

The use of artificial intelligence and its impact on the learning of university students: a review of the literature

El uso de la inteligencia artificial y su impacto en el aprendizaje de los estudiantes universitarios: una revisión de la literatura

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Abstract

In this article, which has as its objective to perform a systematic review of the scientific literature to understand the impact of AI on the learning of university students, some reviews on the topic of artificial intelligence in the classroom and how it has been gaining relevance in Latin American classrooms are discussed. Methodologically, the search and review of the literature with keywords according to the topic under study was considered, as well as, publications in journals related to it. Among the most important results, it is highlighted that it is necessary to break previous paradigms and move to a new model where the student's practice and interaction with the new technological tools are of daily use and are not perverted by the teacher or seen as an enemy instead of an ally.

Keywords: artificial intelligence; digital competence; learning; educational technology; university education.

Resumen

En el presente artículo cuyo objetivo fue realizar una revisión sistemática de la literatura científica para comprender el impacto de la IA en el aprendizaje de los estudiantes universitarios se discuten algunas revisiones sobre el tema de la inteligencia artificial en el aula y cómo ha venido tomando relevancia cada día más en las aulas de Latinoamérica. Metodológicamente, se consideró la búsqueda y revisión de literaturas con palabras claves acorde a la temática en estudio y, además, se consideraron publicaciones en revistas que tuvieran relación con la misma. Entre los resultados más importantes se destaca que, hay que romper paradigmas anteriores y pasar a un nuevo modelo en donde la práctica del estudiante y la interacción con las nuevas herramientas tecnológicas sean de uso cotidiano y no sea pervertido por el docente o visto como un enemigo en lugar de un aliado.

Palabras clave: inteligencia artificial; competencia digital; aprendizaje; tecnología educacional; educación universitaria.

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INTRODUCTION

AI offers numerous opportunities and benefits in university education, such as personalization of learning, improved feedback, time savings, educational resources, and tools, among others. However, there are also concerns about the potential loss of teaching jobs, lack of human interaction, and privacy of student data. AI also poses significant threats, one of the main concerns being the loss of jobs due to automation (Muñoz Arango; Márquez Villegas, 2023). Therefore, it is necessary to critically analyze the impact of AI on undergraduate learning and address the challenges and questions that arise with its implementation.

Although there is great interest in the use of AI in university education, there is still a lack of research on its impact on student learning, so it is considered that there is a gap in some forms, tools, and strategies for learning through AI. It is believed that more studies than currently exist are still required to evaluate the impact of AI on the learning and success of university students, who are the ones who mostly manage technology more efficiently for their learning.

However, it should be noted, that a technology such as ChatGPT, for example, does not understand what you actually write, “[...] but predicts what is the next most likely word in the text it generates, it is not really lying, as it does not know whether a fact is false or not, since it does not have a knowledge database behind it” (Baeza-Yates, 2023, p. 37). Another element that may become a concern is ethics and privacy, as expressed by (Rodríguez Torres et al., 2023) the implementation of AI in education also poses challenges and ethical considerations. It is essential to ensure the privacy and security of student data, as well as to avoid creating AI systems that amplify existing inequalities in access to education (Guaña-Moya; Chipuxi-Fajardo, 2023).

AI should be a means to support the development of such skills, but not be the factor that slows down the cognitive development and ethical principles of the student (Castillejos, 2022). On the other hand, the lack of access to technology, although AI has the potential to enhance teaching and learning, not all students have access to the technology needed to take full advantage of these tools. It is inescapable and irrefutable not to consider, that social inequalities, openly impact the position of the digital divide (Fernández Morales; Reyes Angona; López-Ornelas, 2021).

To talk about AI is to refer to an emerging technology, which has the potential to transform university education and be seen as the breakthrough that was long overdue and that came in the Covid-19 pandemic, as the process that had been developing was accelerated.

Digital resources with artificial intelligence provide students with access to a wide range of up-to-date information and educational resources online. They can explore diverse sources, access multimedia materials, and take advantage of interactive tools to enrich their learning” (Gangotena Echeverría et al., 2023, p. 1478).

In the current digital and technological era, AI has proven to be a powerful tool that has transformed various aspects of our lives. Its application in education has opened up a new world of possibilities, offering innovative opportunities to improve teaching and learning processes (Torres Cruz et al., 2023).

AI has revolutionized the field of university education by offering new opportunities and methodological approaches. By implementing an AI-based methodological approach, significant benefits can be achieved in the development of critical thinking skills and complex problem-solving (Zawacki-Richter et al., 2019).

The aim of the present research focuses on conducting a systematic review of the scientific literature to understand the impact of AI on university students' learning. Answering to the question What is the impact of the use of artificial intelligence on college students' learning? The present research is justified because it can offer advantages in the formative process of students, as long as it is used ethically and responsibly; in addition, this research can be taken as an effective complement to new researches that make reference to the subject of study and contribute in the teaching of students by providing the appropriate tools for it.

This article is structured in several sections, which begin with a preamble on the researched topic, then there are the theories used, the methodology used, and the final considerations.

Use and application of Artificial Intelligence in the classroom

AI has the potential to transform the way teaching and learning take place, providing new opportunities and challenges (Rodríguez Chávez, 2021). In addition, the implementation of AI in the classroom may also pose challenges in terms of training and equitable access. It is important to address these challenges and establish appropriate regulations to ensure that AI is used responsibly and for the benefit of all students.

In recent years, programs that rely on AI have been revolutionizing both processes of education, teaching and learning, identifying technologies to streamline their processes and the management performed by members of the university community (Orozco-González et al., 2020).

Bonet et al. (2022, p. 160) refer that when talking about the development of AI in education, it can be observed that “the most marked trend is oriented towards the development of technologies that allow emulating the functions of a teacher in his teaching role”.

Digital competence for the use of Artificial Intelligence

Digital competence basically refers to the creative and safe use of information and communication technologies to achieve the goals related to the work process or action; likewise, it can be said that the form of use and applicability are closely related to this competence. In Latin America, for example, the case deserves attention, since there is a gap that does not allow all students to access in the same way, Chavez (2022, p. 71) states that:

Digital competencies consider a gap in education given that some educational institutions do not have the technological resources or, in the case of the elderly, there is resilience to the use of technology to carry out banking movements, request a cab through an application or food; such is the case of both marginalized areas or people who do not have an email or Facebook account, which prevents downloading applications.

Countless institutions in Latin America do not have access to the Internet, thus denying access to up-to-date knowledge.

The use of Artificial Intelligence for the student

With the use of AI, students can improve and be more competitive, in addition, they can develop new competencies and skills for the good of their education, in this way, in situations that warrant it, they can innovate with the support of a new tool that offers endless possibilities of use, from a simple research task on a particular topic of a course or subject to more complex situations such as case analysis and logical reasoning. The following is a description of two of the most widely used programs currently in use for business, health, and educational purposes, such as Chatbots and ChatGPT.

Chatbots

A Conversational Agent or ChatBot can be defined as a computer program designed to simulate an intelligent conversation with one or more people or, with other software systems, through auditory or textual methods (Martin; Allende, 2015). Another definition of Chatbot is the one from (Bansal; Khan, 2018, p. 53), which states “It is an AI program and a human-computer interaction (HCI) model”. According to (García-Gaona et al., 2023, p. 33) “Chatbots are digital systems that allow interaction through natural language, either through text or voice interfaces.”

That is why, they can interact in a very easy way and, in the case of education, it is evident that today's student usually keeps in constant contact with computers, so synchrony between humans and machines can be made. The flexibility of this technology and its ability to adapt to the pace of each user have allowed its expansion in all fields (Arredondo Castillo, 2020). For university education, this type of program was implemented for simpler and automatic tasks, those that did not require a high cognitive level. However, the capabilities of these

systems have advanced to the point that they can perform tasks related to the learning and teaching process (Canfran, 2023).

ChatGPT

It is a conversational chatbot based on the GPT-3 language model developed by the OpenAi company (Canfran, 2023). It is based on an application that simulates a human conversation based on a topic and the interaction is noticeable. Recently, the latest GPT-4 update has been released and is considered one of the most powerful in the field of language modeling (Et Online, 2023). It is important to note that:

The natural language processing nature of CHAT GPT allows it to be adapted to a wide variety of educational contexts. Teachers can use this tool to design interactive activities, resolve student doubts, generate challenging questions, and provide instant feedback. (Nacipucha et al., 2023, p. 557)

Nacipucha et al. (2023, p. 558) refers that "The correct use of prompts in CHAT GPT is crucial to take full advantage of the potential of this tool and ensure that the answers generated are relevant and accurate".

ChatGPT is a language model and not a creative writing tool; it is not capable of generating original ideas or concepts that can be used as the basis for a script. As Artificial Intelligence (AI), ChatGPT has a superior advantage in terms of quickly understanding in-depth information and connecting evidence to reach conclusions, compared to humans who have limitations in their ability to read a wide range of literature and distinguish connections between seemingly separate pieces of information (Ojeda et al., 2023).

Teachers' perceptions of Artificial Intelligence

Teaching is making an important leap within the process of teaching and learning, it is a change, which for most teachers is significant, some being forced to leave the routine that is synonymous with comfort (García Villarroel, 2021).

It is important to ensure that teachers are trained to use AI effectively and that all students have access to the necessary technologies (Rodríguez Chávez, 2021). Otherwise, it could increase the digital divide and inequality in education. As expressed:

The possibilities of artificial intelligence, applied to the educational environment, seeks to offer quality education, applying all the knowledge of digital technology, evidencing advantages, such as reaching many people in a short time, the personalization of teaching, having a particular teacher, and education adapted to the student's learning speed. (García Villarroel, 2021, p. 45).

The teacher can perceive AI in two ways, as a support tool or as an enemy that comes to facilitate the student's work. For this reason, teachers should be trained and oriented about what technology brings with it to support them. It is a complex issue, because it must be remembered that not all teachers are trained for the current technological progress, and this could be seen with the arrival of the Covid-19 pandemic when people had to move from a face-to-face education to a completely virtual one.

METHODOLOGY

The methodology was framed in a qualitative approach, following strategies of searching for relevant information in articles, selection by exclusion and inclusion criteria, the definition of the study universe, categorization, and finally, the construction of the units to be analyzed for a descriptive interpretation of the same, in function of carrying out a systematic review of the scientific literature to understand the impact of AI on the learning of university students. Likewise, a content analysis was carried out based on a set of categories previously defined from the stated objective. Figure 1 below presents the methodology in the steps by which the research was organized and constructed:

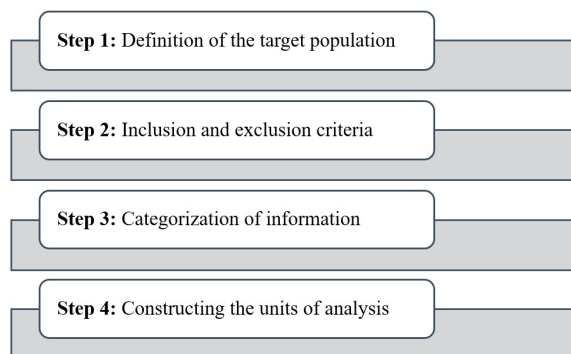


Figure 1. Steps for the construction of the research.

Definition of the target population

A literature review was conducted on the use of AI and its impact on the learning of university students, for which a search was conducted and identified the sources to consult which were academic databases, and 15 documents were found in journals indexed in Scopus, Springer Open, Dialnet, Latindex, Scielo, EBSCO HOST, PROQUEST that are related to the objective of this research, in the same way, a search was conducted in university repositories: Pontificia Universidad Catolica del Peru, Universitat Oberta de Catalunya, Universidad Autonoma Metropolitana, and Universidad Nacional de la Plata, which resulted in 22 more documents that were registered in the Zotero bibliographic manager to support the search for information and to be able to organize it in such a way that it could be found later. Likewise, for information purposes, we searched journals specialized in IA and education (see Table 1).

Table 1. Articles analyzed.

N°	Author/Year	Journals	Conclusions
1	Baeza-Yates (2023)	Bits Science Journal	Although ChatGPT has access to a wealth of information, its knowledge is limited by the dataset on which its training is based.
2	Bansal and Khan (2018)	International Journals of Advanced Research in Computer Science and Software Engineering	Since human-computer interaction is based on the interaction between the two, it will become much easier to make use of the tools, since, it is totally dependent on humans/users and work on the instructions given to them.
3	Castillejos (2022)	Educacion Journal	The competencies demanded by 21 st -century society refer to individuals with communicative and collaborative skills, with critical and creative capacity to face uncertainty and solve the problems they face in life. AI should be a means to support the development of such skills, but it should not be the factor that slows down the cognitive development and ethical principles of the student.
4	Gangotena Echeverría et al. (2023)	Ciencia Latina Multidisciplinary Scientific Journal	Artificial intelligence allows students to receive instant and accurate feedback on their performance. This helps them identify errors, understand concepts deeper, and correct their mistakes timely, which accelerates their progress and comprehension.
5	García-Gaona et al. (2023)	Revista Multidisciplinaria de Ciencia, Innovación y Desarrollo (REMCID)	AI, through the use of chatbots, could be considered as a viable solution since it could allow a dynamic that improves knowledge acquisition, and skill development, as well as improving the effective use of time and dedicating it to new tasks for the improvement of the teaching-learning processes.

Source: Own elaboration.

Table 1. Continued...

N°	Author/Year	Journals	Conclusions
6	Fernández Morales, Reyes Angona and López-Ornelas (2021)	Revista Conhecimento Online	In a contemporary world where youth must face the overwhelming transformation of all aspects of life, categories such as "appropriation", "competence", or "skill" must be stripped of their inherited use and rethought as valid tools, but from the current perspective.
7	Guaña-Moya and Chipuxi-Fajardo (2023)	Scientific Journal of Research Update of the World of Sciences (RECIAMUC)	The implementation of artificial intelligence raises ethical challenges and concerns regarding personal data protection and privacy, which require special attention.
8	Martín y Allende (2015)	Technology and development. Science, Technology and Environment Journal	The leap from chatterbots hosted on websites to personal virtual assistants on mobile devices has also unleashed a fierce battle between these giants to see who is the first to be able to create the perfect virtual assistant and thereby try to win an undetermined share of the market, which will mean thousands or millions of potential consumers of their products.
9	Muñoz Arango and Márquez Villegas (2023)	Agora Virtual Student Journal	If implemented ethically and equitably, AI can improve the quality of education, help teachers, and detect learning problems early. However, there is a risk of replacing essential human interaction in teaching and amplifying educational inequalities.
10	Nacipucha et al. (2023)	Revista Polo del Conocimiento	Artificial intelligence has the potential to transform education in revolutionary ways, but its implementation must be carefully managed. Collaboration between educators, AI developers, policymakers, and society, at large, is essential to ensure that AI is used ethically and effectively in education. The education of the future will largely depend on how we address these challenges and take advantage of the opportunities offered by AI.
11	Rodríguez Chávez (2021)	RIDE Iberoamerican Journal of Educational Research and Development	It is shown that it is necessary to adapt to the learning abilities of students. Students must be stimulated so as not to generate boredom and disinterest.
12	Rodríguez Torres et al. (2023)	Dominio de las Ciencias Scientific Journal	The personalization of the learning process through AI allows us to adapt content and teaching methods according to the unique needs of each student. However, this approach is countered by the pressing need to address the ethical implications of the collection and use of AI-generated data.
13	Torres Cruz et al. (2023)	Approaches to teaching and learning and teacher training Journal	By leveraging AI capabilities to personalize learning, facilitate complex problem solving, and promote collaboration, traditional educational barriers are overcome, and students are prepared for the challenges of today's world.
14	García Villarroel (2021, p. 50)	Orbis Journal Tertius – UPAL	While information and communication technologies are significant advances in education, there is no doubt about the dizzying development of artificial intelligence, which is basically used in platforms for information search, translation, and human-technology interaction.
15	Zawacki-Richter et al. (2019)	International Journal of Educational Technology in Higher Education	Today, the full implications of AI development cannot yet be foreseen, but it seems likely that AI applications will be one of the major educational technology issues over the next 20 years. AI-based tools and services have great potential to support students, teachers, and administrators throughout the student lifecycle.

Source: Own elaboration.

Regarding the selection of keywords, search terms such as: “artificial intelligence”, “machine learning”, “university education”, “university students”, and “educational technology”, artificial intelligence tools, human-machine interaction, intelligent applications for teaching were combined using Boolean operators such as OR to show the coincidences of all the words included in the search, in addition to AND for exact matches, for which it was necessary to use the symbolism of quotation marks "" in the word(s) to be searched.

Inclusion and exclusion criteria

The inclusion and exclusion criteria were oriented towards selecting academic articles, reviews, and empirical studies published in the last 5-10 years, in Spanish or English language, that address topics on the use of AI in university learning and its impact on students. The exclusion criteria were oriented towards discarding non-academic sources, such as blogs or news, and articles not directly related to the subject.

An analysis was carried out by synthesizing the information, that is, summarizing the findings of the selected articles, with full attention to the methods, results, and conclusions. In the same way, trends were identified to look for patterns in the reviewed studies, such as the impact of AI on student retention, academic performance, or personalization of learning.

There were taken into account criteria that were considered important for categorization, such as studies on the use of artificial intelligence in university education, as well as an interpretative or hermeneutic analysis of the categories, both aprioristic and emergent; the paragraphs of the theories used were divided or fractioned into small parts; codes and the semantic network were analyzed and created (see Figure 2).

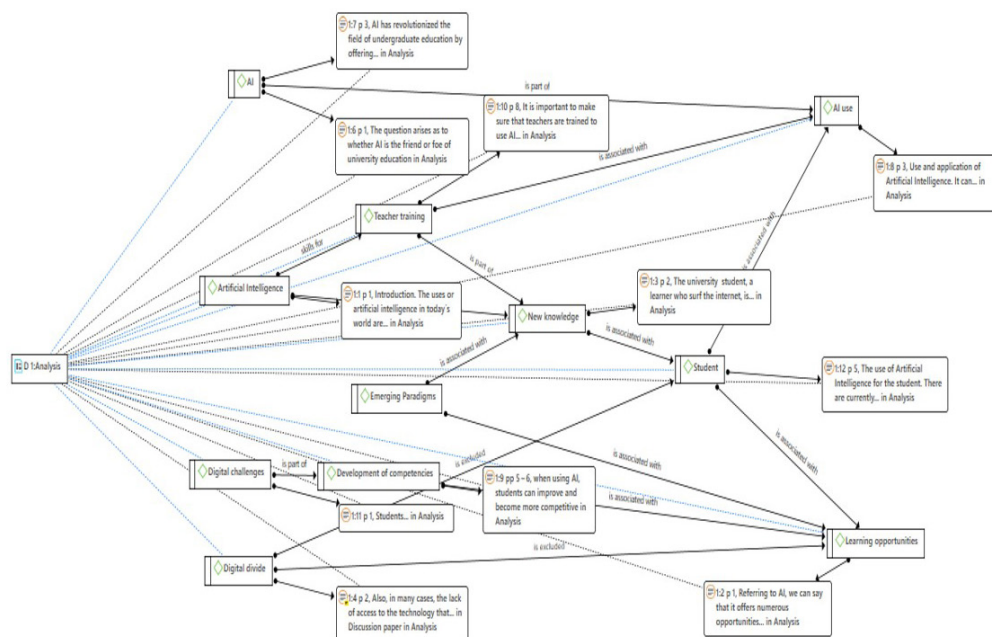


Figure 2. Network of relationships established for the content analysis supported by Atlas.ti software, version 9.

About the studies selected for categorization, the following can be mentioned.

Categorization of the information and construction of the units of analysis

Considering what is established by (Pineiro-Naval, 2020) content analysis is a technique that is recurrently used in the production of empirical research, and a series of steps or phases must be followed to perform a good content analysis, which can be performed manually or supported by technology. In this sense, the steps established in the methodology have been followed and the atlas.ti version 9 software was used to categorize and analyze the information collected.

RESULTS AND DISCUSSION

Results

Once the literature review was completed, we proceeded to steps 3 and 4 of the methodology, corresponding to the categorization and units of analysis, so that the categories were analyzed and related to build a semantic network of relationships between them; all supported by the atlas.ti version 9 software for qualitative data analysis.

Preliminary categories

Student (S): The student is the protagonist of learning and is part of the relay generation, so being active in the use of technological tools is unconditional for the progress of society.

Artificial Intelligence (AI): AI currently offers great benefits for students' learning and teachers' teaching, as it has become a support tool as long as they know how to use it for their development, and the academy as such.

Artificial Intelligence (AI2): The use of Artificial Intelligence is a topic that opens up many edges on elements that can have an impact on training. The use of artificial intelligence can be of great benefit to the student, however, it is important to think about the proper use and ethics when carrying out activities supported by this valuable tool.

Digital Divide (DD): It is known that not everyone, both students and teachers, has access to technological tools and that this is one of the main factors in the lack of knowledge about the use of the benefits offered by new technologies.

Teacher training (TT): Training and educating teachers in the use of AI is one of the ways to mitigate the current knowledge divide supported by technology, and the institutions will be responsible for strengthening and supporting the development of new skills and competencies that will allow teachers to use AI for student learning by, for example, creating new assessment strategies with the support of AI.

Competency Development (CD): Developing digital competencies for the use of AI is the way to be at the forefront of the new educational challenges since both parties must know how to efficiently use artificial intelligence for learning and teaching to be optimal and quality.

Use of Artificial Intelligence (UAI): The use of AI has become a support for those who make good use of it since it can, among other things, improve feedback, save time, and use new resources and new educational tools.

Emerging categories

New Knowledge (NK): Artificial intelligence is a new element that comes to form part of the knowledge of students, which is why a reasonable use should be made of this valuable tool that is here to stay. From it, more and more knowledge will be generated every day that will form the new man of the future or relay generation.

Learning Opportunities (LO): Learning opportunities will be generated and will take teaching to another level, one with a greater guarantee of the individual's cognitive development.

Emerging Paradigms (EP): The new paradigms or technological models are a perfect gear to simulate and develop new conditions that provide meaningful learning according to what society really requires today.

Digital Challenges (DC): Some challenges will be overcome, day by day, as progress is made in both the use and training of competencies to end the inequality that exists in various fields, especially in education. More research is needed by educators and learning designers on how to integrate AI applications throughout the lifecycle of learners to take advantage of the enormous opportunities they offer to create intelligent teaching and learning systems.

Based on each category, the analysis was conducted, where quotes from each category were interpreted and coded memos were created. The coded memos are presented below with the initials of each category:

According to Figure 3, the categories that emerged from the content analysis were: Student (S), Artificial Intelligence (AI), Digital Divide (DD), Teacher Training (TT), Competency Development (CD), and Use of AI (UAI), which were the a priori categories derived from the stated objective. On the other hand, the categories that emerged from the content analysis of the information in the documents consulted were New Knowledge (NK), Learning Opportunities (LO), Emerging Paradigms (EP), and Digital Challenges (DC). From these categories, the relationship was established on each one, according to the link established through the content analysis carried out.

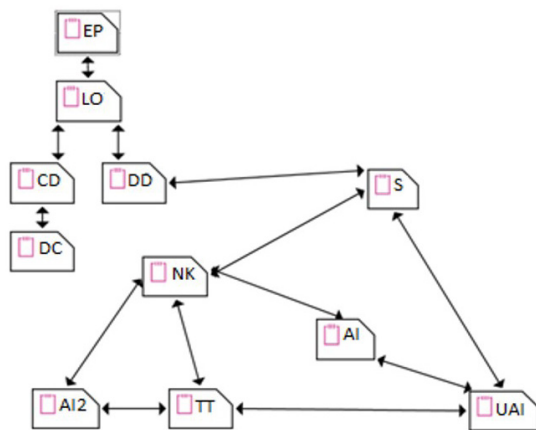


Figure 3. Memos for content analysis.

DISCUSSION

In the literature consulted, there are coincidences regarding the use of Artificial Intelligence in university students since it has become a necessity and a benefit for the educational actors involved in the teaching and learning process, (Castillejos, 2022, p. 11) “Both universities and technology developers seek to satisfy academic needs related to the teaching and learning process”. However, in disagreement with what the previous study provides, since the use of AI in education may be limited to the little interpretation capacity or the confidence that the student gives to the ChatGPT response, for example, Baeza-Yates (2023, p. 36) considers that the OpenAI star chatbot “does not understand what you type, but predicts what is the next most likely word in the text it generates”. Therefore, it can be said that the role of the teacher in this case is very important since the teacher must be able to guide the student in the use of AI tools.

Analyzing the selected texts, the importance of educational innovation for educators is also appreciated (García Villarroel, 2021); teaching is evolving significantly, which implies that many educators must adapt and change their habits and practices, abandoning the comfort of the routine they have always had. Likewise, the results indicate that, in university education, Artificial Intelligence can serve as a support, but it also implies ethical challenges (Rodríguez Torres et al., 2023, p. 2166) that require a direction that prevents tools, such as AI, from compromising rather than strengthening educational processes.

In summary, the use of artificial intelligence in education has the potential to transform the learning of university students, providing a more personalized, efficient and effective learning experience. Furthermore, digital resources powered by artificial intelligence enable the personalization of educational content and learning tasks according to the specific needs of each student (Gangotena Echeverría et al., 2023). This grants them the possibility of progressing at their own pace and attending more effectively to the areas in which they need improvement

FINAL CONSIDERATIONS

Regarding the results obtained through the content analysis carried out based on the documents consulted and the support of the technological tool for qualitative information

analysis Atlas.ti version 9, it is important to mention that aprioristic and emerging categories arose, which were analyzed by creating memos for such analysis and codified for a better understanding of the information.

On the other hand, in the research on the use of AI and its impact on the learning of university students, a review was conducted on some tools and how they are observed according to the perspective of students and teachers, identifying those common practices they have today and the competence necessary for the use and application of AI in university education. We have concluded, that we must break previous paradigms and move to a new model where the student's practice and interaction with new technological tools are of daily use and not perverted by the teacher or seen as an enemy instead of an ally.

The review has shown that AI can contribute to the improvement of student performance in their academic activities, improve the quality of feedback and personalize learning, as well as adapt the content to the teaching pace. There is also a need to train teachers to integrate AI in the classroom effectively and systematically.

The research consulted refers to the fact that various platforms and trends promise the future development of AI in the field of education, which is extremely attractive, and in some cases unattainable for some realities; however, the possibility that the computer can replace humans' capacity and intellect is unlikely.

With this, it can be implied that there may be millions of programs, tools, and specialized software, but the competencies and skills of human beings are still far from being replaced, but there may be a natural human-machine interaction that will continue to be by far a support in the activities of human beings and in this case, of education.

In this scenario, the implementation and use of artificial intelligence by university students can have an impact on the personalization of learning since the educational content can be adapted to the individual needs of each student, thus improving the learning experience and its effectiveness as such. Shortly, it can be said that a better use of ethics and responsibility will be made, and in addition, student abandonment can be prevented, which is often accompanied by a lack of time, understanding, or support. Likewise, new research will be available to provide knowledge on the proper use of artificial intelligence tools and, in addition, to having a greater impact on the learning of university students since the teacher will also be better prepared to face challenges and guide their students in the use of these tools.

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Authors contribution

LJIR: Research of sources, systematic review, information analysis, and categorization. MNCR: Research of sources, and analysis of information. GFMT: Research, review of styles, and organization. FVSC: Investigation of sources, category relationship, analysis of categories, and organization of information.

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