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ARTICLE

Challenges and Perspectives of Formative Research in Times of Artificial Intelligence

Desafíos y Perspectivas de la Investigación Formativa en Tiempos de Inteligencia Artificial

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ABSTRACT

En las últimas dos décadas, la investigación formativa se ha consolidado como un proceso clave en la educación superior al integrar la enseñanza, la generación de conocimiento y el desarrollo de competencias investigativas en los estudiantes. En este contexto, el objetivo del presente estudio fue examinar el panorama actual, los principales desafíos y las perspectivas futuras de la investigación formativa en relación con el uso de la inteligencia artificial (IA). La investigación se desarrolló bajo el paradigma humanista, con método sistemático y enfoque cualitativo, diseño narrativo de tópico y de tipo documental informativo. Se analizaron 20 artículos científicos publicados entre 2020 y 2025 e indexados en Scopus, Web of Science y SciELO. El análisis permitió sistematizar los enfoques teóricos, metodológicos y éticos relacionados con la integración de la IA en los procesos educativos y de investigación. Los resultados evidencian que estas tecnologías fortalecen las habilidades investigativas, favorecen la personalización del aprendizaje y permiten el uso de la analítica educativa para el seguimiento del rendimiento académico. Sin embargo, también se identificaron desafíos asociados a la dependencia tecnológica, a los riesgos para la integridad académica y a la persistencia de brechas digitales. Asimismo, se observaron tensiones epistemológicas relacionadas con la autoría, la validez y la fiabilidad de los contenidos generados mediante algoritmos. En síntesis, la investigación formativa en la era de la IA constituye un campo emergente que requiere una integración pedagógica responsable, una alfabetización digital crítica y políticas institucionales orientadas a un uso ético de estas tecnologías.

KEYWORDS: Formative research, artificial intelligence, digital literacy, academic ethics, systematic review.

RESUMEN

Over the past two decades, formative research has become a key process in higher education, integrating teaching, knowledge generation, and the development of students' research skills. In this context, the objective of this study was to examine the current landscape, main challenges, and future prospects of formative research regarding the use of artificial intelligence (AI). The research was conducted within the humanistic paradigm, employing a systematic method and a qualitative approach, with a narrative topical design and an informative documentary style. Twenty scientific articles published between 2020 and 2025 and indexed in Scopus, Web of Science, and SciELO were analyzed. The analysis allowed for the systematization of the theoretical, methodological, and ethical approaches related to the integration of AI in educational and research processes. The results demonstrate that these technologies strengthen research skills, promote personalized learning, and enable the use of educational analytics for monitoring academic performance. However, challenges associated with technological dependence, risks to academic integrity, and the persistence of the digital divide were also identified. Epistemological tensions related to authorship, validity, and reliability of algorithmically generated content were also observed. In short, formative research in the age of AI is an emerging field that requires responsible pedagogical integration, critical digital literacy, and institutional policies that promote the ethical use of these technologies.

Over the past two decades, formative research has become a key process in higher education, integrating teaching, knowledge

PALABRAS CLAVE: Investigación formativa, inteligencia artificial, alfabetización digital, ética académica, revisión sistemática.

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Introduction

Formative research has positioned itself as an essential pedagogical strategy for students to develop, from the earliest academic cycles, skills to analyze, argue, search for information, and generate academic production, with the purpose of strengthening a permanent research culture in higher education. Various studies indicate that this methodology favors meaningful learning by articulating theory with research practice. In the current context of artificial intelligence (AI), the main risks are associated with cognitive dependence, the uncritical consumption of generated content, and difficulties in certifying authorship and academic integrity (Kasneci et al., 2023; Sullivan, 2023). However, the specialized literature agrees that AI can be incorporated as a tool that strengthens feedback, idea structuring, and students' formative support.

Consequently, over the past twenty years, formative research has evolved toward an educational approach that integrates teaching, knowledge production, and students' scientific training. In this scenario, AI is transforming the ways in which research is conducted, learning takes place, and knowledge is constructed (Martínez, 2025). The automation of mental processes, expanded access to information, and the use of machine learning tools are modifying academic practices and university research models (Zawacki-Richter et al., 2019). Nonetheless, this process also generates ethical and pedagogical tensions linked to the role of the researcher and the nature of scientific knowledge.

At present, formative research faces challenges derived from the rapid incorporation of artificial intelligence (AI) tools into the university sphere, which has generated tensions between their pedagogical use and their uncritical application. Several studies warn that the unreflective use of generative AI can foster technological dependence and weaken critical thinking (Kasneci et al., 2023; Sullivan, 2023). Likewise, limitations persist in teacher training and in the regulatory frameworks that govern its responsible use. Formative research seeks to strengthen scientific competencies and intellectual autonomy. Even so, technological gaps remain in Latin America (Unesco, 2023; Torres & Molina, 2023) and in Peru (MINEDU, 2024). AI must be conceived as a cognitive support that complements human judgment (Siemens, 2022; Luckin, 2023), considering the ethical risks associated with bias and scientific transparency (Cowls & Floridi, 2021). The pandemic accelerated educational digitalization.

Based on these considerations, the following research question arises: What is the current state? What are the challenges and future lines of formative research in the era of artificial intelligence? This question emerges from the changes that intelligent technologies are generating in teaching, learning, and knowledge production processes within the university context. To address it, the present study aims to examine the current landscape, the main challenges, and the future perspectives of formative research in relation to the use of artificial intelligence (AI).

Methodology

To respond to the proposed objective and analyze the lines of research related to artificial intelligence in research training, a study was developed within the humanist paradigm of an interpretive nature, which seeks to understand and analyze phenomena through the interpretation of existing knowledge in specific contexts (Hernández et al., 2014). The study was conducted through a systematic method, oriented toward the structured organization, review, and analysis of the available scientific literature, which made it possible to identify trends, approaches, and contributions in the field of study (Kitchenham, 2004). A qualitative approach was also adopted, focused on the interpretation and content analysis of the reviewed studies, in order to understand the theoretical and methodological contributions of the scientific literature (Hernández et al., 2014).

The research was structured through a topical narrative design, focused on the analysis of a specific theme within a field of knowledge, which made it possible to organize and synthesize existing contributions on the phenomenon under study. Finally, the study was developed as an informative documentary investigation, since it was based on the review, systematization, and interpretation of scientific articles published in specialized academic databases. This approach does not seek to collect direct empirical data, but rather to analyze how the

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scientific literature constructs meanings, interpretations, and debates around a given phenomenon, which allows processes to be explained from a contextualized and human perspective (Creswell & Poth, 2021).

The documentary population was formed, according to Hernández et al. (2014), by the set of studies that share common characteristics and whose results are intended to be analyzed. Based on this concept, the population of the present review consisted of 105 scientific articles extracted from high-impact databases, such as Scopus, Web of Science, and SciELO, which offer broad coverage and access to high-quality peer-reviewed studies. The selection of these sources was based on their reliability for disseminating scientific research on educational technology, research training, and academic ethics.

An integrative literature review was also conducted according to the PRISMA method, which made it possible to ensure traceability in the review process without limiting the study to a meta-analysis or to a formal assessment of risk of bias. The review was guided by the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) proposed by Page et al. (2021), which ensured transparency and methodological rigor in each phase of the process of identification, selection, and synthesis of the studies. This study was configured as an integrative literature review, aimed at synthesizing findings from previous research in order to identify trends, gaps, and future perspectives in the field of AI-mediated formative research.

According to Piza et al. (2019), technique refers to a specific procedure for collecting information in a study aimed at the systematic organization of concrete actions. In this research, the main technique was documentary analysis, through which relevant scientific texts were examined, selected, and reviewed.

The analytical procedure applied to these documents was based on thematic content analysis, which made it possible to identify categories, group the studies according to theoretical and methodological approaches, and interpret trends and gaps in the specialized literature. The unit of analysis was each scientific article selected for the review, considering variables such as author, year of publication, country of origin, type of study, techniques and methods used, as well as the main contributions related to artificial intelligence and formative Research (see Table 1).

Table 1

Inclusion and Exclusion Criteria.

Inclusion criteria	Exclusion criteria
Publications between 2020 and 2025	Documents outside the analysis interval
Documents related to formative research and artificial intelligence	Documents related to other topics
Language in Spanish and English	Languages other than Spanish and English
Publicly accessible resources	Documents with restricted access

Note. The criteria used to select the documents for the study are presented, considering only recent sources directly related to formative research and AI, in accessible languages and freely available, and excluding those that do not meet these conditions; own elaboration (2025).

The temporal search range covered the period between January 2020 and October 2025, with the purpose of including the most recent studies that show the transformations in university research derived from the emergence of generative AI. Publications in Spanish and English were considered, in response to the growing interest in the topic both in the Latin American context and in European and North American spheres. This temporal and linguistic framework made it possible to analyze the evolution of the academic debate around the ethical, methodological, and formative aspects of AI in contemporary higher Education (see Table 2).

Table 2

Search Equations.

Database	Search equations	Temporal interval of analysis
Scopus	("investigación formativa" OR "formación investigadora" OR "competencias investigativas") AND ("inteligencia artificial" OR "IA" OR "tecnologías emergentes") AND ("educación superior" OR	2020-2025

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	"universidad" OR "aprendizaje digital").	
WoS	("formative research" OR "research training" OR "research competencies") AND ("artificial intelligence" OR "AI" OR "emerging technologies") AND ("higher education" OR "university" OR "digital learning").	2020-2025

Note. The search equations used in Scopus and Web of Science to locate relevant studies on formative research and AI in higher education are shown, and the analysis period is delimited to 2020-2025; own elaboration (2025).

For the bibliographic search, keywords and Boolean operators were used, established according to the thematic structure of the research. The following combined search strings were used: in Spanish: ("investigación formativa" OR "formación investigadora" OR "competencias investigativas") AND ("inteligencia artificial" OR "IA" OR "tecnologías emergentes") AND ("educación superior" OR "universidad" OR "aprendizaje digital"). In English: ("formative research" OR "research training" OR "research competencies") AND ("artificial intelligence" OR "AI" OR "emerging technologies") AND ("higher education" OR "university" OR "digital learning").

In the first search, 105 potentially eligible publications were identified. After eliminating 20 duplicates, 85 articles remained for the initial review of titles and abstracts. At this stage, 65 documents were eliminated because they did not address formative research or because they addressed technical developments in AI without pedagogical applications. Finally, 20 studies were eligible and were reviewed in full. The inclusion criteria were: (a) articles published between 2020 and 2025; (b) peer-reviewed; (c) available in full text; and (d) explicitly related to the use or effect of AI in formative research or higher education. The exclusion criteria included: (a) documents prior to 2020; (b) exclusively technical or computational studies without an educational dimension; (c) publications without peer review; and (d) opinion literature or essays without verifiable empirical evidence.

For the systematization of information, a data extraction matrix was used, in which relevant aspects of each study were recorded: author, year, country, technique, method, and instruments used. Subsequently, through content analysis (Bengtsson, 2016), conceptual patterns, theoretical convergences, and knowledge gaps were identified in the reviewed literature. To ensure analytical consistency, the documents were reviewed comparatively, identifying units of meaning, recurring patterns, and conceptual convergences present in the analyzed studies. This process made it possible to reduce the information into interpretive categories that facilitated understanding of the phenomenon under study. This process resulted in the construction of three emerging categories of analysis:

- Derivation of AI-driven innovation in formative research.
- Epistemological and ethical challenges around the integration of AI in the truthfulness and reliability of research results.
- Future perception regarding the inclusive competence of AI in formative research.

The entire process of selection, exclusion, and synthesis of the reviewed articles was reflected in the PRISMA flow diagram, which specifies the phases of identification, screening, eligibility, and final selection of the documents. This methodological tool ensured traceability and transparency in the process, in coherence with the objectives of the review and the results shown. Specifically, the applicability of the PRISMA structure initially served to organize the content and then to analyze the particular topic of study; the results encompassed the previously described categories regarding the synergy of formative research in times of AI (see Figure 1).

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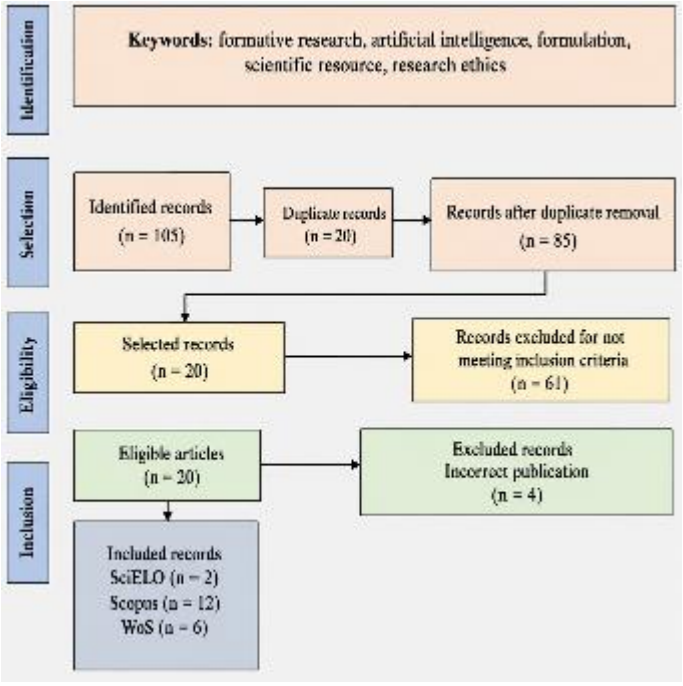
Figure 1
PRISMA Flow Diagram.



Note. The figure shows how the studies included in the review were identified, filtered, and selected, evidencing the refinement process from the initial records to the final articles analyzed in the Scopus, WoS, and SciELO databases; own elaboration (2025).

In general terms, the specialized literature has addressed formative research as a means to strengthen scientific skills, critical thinking, and the consolidation of ethical practices in higher education. Several studies indicate that these transformations are accompanied by changes in teaching. It has also been shown that AI-based technological solutions favor the organization of information, personalized learning, and the understanding of learning processes, provided that their use is grounded in a human and reflective perspective. The research methodology was aligned with current trends in the field, ensuring that the results obtained met criteria of scientific rigor, technological relevance, and contribution to the educational sphere.

In this sense, the study was based on the proposal of Villasis et al. (2020), according to which, in socioeducational studies, four phases of scientific rigor must be considered to meet the objective. These stages were specified as follows: 1) formulation of objectives and guiding questions about what is intended to be investigated; 2) collection of information sources after the search; 3) determination of inclusion and exclusion criteria; 4) categorization of perspectives and challenges; and 5) preparation of a data matrix. Together, these stages made scientific rigor possible through blind peer review of databases.

Finally, the research was conducted in accordance with the ethical principles of scientific research, such as academic honesty, responsibility, and respect for intellectual property. The consulted sources were used exclusively for academic purposes and were properly cited, which guaranteed the transparency of the process and the fidelity of the information analyzed.

Results

A total of 105 scientific articles on the synergy between formative research and AI were reviewed. Following the PRISMA guidelines, 20 studies were selected for review and systematization. To this end, variables such as authorship, year, country of origin, methodological design, and type of study were examined, with the purpose of identifying common approaches and solutions. According to this methodology, the study was developed from two complementary schemes. Based on the analysis of the selected studies, the results were organized into three emerging categories previously defined in the methodological process: (1) innovation driven by artificial intelligence in formative research, (2) epistemological and ethical challenges associated with the use of AI in scientific production, and (3) future perspectives on the inclusive integration of these technologies into research training processes.

In the first scheme, a synthesis matrix was constructed to compile the main theoretical-methodological and empirical contributions of the reviewed articles, which made it possible to show that AI constitutes an emerging tool that strengthens research training and consolidates students' scientific skills. In the second scheme, the data were analyzed through descriptive statistical analysis, which made it possible to identify a growing trend in scientific production between 2020 and 2025, with special emphasis on studies from Latin America and Europe. The results were organized around AI and formative research, highlighting the comparative analysis of pedagogical innovation. Likewise, the examined

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studies emphasized the ethics and humanity of research in automated technologies, underlining that research training must be oriented toward strengthening critical thinking, intellectual autonomy, and academic responsibility.

Finally, it was confirmed that AI, when applied with a pedagogical approach, can contribute to a more innovative, inclusive, and sustainable university education. The systematized consequences are presented in Table 3, which displays the main thematic categories and the studies that support them. To systematize the selected studies and facilitate the comparative analysis of their methodological and contextual characteristics, a synthesis matrix was prepared to summarize the main elements of each reviewed investigation (see Table 3).

Table 3

Synthesis Matrix.

No.	Author	Type of study	Technique, method, instrument	Year	Country
1	Zawacki-Richter et al.	Qualitative/applied	PRISMA systematic review	2020	Germany
2	Holmes et al.	Qualitative/theoretical	Documentary analysis	2022	United Kingdom
3	Dwivedi et al.	Qualitative/theoretical	Documentary analysis	2021	United Kingdom
4	Gallent et al.	Qualitative/theoretical	Documentary review	2023	Spain
5	Slimi & Villarejo.	Qualitative/analytical	Interpretive analysis	2023	India
6	Khalil et al.	Qualitative/exploratory	Exploratory review	2023	Norway
7	Yim	Qualitative/exploratory	Exploratory review	2024	United Kingdom
8	Mogboh	Qualitative/comparative	Case analysis	2025	Nigeria
9	Arévalo	Qualitative/documentary	Documentary analysis	2024	Spain
10	Alastor & Martínez-García	Qualitative/descriptive	Documentary review	2025	Spain
11	Vásquez	Qualitative/applied	Content analysis	2025	USA
12	González-Campos et al.	Qualitative/theoretical	Documentary review	2024	Chile
13	Aguirre-Aguilar et al.	Quantitative/descriptive	Survey and descriptive analysis	2024	Mexico
14	Espinoza Vidaurre et al.	Quantitative/applied	Interviews	2025	Peru
15	Torres-Gómez	Quantitative/descriptive	Likert-type questionnaire	2024	Mexico
16	Airaj	Qualitative/applied	Interpretive analysis	2024	India
17	Calderón Bogota	Qualitative/analytical	Documentary analysis	2025	Colombia
18	Aparicio-Gómez et al.	Qualitative/theoretical	Documentary analysis	2023	Colombia
19	UNESCO.	Documentary/normative	Policy review	2023	Switzerland
20	Cachay Chonlon & Gonzales Soto	Qualitative/applied	PRISMA systematic review	2024	Peru

Note. The table summarizes the reviewed studies in an organized manner, showing who investigated the topic, how they approached it, what techniques they used, and from which countries the knowledge was generated, which makes it possible to visualize the diversity of approaches and contexts that support the research; own elaboration (2025).

The information presented in Table 3 made it possible to identify a first structural finding: the studies tend to use convergent qualitative methodologies, with a predominance of documentary reviews, interpretive analyses, and exploratory approaches. This methodological architecture shows that research on AI applied to education is mostly situated in theoretical-constructive and analytical phases, with little presence of verifiable experimental designs. In proportional terms, more than half of the reviewed studies use qualitative or documentary approaches, which evidences a field trend toward interpretive analysis and theoretical reflection on the impact of artificial intelligence on formative processes.

Likewise, a concentration of studies oriented toward understanding formative processes, pedagogical mediations, and ethical dimensions was observed, which makes it possible to infer that the field prioritizes understanding the educational impacts of AI over measuring quantifiable results. Cross-sectionally, the matrix revealed notable diversity in thematic approaches, research competencies, academic ethics, and cognitive mediation, as well as marked contextual heterogeneity among the countries of origin, revealing a global interest still characterized by fragmented and scarcely standardized approaches (see Figure 2).

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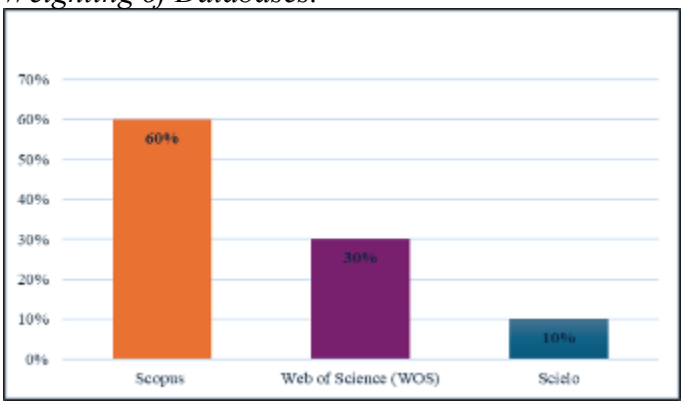
Figure 2

Weighting of Databases.



Note. The systematic analysis shows that the predominant database was Scopus, with 60% (12) of the scientific resources analyzed in the synthesis matrix. Meanwhile, 30% (6) corresponded to resources extracted from WoS; finally, 10% (2) corresponded to SciELO; own elaboration (2025).

For its part, Figure 2 shows that influential scientific production on the topic is concentrated in Scopus, which constitutes a relevant finding regarding the centralization of the academic debate in high-impact editorial circuits. This distribution not only reflects where publication occurs most frequently, but also indicates that the scientific discussion on AI in formative research is mediated by academic communities that operate under international indexing standards, which may condition the theoretical, methodological, and ethical approaches legitimized as references in the field.

Figure 3

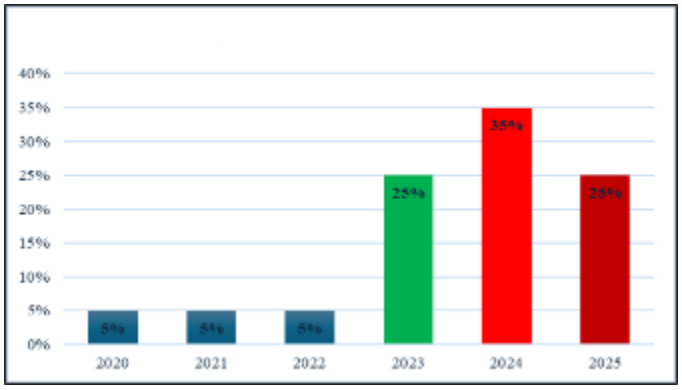
Resources Published by Year.

Note. The most significant weighting of published resources was observed in 2024, with 35% (7); for 2023 and 2025, the number of publications remained constant at 25% (5); finally, for 2020, 2021, and 2022, the publication level remained constant at 5% (1); own elaboration (2025).

Figure 3 shows an ascending temporal dynamic, with a notable increase in publications beginning in 2023 and reaching its peak in 2024. This behavior constitutes an empirical finding that shows that research on AI and formative research represents an emerging field in expansion, directly linked to the rise of generative AI in educational environments. The temporal pattern makes it possible to recognize that scientific interest is not stable, but rather reactive to recent technological transformations, which explains the rapid proliferation of studies aimed at understanding its pedagogical, ethical, and methodological implications.

Figure 4

Countries with Published Resources.



Note. It is evident that countries such as Spain and the United Kingdom presented the highest weighting of analyzed resources, at 15% (3); meanwhile, countries such as India, Colombia, Peru, and Mexico consolidated a weighting of 10% (2); finally, countries such as Nigeria, Norway, Germany, Switzerland, Chile, and the United States established the lowest percentages of resources, at 5% (1); own elaboration (2025).

Figure 4 reveals that scientific production is concentrated mainly in Spain and the United Kingdom, followed by Latin American countries such as Mexico, Peru, and Colombia. This finding makes it possible to identify a geographical configuration of knowledge, in which Europe leads conceptual production and Latin America participates actively from contextual, normative, and applied perspectives. The distribution suggests that, although the phenomenon is global, there are regional asymmetries in the generation of evidence, which

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constitutes a potential gap for future research in regions with less scientific representation.

The results show that formative research in the context of AI is configured as an emerging field characterized by growing scientific production, a predominance of qualitative approaches, and a geographical concentration of knowledge, which makes it possible to recognize clear patterns of pedagogical innovation, epistemological tensions, and inclusive projections. These findings establish an empirical basis that guides the subsequent critical analysis, from which the theoretical, ethical, and formative implications that these results entail for contemporary higher education will be examined. Together, these results make it possible to understand the current configuration of the field of study and provide an empirical basis for the critical analysis developed in the discussion section, where the theoretical, ethical, and pedagogical implications derived from the findings are examined.

Discussion

The results of this review make it possible to affirm that formative research in the era of artificial intelligence is configured as an emerging field characterized by three main dimensions: recent growth in scientific production, the presence of pedagogical and ethical challenges associated with the use of intelligent technologies, and the need to develop formative and regulatory frameworks that guide their responsible integration into higher education.

Regarding the first question, related to the main limitations for the development of formative research in times of AI, most of the reviewed studies point to structural, pedagogical, and ethical barriers. Mirazchiyski (2025) identified a methodological gap between technical knowledge in AI and its application in formative processes, and warned about the risk of technological dependence and the loss of academic originality. These statements coincide with the results obtained in the present review, in which it was identified that the main limitations are not reduced to technological access, but are also related to pedagogical, ethical, and formative factors that condition the integration of AI into university research processes.

Another group of studies highlights the epistemological and normative limitations associated with the integration of AI into teaching and research processes. Torres & Molina (2023) pointed out that the gap between digital infrastructure and the pedagogical adoption of technological innovation limits the consolidation of coherent formative models. These findings agree that current restrictions are not only technological, but also cognitive and moral, which evidences the need for critical digital literacy to transform education.

In relation to the second question, linked to the main strengths identified, the reviewed studies agree that AI provides significant benefits to formative research. In addition, Yim (2024) showed that AI literacy strengthens autonomy, critical thinking, and pedagogical innovation. Another relevant strength lies in AI's capacity to personalize learning and inquiry processes according to each student's needs. In this regard, Holmes et al. (2022) demonstrated that intelligent tutoring algorithms adjust research training to the pace and learning style of students and faculty, which favors academic self-regulation and timely feedback in formative processes.

Regarding the third question, referring to the main theoretical and practical challenges, the studies agree that the first challenge lies in adjusting AI to ethical, critical, and sustainable training in research. As Aparicio et al. (2023) indicate, the automation of content analysis requires human interpretation to guarantee its scientific character. In this sense, Floridi & Cowls (2021) propose the notion of value-centered AI, which can be understood as an integrative pedagogical model that expands human capacities without replacing scientific reasoning. At the institutional level, UNESCO (2023) and the Ministry of Education of Peru (MINEDU, 2024) propose the need to establish public policies aimed at regulating the ethical use of AI and its responsible integration into research training.

Formative research faces additional challenges related to the validation of knowledge, support for automated systems for text generation, data inspection, and academic feedback. For Zawacki-Richter et al. (2019), the integration of AI into teaching, learning, and research in higher education makes it possible to free cognitive and analytical skills. However, this progress must be conceived

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from a balanced perspective, in which formative learning environments incorporate AI as a support tool and not as a substitute for critical thinking and epistemological reflection.

Furthermore, Holmes et al. (2022) point out that AI is both an opportunity and a threat to educational processes, since it implies changing teaching practices and preparation for inquiry. University teachers, as mediators of formative research, are connectors between technology and pedagogy for autonomous and responsible learning. Mogboh (2025) warns that technological innovation must be balanced with personalized educational management, and that automation should not be allowed to displace humanity in learning. Therefore, formative programs must develop ethical, reflective, and methodological skills so that students can use AI as a tool and not as a substitute for critical thinking.

From an epistemological perspective, the integration of AI into formative research requires an ethical, critical, and regulated framework that preserves authorship and academic integrity. Holmes et al. (2022) maintain that AI represents, depending on the pedagogical criteria that guide its use, both an opportunity and a risk for educational processes. Along the same lines, Gallent et al. (2023) and Arévalo (2024) warn that generative AI introduces uncertainties around originality and scientific honesty, which obliges universities to establish clear institutional policies for its implementation. From the area of public policy, Slimi & Carballido (2023) and Millán-Gómez & Mujica-Sequera (2023) agree that the absence of comprehensive regulatory frameworks limits the ethical, equitable, and responsible adoption of these technologies in higher education. In the Peruvian context, Espinoza Vidaurre et al. (2025) emphasize the need to strengthen continuous training, teacher supervision, and critical awareness of the limits of automation in knowledge creation.

It should be noted that one of the main limitations of this work lies in the predominantly qualitative and documentary nature of the analyzed corpus, which makes it difficult to establish causal relationships or measure direct empirical effects on the development of research competencies. Nevertheless, this approach allowed for a deep understanding of the theoretical, ethical, and formative trends associated with the use of AI. Likewise, the review focused on publications indexed in Scopus, Web of Science, and SciELO, which may have excluded relevant studies of local or institutional scope, especially those developed in Latin American contexts with less editorial visibility.

Finally, the analysis period, between 2020 and 2025, prevented the longitudinal observation of the long-term effects of AI integration in formative research, since this is a phenomenon still in the process of consolidation and progressive application.

Based on these results, future research may use longitudinal and quasi-experimental designs to examine more precisely the impact of AI on the development of research competencies. It is also suggested that the effects of these technologies on teacher training and university institutions be analyzed in greater depth. Likewise, it is pertinent to strengthen digital infrastructure and technological governance models, in order to guarantee replicable and scalable experiences in diverse educational contexts. In sum, there is a need to develop pedagogical models of digital literacy, academic ethics, and technological mediation that strengthen a more just, reflective, and socially responsible formative research.

Conclusions

The research was significant because it made it possible to understand, from an updated and comprehensive perspective, how AI transforms formative research in higher education. In particular, the study made it possible to identify the current state, the main challenges, and the future perspectives of formative research in the context of AI. In this context, AI is configured as a relevant support in learning processes, knowledge creation, and the strengthening of ethics in scientific research. By organizing the most recent empirical evidence, positive and emerging impacts were identified that guide pedagogical innovation. In this way, the study provides criteria for the formulation of institutional, educational, and curricular policies that integrate AI without compromising critical thinking, authorship, or academic integrity.

The results show that the future of formative research will depend on the capacity of universities to integrate AI through personalized, inclusive

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pedagogies oriented toward critical thinking. Likewise, it is confirmed that these technologies enhance learning processes and strengthen scientific skills when their use is supported by digital literacy programs, institutional ethical frameworks, and ongoing teacher support. In this sense, the incorporation of inclusive pedagogical models is essential to guarantee that AI does not replace scientific reasoning, but instead contributes to its strengthening in the training of future researchers.

Finally, future research may explore, through longitudinal designs, the real impact of AI on inquiry skills, critical thinking, and academic integrity. In addition, comparative analyses in diverse institutional contexts are recommended to identify replicable and sustainable models. Similarly, the need is raised to develop ad hoc instruments to evaluate the mediation of AI in formative research, as well as to consolidate a scientific agenda oriented toward the ethical, critical, and inclusive use of intelligent technologies in university education.

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Ethics Statement

This study did not require approval from an institutional ethics committee, since it was based exclusively on the review and analysis of scientific literature available in public sources, without involving human participants or identifiable personal data.

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