have not been validated through experimental research designs.

The analysis carried out points to the path taken by previous studies, as systematic reviews of literature related to the methodology give us serious indications that it is necessary to delve into more specific studies with deeper corpora, so that the data can be extrapolated to other contexts. Thus, the studies will cease to be mere empirical references and will instead establish the standard regarding research on generative AI in Ecuador, Latin America, and worldwide.

Thus, even though the studies reviewed mainly discuss the impact that AI has had on the educational process of students, the impact on content generation and the interaction that has been generated between students and teachers, this brief review reveals the urgent need to focus studies on more precise analyses of the uses of generative AI and its ethical management in higher education institutions.

Even if the studies analyzed address corpora related to higher education, it is noteworthy that most findings do not specify the educational level of the institutions that have been the subject of research. This situation limits our ability to gain an in-depth understanding of the impact of generative AI in university settings.

Based on the above, this brief study serves as a starting point for understanding the research designs used to analyze the use of GenAI, as well as for proposing new methodologies with a view to strengthening research in order to achieve more accurate and relevant results.

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