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Innovative Approaches In Artificial Intelligence In University Teacher Education: A Systematic Review

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Currently, the use of artificial intelligence in university teaching has emerged as an issue of utmost importance and is transforming the way education is approached in academic environments. The objective of the present systematic review study was to identify current approaches in teacher training for the integration of artificial intelligence (AI) in university teaching. Best practices, impacts and strategies in this area were examined and identified, highlighting the importance of implementing effective organizational models that support the training of university teachers in various virtual environments. Within the methodological scope, the study was of the documentary type of theoretical and bibliographic review. Likewise, the PRISMA methodology was used, which is based on structured guidelines for conducting systematic reviews and meta-analyses. The information search process was between the months of January and June 2024, considering those studies carried out between 2019 and 2024. The detailed search for scientific articles was carried out in institutional repositories, specialized journals, as well as in scientific databases. such as Scopus, Web of Science and ScienceDirect. The importance of strengthening and integrating pedagogical knowledge with educational practices is highlighted, as well as the application and implementation of inclusive strategies in the training of university teachers in artificial intelligence. These results indicate that the need for new research is urgently required to improve the quality of university teaching and promote diversity and inclusion in university teaching. It is suggested to explore and investigate how these various practices can be applied effectively in future research so that the training of university teachers in artificial intelligence can be strengthened and the teaching-learning process can be enriched. Finally, ethics and integrity in the

use of artificial intelligence in the teaching-learning process must be encouraged and promoted among university teachers and students.

KEYWORDS Teacher training, university teaching, artificial intelligence, educational technology, educational strategies, systematic review.

INTRODUCTION

Artificial intelligence, in recent decades and especially in recent years, has developed in an impressive way, managing to have a significant impact and integration in almost all aspects of life, including education. The university has not been the exception and artificial intelligence has been integrated in an innovative way, even changing the way in which students acquire knowledge and interact with the thematic content of their subjects. Faced with this situation, the training of university professors in the use of the tools provided by artificial intelligence has become a crucial component to improve the quality of education and prepare them to face the new challenges of the digital age. "The integration of AI in higher education offers a wide range of opportunities to improve teaching and learning, as well as to optimize institutional management." On the other hand, it is mentioned that.(Vera, 2023, pág. 18)

> The great challenge of the university of the new millennium lies in the urgent need to plan, design, develop and implement digital skills in order to train better professionals capable of understanding and developing the technological environment according to their needs, as well as to implement the universalization of a digital language supported by programs developed under artificial intelligence formats. (Ocaña-Fernandez, Valenzuela-Fernandez, & Garro-Aburto, 2019, pág. 537)

It is important to note that the COVID-19 pandemic experienced in 2020 accelerated the adoption of innovative educational technologies. Similarly, it is highlighted that web 2.0 has been a fundamental tool for university teaching during the pandemic. In this context, it is important to highlight that it is essential to understand and analyze the current approaches that integrate AI in university teacher training.(Revelo-Rosero, Yaguana-Campos, Cadena-Heredia, & Andrade-Erazo, 2023)

Research in recent years on the integration of artificial intelligence in teacher training has expanded significantly, making a significant contribution to current knowledge. For example, he developed a systematic review article on the use of artificial intelligence in university education, examining previous research and scientific data. This study provides an overview of how artificial intelligence has been used in university education, thus contributing to current knowledge and offering valuable insights on current approaches in teacher training for the integration of this technology. On the other hand, due to the evolution of technology, new didactic tools have been developed to strengthen education, among these we have intelligent tutoring systems (ITS), which are designed to strengthen learning inside and outside the classroom. It is highlighted that ITS uses artificial intelligence techniques to represent knowledge and thus propose/direct a teaching prepared to behave as an expert capable of making a situational diagnosis of the student and, in relation to this, offering a solution or action.(Tinoco Plasencia, 2023)(Rodriguez Chavez, 2021)(Rodriguez Chavez, 2021)

In another study, the findings highlight the critical importance of providing training and professional development to university teachers in the field of artificial intelligence. A lack of understanding and knowledge among educators has been identified as an obstacle to the successful integration of this technology. Another research highlights the process of adaptation to virtuality during the COVID-19 health emergency of university teachers in Peru, which offers new perspectives on teacher training in technological environments, the use of ICTs and its relevance for the incorporation of artificial intelligence in university teaching. Likewise, another study has explored the use of artificial intelligence in the teaching of law at the university level during the 2020 pandemic, in this study it is concluded that the incorporation of artificial intelligence in the training process of law students is feasible because it prioritizes digital literacy. (Bellettini Vela, Mora Naranjo, Rios Quinte, Egas Villafuerte, & Lopez Velasco, 2024)(Vargas Salazar, Motta Flores, & Cortez Cortez de Uceda, 2022)(Quezada Castro, Castro Arellano, & Quezada Castro, 2022)

These studies reflect the recent advances in the integration of artificial intelligence in university teacher training, providing important and valuable insights to identify current approaches in teacher training to face technological challenges in the educational field.

Despite the research carried out in recent years, there are still significant gaps in the current literature that justify the need to identify current approaches in teacher training for the integration of artificial intelligence in university teaching. examine the new opportunities and challenges offered by tools like ChatGPT for education, highlighting its ability to improve interaction and personalization of learning experiences. The use of large language models such as Chat GPT in education is a promising area of research that offers many opportunities to improve the learning experience for students and support the work of teachers, however, it is important to approach the use of these models with caution and critically evaluate their limitations and possible risks. Another study highlights the importance of understanding the ethical and pedagogical issues related to the use of artificial intelligence in education and underlines the importance of addressing these issues in teacher education. On the other hand, the proposal of an integrated model that predicts the acceptance by students of robot teachers based on artificial intelligence was investigated, identifying key determinants such as: anxiety about the use of the robot, perceived usefulness, perceived ease of use and the difficulty of the robot's instructional task. (Kasneci et al., 2023) (Kasneci et al., 2023)(Sancho Gil & Giro Gracia, 2022)(Chen et al., 2023)

Other research reveals the paucity of research that takes an in-depth look at how university faculty have adopted their teaching practices to incorporate artificial intelligence into university education, taking into account the changing needs of students and emerging technological challenges. A recent article concludes that there is a scarcity of research that analyzes the relationship between the competencies that university professors have and the integration of artificial intelligence in university teaching, which in some way justifies the need to investigate how the knowledge, attitudes, openness and skills of teachers directly influence the implementation of artificial intelligence in the university classroom.(Le et al., 2022)(Fassbender, 2024)

These thematic gaps clearly show the urgent need to develop research that comprehensively addresses the education and training of university teachers in artificial intelligence issues so that they can be effectively integrated into higher education.

The objective of this theoretical review article is to identify current approaches in teacher training for the integration of artificial intelligence AI in university teaching. It is worth mentioning that this objective clearly reflects the intention to fill the thematic gaps and advance in the knowledge of the field, providing a more complete vision of the current approaches that are being developed in teacher training on AI topics and thus be able to integrate them into the university classrooms.

METHOD

This article corresponds to a documentary research (systematic review) which was carried out following the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to ensure quality and transparency during the systematic review process related to current approaches to teacher training in artificial intelligence in university teaching. The PRISMA 2020 statement was primarily designed to assess SR (systematic reviews) of studies evaluating the effects of health interventions, regardless of the design of the included studies. However, it is applicable to SR reports that evaluate other types of interventions (such as social or educational), and many of its items are applicable to SR that have different objectives than those of the evaluation of interventions (such as etiological, prevalence, or prognosis).(Ciapponi, 2021)

The information search process was carried out between the months of January and June 2024 in different scientific databases, in this search period those studies carried out between 2019 and 2024 were considered, taking into account the great advance of artificial intelligence, especially in recent years. For the systematic review, the following research questions relevant to our study were raised:

1. What are the current approaches in university teacher training for the integration of artificial intelligence in university classrooms?
2. What artificial intelligence training strategies have been implemented in university teacher training?
3. What is the impact of teacher training in artificial intelligence on the quality of university teaching?
4. What are the necessary competencies that university professors need in the use of artificial intelligence in the classroom?
5. What recommendations emerge from the literature to improve teacher training in artificial intelligence in higher education?

To identify relevant studies, keywords such as: teacher training, artificial intelligence, current approaches, university teaching, integration, among others, were used in the search strategies. The detailed search for scientific articles was carried out in institutional repositories, journals specialized in technology and education, as well as in academic databases such as: Scopus, Web of Science and ScienceDirect. The connectors "AND" and "OR" were used in the search process to select the relevant articles for the study.

To ensure the quality and relevance of the studies included in the systematic review, certain exclusion criteria were established. Studies that did not meet the appropriate methodological quality standards for systematic review, those that were not available in full text, and those that were not directly related to teacher training in artificial intelligence or were not relevant to university teaching were excluded.

RESULTS AND DISCUSSION

Taking into consideration the prism methodology and taking into account the research questions posed in the previous section, the following findings were found:

Answering the first question: What are the current approaches in university teacher training for the integration of artificial intelligence in university classrooms? The following works were analyzed, a first study highlights the use of intelligent tutoring systems (ITS) based on artificial intelligence, highlighting their potential to improve the teaching-learning process. The objective of the work is the analysis of the use and characteristics of intelligent tutoring systems as computer-assisted teaching programs, which use artificial intelligence techniques for the representation of knowledge and thus propose/direct a teaching prepared to behave as an expert capable of making a situational diagnosis of the student and, in relation to this, offer a solution or action. Similarly, another study proposes that university teachers have a digital training that can strengthen the teaching and learning process, for this, this study was based on the validation of an instrument that allows diagnosing the educational use of information and communication technologies (ICT) by university teachers: this was based on the model of digital competence of university teachers in the twenty-first century. A third research analyzed the incorporation of artificial intelligence in the teaching of law during the COVID-19 pandemic, applying an instrument to 15 professors of the profession lawyers who work as professors in different Peruvian universities. In this research it is concluded that the incorporation of artificial intelligence in the training process of law students is feasible because it will prioritize literacy and digital literacy and that its incorporation could contribute to the reduction of the digital divide for the benefit of the university student population, this being a concrete action to obtain results in the short term. It is also mentioned that artificial intelligence will not replace the lawyer who exercises the role of teacher, on the contrary, it represents the complement that the role of online tutor could play throughout the training of the law student, therefore, it needs to be programmed through algorithms for this purpose. On the other hand, an article concludes that artificial intelligence can be applied very strongly in education to design new study programs. To this end, there is an AI software (ChatGPT) that searches the internet for content that can be designed by virtual tutors that greatly facilitate the work of university teachers, because they are programmed to grade questionnaires, identify the most common mistakes of students and even offer them real-time feedback on their performance. (Rodríguez Chávez, 2021) (Banquez et al., 2021)(Quezada Castro, Castro Arellano, & Quezada Castro, 2022) (Quezada Castro, Castro Arellano, & Quezada Castro, 2022)(Lopez Pumayali, 2023)

In relation to the second question: What artificial intelligence training strategies have been implemented in university teacher training? The bibliographic references mention the following: a research paper analyzes the perception of students in the use of generative artificial intelligence in the classroom with the aim of improving learning. In conclusion, the study highlights the potential of generative artificial intelligence as a promising tool in the learning of high school students. Likewise, the working hypothesis is accepted, that is, "the implementation of generative artificial intelligence in the learning process allows high school students to develop creative and critical thinking skills more effectively than traditional teaching methods". Another study highlights that the implementation of pedagogical strategies

such as the flipped classroom (IA) and collaborative learning (CA) have contributed to the teaching of computer programming. In this sense, this article allows "to identify the current state of technologies and tools based on active and collaborative learning, and how they have supported the learning of programming, and the contributions that artificial intelligence has generated in this process". As a conclusion, it is mentioned that several training strategies were identified for university teachers in artificial intelligence, highlighting the use of collaborative learning and the use of the flipped classroom for programming learning. On the other hand, a research reflects on artificial intelligence and its role in higher education, with an approach to the challenges it faces and the opportunities it poses, from a documentary and field point of view. Among its recommendations, it is highlighted that educational institutions should design teacher training programs, which allow them to identify the products obtained by AI and, at the same time, help them with strategies and methods that enable them to properly implement the use of these tools in the classroom. (Alpízar Garrido & Matinez Ruis, 2024, p. 20) (Hidalgo Suarez, Llanos Mosquera, & Bucheli Guerrero, 2021, pág. 196)(Zamora Varela & Mendoza Encinas, 2023)(Zamora Varela & Mendoza Encinas, 2023)

Taking as a reference the third question: What is the impact of teacher training in artificial intelligence on the quality of university teaching?, a study found that "AI can not only help teachers and students to create courses customized to their needs, but can also provide feedback to both on the success of the course as a whole". This study also concludes that:(Ordoñez et al., 2024, pág. 190)

> It is well known the multiple functions that can help the teacher when using the different applications according to their objectives through artificial intelligence, virtual assistants can help the teacher to prepare a class, to organize grades, to correct exams, assignments, among others, that is, to lighten the administrative process of the teacher, understanding that no technology can replace the human being in key functions, only a support to make the human better and more productive. (Ordoñez et al., 2024, pág. 190)

Similarly, other research showed that AI can be used effectively to enhance the personalization of learning, faculty support, assessment, student retention, and decision-making in institutional academic management. In conclusion, the introduction of AI in higher education presents significant opportunities to improve the teaching-learning process. Despite these benefits, the implementation of AI faces critical challenges, such as safeguarding data privacy, equity in technological access, and the need for training on digital ethics. Effectively addressing these challenges is essential to ensure a responsible and beneficial integration of AI into education. Likewise, another research analyzes the inclusion of artificial intelligence in university teaching from the perspective of management in higher education. It is concluded that the incorporation of artificial intelligence in higher education offers a transformative potential to improve the quality and efficiency of teaching and learning. However, it is essential that this integration is carried out ethically and considering data privacy, under this perspective, the need for teachers and students to continuously prepare themselves not only to use this technology but also to develop optimal alternatives that guarantee educational quality and the preservation of human heritage is also recognized.(Ayala Ala, 2024)(Vera et al., 2023)

Considering the fourth question: What are the necessary competencies that university professors need in the use of artificial intelligence in classrooms?, some articles were

reviewed. In an applied research, the competencies and skills that a university professor must have to use AI in their classes were analyzed, its conclusions were that they must develop the following: digital literacy, creativity to generate new ideas, adaptability since change is inevitable, critical thinking, leadership to motivate, inspire and support a work team, assertive, efficient and effective communication and emotional intelligence to understand and manage their own emotions and those of others. On the other hand, another study concludes that in today's knowledge and information society, technologies prevail in our lives, constantly being updated.(Lopez et al., 2023)

> It is necessary for teachers to be able to master digital environments, be able to manage information correctly, as well as continue training, so training in relation to virtual environments must be promoted, either face-to-face or remotely, with this teaching practice will be improved, thus increasing the mastery of new technologies and maintaining a positive stance towards the use of ICT in university teaching work. (Salazar Farfan, 2022, pág. 100)

Finally, in response to the last question: What recommendations emerge from the literature to improve teacher training in artificial intelligence in higher education?, the following tips or contributions made in some research works are highlighted. It is important to note that the integration of artificial intelligence in the learning-teaching processes must be carried out ethically and responsibly, taking into account aspects such as the privacy and security of the student and always complementing the interaction and teaching support in the educational process. In another context, a publication indicates the following recommendations, at the micro level it should be encouraged to find ways to link the learning outcomes of the courses with the skills necessary for the ethical use of generative AI, which align not only with institutional guidelines, but also with the corresponding accreditation requirements by examining recommendations for the Use of Generative Artificial Intelligence with Integrity from a Lens of Teaching and Learning, at the meso level it is suggested that generative AI literacy, ethics and other basic skills such as self-efficacy and critical thinking should be included in programs and courses, at the macro level the recommendations involve intentional institutional efforts focusing on the training of those responsible for investigating cases of academic misconduct and the search to better communicate the trends associated with academic integrity failures. Similarly, another study advises that universities should be able to train professionals who incorporate the use of emerging technologies into their work strategies, in a collaborative, responsible, reflective and critical way, with a projective vision in the face of their rapid evolution, without being marginalized.(Vera, 2023)(Moya & Eaton, 2023)(Velez et al., 2024)

Table 1 presents the 14 publications that met the requirements set out in the method:

Table 1 List of publications

TITLE	MAGAZINE	AUTHOR	YEAR

Smart Tutoring Systems and Their Application in Higher Education	Ibero-American Journal for Educational Research and Development	Rodriguez Chavez	2021
The teacher in the 4.0 era: a digital training proposal that strengthens the teaching and learning process	Universidad Católica del Norte Virtual Magazine	Banquez et al.	2021
Artificial intelligence and the teaching of law: its incorporation during the Covid-19 pandemic	Venezuelan Journal of Management	Quezada Castro, Castro Arellano, & Quezada Castro	2022
Perspective of high school students regarding the use of generative artificial intelligence in their learning	Ibero-American Journal for Educational Research and Development	Alpizas Garrido, Luis Octavio, Martinez Ruiz, Héctor	2024
A systematic review of flipped classroom and collaborative learning supported by artificial intelligence for programming learning	Tecnura	Hidalgo Suarez Carlos Giovanny, Llanos Mosquera Jose Miguel, Bucheli Guerrero, Victor Andres	2021
Artificial intelligence and the future of education, challenges and opportunities	Pedagogical horizons	Zamora Varela Yessika, Mendoza Encinas Maria del Carmen	2023
Impact of artificial intelligence on teacher training for higher education	Reciamuc	Ordeñez Garcia Santiago, Padilla Romero Lorena, Buenaño barrionuevo, Llaquelina, Herrera Valdivieso María	2024
Impact of Artificial Intelligence on the transformation of Higher Education	Ciencia Latina Multidisciplinary Scientific Journal	Ayala Ala, Aldo Rubén	2024

Artificial intelligence in higher education: a transformative approach	Knowledge pole	Vera Rubio, Patricia Elizabeth, Bonilla Gonzales, Gladys Patricia, Quishpe Salcan, Aída Cecilia, Campos Yedra, Hugo Marcelo	2023
Teaching Competencies in Higher Education, for the Use of Artificial Intelligence in Plural Societies	Public agenda and human rights for a plural and inclusive society	López Águila Genaro R. , Lara Andrade Ma. Verónica, Cruz Gómez Marco Antonio, Flores Gonzales Sergio	2023
Digital Competencies in University Teaching	Latin American Journal OGMIOS	Salazar Farfán María del Rosario	2022
Integrating Artificial Intelligence in Higher Education: Challenges and Opportunities	Transform e-magazine	Vera Fernando	2023
Examining Recommendations for Using Generative AI with Integrity from a Teaching and Learning Lens	Relief: Electronic Journal of Educational Research and Evaluation	Moya Beatriz, Eaton Sarah Elaine	2023
Use of artificial intelligence in higher education and its ethical implications. Systematic Literature Mapping	Scientific Journal of Education and Communication	Velez Rivera Rocío, Muñoz Alvarez Diana, Leal Orellana Priscila, Ruiz Garrido Alejandra	2024

Several relevant bibliographic sources have been found in this systematic review study on the current approaches in teacher training in artificial intelligence in higher education, these sources provide important information on the various strategies that are being

implemented in university teaching and how they affect the educational performance of teachers and students.

When comparing the articles analyzed, a common approach can be identified that highlights the importance of artificial intelligence training for university teachers to improve quality in higher education, these studies highlight the need to integrate teacher training to the demands of the digital age and articulate AI effectively in educational processes.

An important limitation of this systematic review study is the temporal restriction of the scientific articles that were included, which were limited to the last five years, this may have eliminated previous relevant and relevant research that could have provided very useful data on the training of university teachers in artificial intelligence. In addition, the selection of research papers could have been influenced by the availability of and access to certain databases, which in the end may have biased the results of the systematic review.

CONCLUSIONS

In this systematic review article on innovative approaches in teacher education for the integration of artificial intelligence in university higher education, substantial results have been identified that highlight the importance of university professors updating and training in the use of modern and emerging technologies. According to the studies reviewed and analyzed, teacher training in artificial intelligence is essential to improve their professional skills, optimize the quality of the teaching-learning process and adapt to current educational demands.

The present research is framed in the type of theoretical review studies. The information available in the main scientific databases on current approaches in teacher training in artificial intelligence in university education has been collected, analyzed and systematized.

The findings of this systematic review highlight the different types of training that are being carried out by university professors in artificial intelligence to be used in the teaching-learning process, in addition to this, the need to continue researching and improving the training of teachers in artificial intelligence is highlighted since technological progress occurs rapidly. It also recommends future research related to how artificial intelligence can improve the personalization of learning and the quality of education at the university.

The importance of encouraging and promoting ethics and integrity in the use of artificial intelligence in the teaching-learning process among university teachers and students is emphasized. The design and implementation of tools that use AI must be based on ethical values and principles to ensure a safe, respectful, and responsible environment. Future research should prioritize these fundamental and all-important considerations in today's digital context.

As a final conclusion, it is mentioned that teacher training in artificial intelligence applied to university teaching is a field of constant change and evolution that requires continuous attention and an interdisciplinary approach to make the most of the various opportunities and challenges offered by technological progress.

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