

Artificial Intelligence: Its Impact on the Education System

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Abstract

Artificial intelligence has demonstrated its potential to transform numerous fields, and education has been no exception. This research aims to analyze the impact of this technology on the teaching and learning process, and how it is transforming the educational system. The methodology applied in this study was a quantitative approach through a descriptive non-experimental design by means of a survey applied to graduate students of the Pontificia Universidad Católica del Ecuador located in Manabí. This approach was complemented with a bibliographic documentary type qualitative methodology. The results obtained indicated that artificial intelligence is very useful for education, with 70%. Also, that it can help identify and support students with learning difficulties 77%. Challenges were examined highlighting over-dependence on technology with 79%, and equitable access to technology with 75%. The areas in which this tool can have a positive impact are assessment and feedback with 84%, and personalization of learning with 81%. It could be seen that in recent years artificial intelligence has had a positive impact on the educational system, its use in the teaching and learning process has improved the academic performance of students.

Keywords:

Artificial intelligence, educational innovation, education, teaching, learning

Introduction

Today's technology has had a significant impact on the world. The use of artificial intelligence (AI) in everyday life is becoming more evident every day, it has become synonymous with new promises, but also with the risks that the massification of digital technologies entails in the different spheres of economic and social life in the 21st century. However, before AI can truly be used in education, there is still much to be done and organized. (Liz, 2020)(Jara & Ochoa, 2020)(Padilla, 2019)

Education is a complex process that involves the transmission of knowledge, skills, and values that have traditionally been determined by the interaction between teachers and students. However, this interaction can be altered due to different factors such as class sizes, student diversity, and time constraints (Rodríguez et al., 2023). That is why the educational system pays more and more attention to tools with smart technology, due to the potential they have to revolutionize teaching-learning processes.(Forero & Bennasar, 2023)

The use of AI in education has had a major impact, including global, personalized learning, adaptive content development, improved effectiveness and efficiency in education administration. It has been involved as a technological tool with the aim of transforming numerous aspects of society and education, posing new opportunities and challenges that deserve to be explored. In addition, it has contributed to the creation of interactive learning environments where students can interact with digital tools to promote and stimulate their active participation in teaching processes, without the presence of this technology, it would not have been possible to carry out the virtual teaching that governments have implemented.(Arana, 2021)(Tomalá, Mascaró, Carrasco, & Aroni, 2023)

AI makes it easier for teachers to grade assignments and in turn allows them to evaluate students' performance by identifying where they are struggling so that they can provide them with the necessary resources and improve their learning (García et al., 2023). Grading systems powered by these technologies can provide quick and accurate feedback to students, allowing them to improve their homework and track their progress effectively. This tool applied to teaching can address different areas, from the assessment and monitoring of student progress to the personalisation of educational content (Rodríguez et al., 2023).

The application of AI in education has many benefits and one of the main ones is to adapt educational content and learning strategies to the individual needs of students, improving the effectiveness of the training process and in turn increasing motivation

and commitment. However, not everyone has the opportunity to access technology and the resources necessary to fully reap the benefits of integrating it into the curriculum. (Vera, 2023)

One of the biggest challenges that AI has in education is to make sure that all students, regardless of their location or socioeconomic status, can access the tools and platforms built on it, promoting equitable and inclusive use, removing barriers related to disability, social or economic status, ethnic or cultural origin, or geographic location. In this way, it will be possible to overcome the current disparities in access to knowledge, research and the variety of cultural expressions. (Magallanes, Plúas, Aguas, & Freire, 2023)(UNESCO, 2023)

The incorporation of AI in education offers multiple possibilities to improve teaching and learning and optimize institutional management. It is considered important and necessary to implement an educational system with technological support, which includes this technology as an administrative, academic and research management tool, which allows teachers and students to face issues related to student dropout, academic performance, teaching-learning process, intelligent tutoring, social inclusion, intercultural education, among others (Vera, 2023)(Incio et al., 2022).

There are fears that this technology will replace teachers and reduce human contact in the educational process (Torres et al., 2023). Therefore, it is necessary to rigorously train them on the scope and limitations of this technology, in order to incorporate it as a complementary support to their educational practice. It is important to find a balance between technology and the role of the teacher, although AI is a powerful tool, it cannot replace the empathy, interaction and creativity imparted by human staff.(González, Villota, Moscoso, Garces, & Bazurto, 2023)

The implementation of AI in the educational system can offer various benefits in the teaching-learning process, among its various utilities it allows to carry out a more personalized monitoring of student motivation and academic performance. That is why this research aims to analyze the impact of AI on the teaching and learning process, and how it is transforming the education system. (Magallanes, Plúas, Aguas, & Freire, 2023)

Materials and methods

It is a study with a quantitative approach through a non-experimental descriptive design through a survey, which allowed collecting data on the opinion of students on the application of AI in education and its effectiveness in the teaching and learning process, this provides valuable information on the perception and acceptance of this tool in the educational system. This data was collected through a structured questionnaire on the web, specifically, the Google Forms tool was used. It should be noted that this approach is complemented by the qualitative bibliographic documentary methodology, which allowed for the collection of information, using different search tools; Review, analysis and bibliographic synthesis of primary and secondary sources on the development of technology and the impact it is having on education.(Magallanes, Plúas, Aguas, & Freire, 2023)(Arias, 2023) (Flores & García, 2023)

The study population consisted of 650 postgraduate students from the Pontificia Universidad Católica del Ecuador Sede Manabí, for which the probabilistic sampling method was used using the finite population formula (Equation 1), to obtain the study sample.(Aguilar, 2005)

Analysis and discussion of the results

There are several educational applications based on AI that improve the teaching-learning process and provide solutions to the needs of the education system. (Huang, Saleh, & Liu, 2021)

Figure 1 shows several types of buildable systems that are in production from AI.

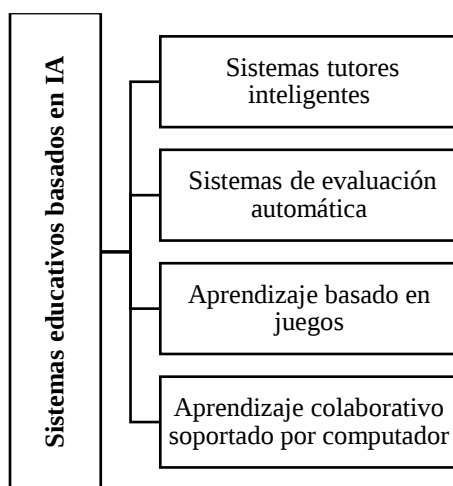


Figure 1

AI-based education systems

Note. The figure represents several AI-based education systems.

Source. Own elaboration. In original language Spanish

Intelligent tutoring systems: They are increasingly being used to teach science, mathematics, language, and other disciplines. They act as coaches, offering suggestions when students are hesitant in the problem-solving process, and not just when they introduce the answer. (León & Viña, 2017)

Automatic evaluation systems: They allow students to evaluate their strengths and weaknesses through the tests that are carried out on a subject or activity. (Sánchez & Lama, 2007)

Game-based learning: It tries to use the power of computer games to attract and motivate students to develop new knowledge and skills. (Sánchez & Lama, 2007)

Computer-supported collaborative learning: it allows the interaction of one or more groups of people involved in a common task or goal that provides an interface to a shared environment. (León & Viña, 2017)

There are numerous well-known educational applications that use AI techniques, table 1 shows some of them and the area in which they are used.

Board 1

AI-based educational applications

Areas	Applications
Automated Assessment	 turnitin
Smart Tutoring	 CARNEGIE LEARNING
Detailed feedback	 duolingo
Adaptive Learning	 SMART SPARROW
Game-based learning	 MATHSPACE
Creating texts	 ChatGPT

Note. The table shows some AI-based educational applications used by teachers and students. Fountain. Information taken from .(González, 2023)

A survey was carried out in which a sample of postgraduate students was taken, to analyze the impact that AI has on the teaching and learning process in the educational system. Equation 1 was used, used to calculate a finite population:

$$n = \frac{N}{1 + \frac{e^2(N-1)}{Z^2 pq}} \quad (1)$$

Where:

n → Tamaño de la muestra que desea conocer.

N → Tamaño conocido de la población. = 650

Z → Nivel de confianza = 95%

pq → Varianza de la población o variabilidad del fenómeno estudiado.

e → Índice de precisión o error muestral. = 5%

The result was a sample of 243 students, 54% of whom were women and 46% men. The age of the participants ranged from 26 to 30 years old, 37%, 35% between 20 and 25 years old, 18% between 31 and 35 years old, and 8% between 36 and 40 years old.

The use of AI in educational environments was investigated, the results are shown in Figure 2.

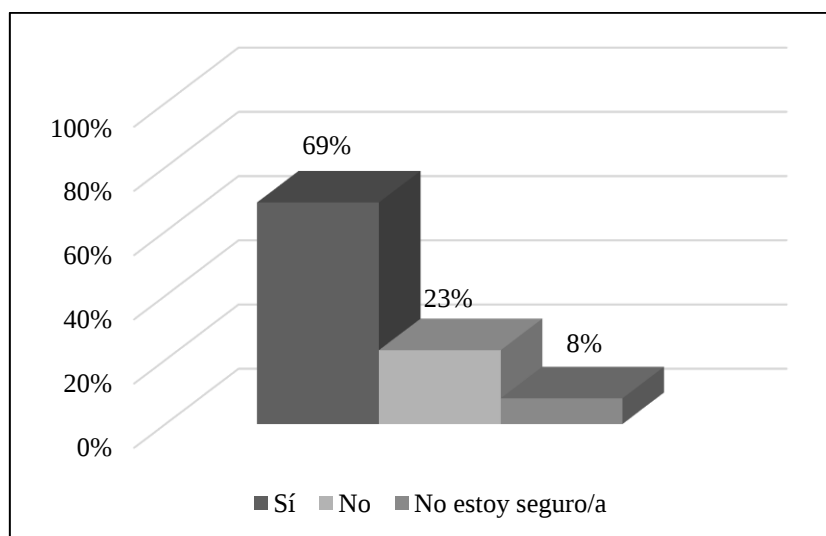


Figure 2

Use of artificial intelligence in the education system

Note. The figure shows the population's perception of the use of artificial intelligence in the education system.

Fountain. Own elaboration. In original language Spanish

It is shown that 69% of the population has experienced and knows about the use of AI in educational environments, while 23% indicate that they have not experienced this technology, currently this tool is being part of the teaching-learning processes and in turn has generated new contributions to reinvent traditional education. Its use in the educational field is constantly growing and is expected to continue expanding in the future, poses important challenges, but at the same time opens up a wide spectrum of opportunities for both teachers and students. However, it is important to address the challenges and limitations associated with its implementation in education to ensure its long-term success. (Chávez, Castro, Ibarra, & Tobar, 2024)

AI is very useful for education, providing tools and resources that transform the way you teach and learn; The ability to tailor educational materials, activities, and assessments to the individual needs and preferences of each student has greatly improved the effectiveness of the teaching and learning process. An example of this is the latest developments in Google Classroom, in which AI is used to help students and teachers. Others include using this tool to automate routine administrative tasks, diagnose student competencies, and offer learning content and feedback tailored to individual progress. (Aparicio, 2023)(Flores & García, 2023)

This technology is and will be an unexpected turn in the changes of traditional educational paradigms, given that pedagogical modalities at all levels are in the process of adaptation by current technological tools. (García, Mora, & Ávila, 2020)

It was analyzed whether AI can identify and support students with learning difficulties, the results are evidenced in Figure 3.

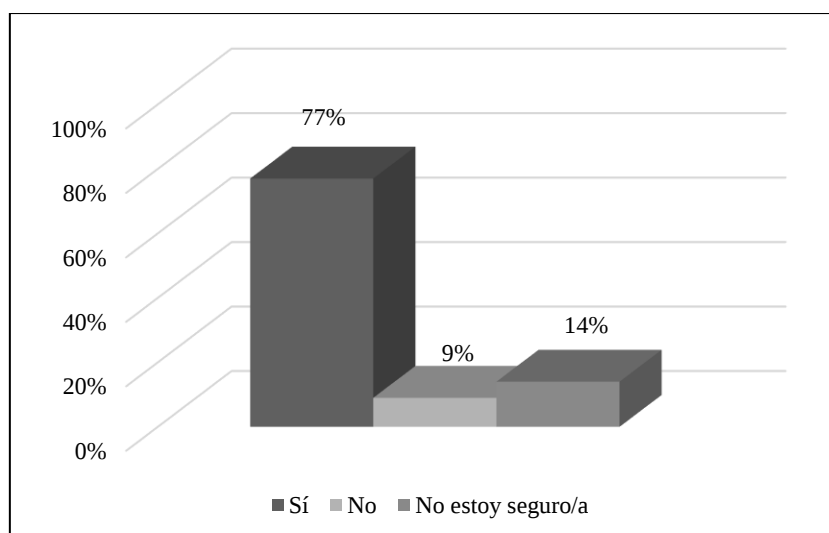


Figure 3

Artificial Intelligence Can Identify and Support Students with Learning Difficulties

Note. The figure illustrates whether artificial intelligence can identify and support students with learning difficulties, as expressed by the population.

Source. Own elaboration. In original language Spanish

It is evident that 77% of students indicate that AI can help identify and support students with learning difficulties, 14% indicated that they are not sure and 9% that this technology does not contribute in this area. Each student has different capacities and skills that allow them to assimilate knowledge in different ways, therefore, the teacher faces the problem of evaluating the level of understanding of the subject of their students, to detect some failures and prevent these students from having erroneous notions about it. It should be noted that many times learning difficulties do not occur due to lack of student ability, but due to the teaching style used in the classroom. (Cruz & Gamboa , 2005) (Urquijo & López, 2020)

Applications that incorporate this technology can help identify learning difficulties and, with a good pedagogical basis, reduce this gap. That is, an AI-based virtual tutoring system can provide individualized feedback, resolve doubts, and provide detailed explanations about difficult concepts, allowing the student to progress at their own pace and focus on specific areas that require more attention. Therefore, it helps to identify and address problems before they become significant obstacles to learning. (Aparicio, 2023) (González, 2023)

AI, in addition to helping students with learning difficulties, allows them to identify trends or patterns of behavior that affect their academic performance. In the education sector, machine learning techniques are used to understand and explore patterns that characterize student behavior, using methods and algorithms based on their data, assessments, and mastery of their knowledge. An example of this is data mining techniques, which are used to analyze large amounts of student information in order to identify patterns and trends in their academic performance and behavior, which can help teachers design personalized curricula and thus provide detailed feedback. (Rojas, 2021)(González, 2023)

It was studied whether AI contributes to equity and inclusion in the education system, the results are shown in Figure 4.

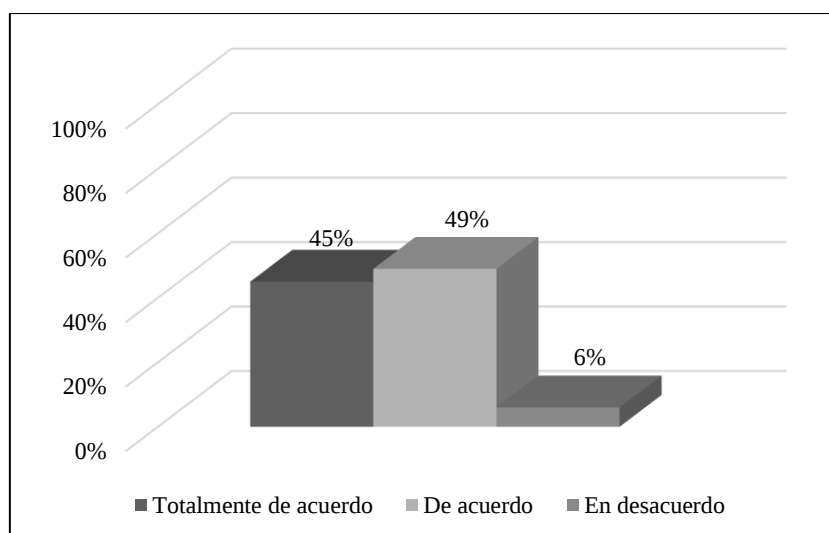


Figure 4

Artificial intelligence contributes to equity and inclusion in the education system

Note. The figure presents the respondents' point of view on whether artificial intelligence contributes to equity and inclusion in the education system.

Source. Own elaboration. In original language Spanish

It is evident that 49% of students agree that AI contributes to equity and inclusion in the educational system, 45% strongly agree with this, the population that disagrees is relatively lower with 6%. The integration of this tool into education poses challenges and ethical considerations that must be addressed to maximize benefits and decrease risks. By addressing privacy, accountability, and equitable access to technology, we can build an ethical, inclusive, and effective educational environment for all students. (Aparicio, 2023)

Equity and inclusion in education are fundamental for the development of just and progressive societies; AI can be an ally in this regard, by identifying learning barriers and providing accessible solutions for students with disabilities or special needs. It can also reduce the digital divide and facilitate access to education in remote or disadvantaged communities, creating inclusive education. (Reyes, 2023)

In which areas AI could have a positive impact on education were studied, the results are shown in Figure 5.

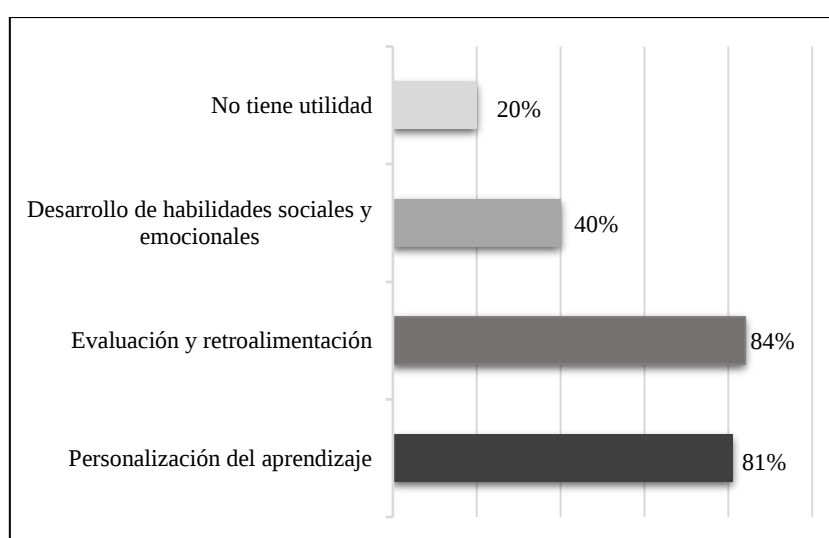


Figure 5

Areas where artificial intelligence could have a positive impact

Note. The figure reveals the population's view of areas where artificial intelligence could have a positive impact.

Source. Own elaboration. In original language Spanish

It is observed with 84% that evaluation and feedback is one of the areas that can have a positive impact on education, followed by the personalization of learning with 81%, by using techniques and tools that include AI, teachers are helped to assess students' understanding of a topic, for example, Deep learning algorithms can be used to automatically evaluate students' responses to multiple-choice questions and provide detailed, personalized feedback. One of the areas that stands out the most in education is the personalization of learning, which is about the use of machine learning algorithms to adapt the learning experience to the individual needs and characteristics of the student, which can significantly improve the effectiveness of the educational process. (González, 2023)

40% of respondents mentioned that this technology can have a positive impact on the development of social and emotional skills, and 20% pointed out that this technology is not useful in the educational field and therefore would not have any positive impact on education.

The challenges that could arise when implementing artificial intelligence in educational institutions were analyzed, the results are shown in Figure 6.

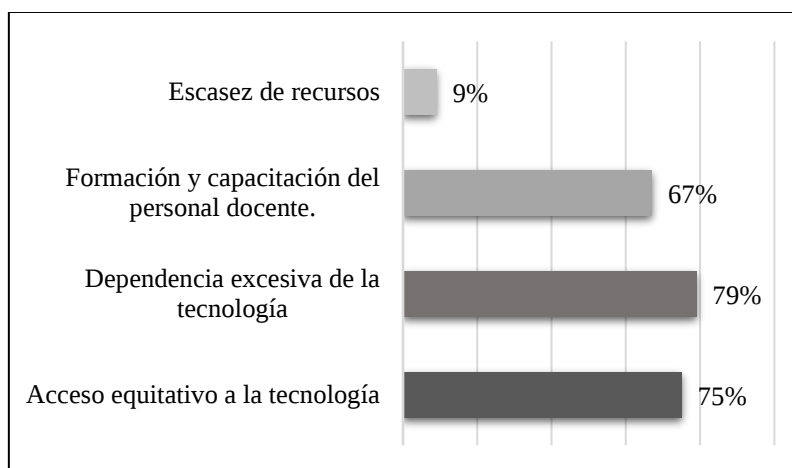


Figure 6

Challenges of artificial intelligence in educational institutions

Note. The figure shows the challenges that could arise when implementing artificial intelligence in educational institutions.

Source. Own elaboration. In original language Spanish

Several challenges that may arise when implementing AI in educational institutions are observed, although this technology offers significant benefits for education, it also poses challenges and privacy concerns, one of them is the excessive dependence on technology that stands out in figure 5 with 79%, it is important to maintain the central role of the teacher as a facilitator of learning. This factor can have negative implications on the development of essential human skills, such as critical thinking, creativity and problem solving, it is important to keep in mind that this technology should be a complementary tool and not a substitute for human personnel. (Reyes, 2023)(García, 2023)

Other challenges that arise are equitable access to technology with 75%, It should be noted that the use of the internet and technological tools has the potential to increase social, economic, cultural and diverse inequalities, as well as to make new opportunities only distributed among those who have access to them. (Sánchez, 2008)

67% of respondents indicate that one of the challenges that arises from increasing AI in the educational system is the training and training of teaching staff, within education it is one of the biggest challenges since daily challenges arise for teachers and it is of utmost importance that they have the necessary tools to be able to solve them. The teacher has the responsibility of training students in all their aspects and if he does not have the necessary knowledge, he will not be able to transmit knowledge to the students. However, it is a reality that several educational institutions do not have teacher training in accordance with educational technological changes.(Rodríguez, 2017)

It is necessary that a transformation emerges on the part of the academic units, in relation to pedagogical training and under optimal conditions for the teacher to train innovative students prepared for the future. The scarcity of resources was also a challenge that stood out in this survey, since not everyone has the opportunity to access these tools due to the economic factor.

AI has the potential to change teaching and learning. Importantly, this technology does not replace human teachers, but can serve as an instrument to complement the way in which teaching and learning are done.

Conclusion

AI has become a valuable tool in the education system, which allows improving the teaching and learning process. This article demonstrates how this technology, despite all the challenges that arise from its implementation, is very useful for education, personalizing the learning experience of each student, adapting the content and activities to their needs.

It was proven that AI does not have a negative impact on the education system, but rather contributes positively to student performance, helps identify behavioral patterns that affect performance, and supports students with learning difficulties. The data from this research supports the positive perception of AI in education, highlighting assessment and feedback, as well as personalization of learning, as key areas of impact. The use of AI-based techniques and tools, such as deep learning algorithms, emerges as an effective strategy to improve assessment and provide detailed, personalized feedback.

The integration of AI into the education system represents a significant step towards improving the teaching and learning process. The opportunities that this tool provides are of vital importance for education, as it improves accessibility and fosters the development of twenty-first century skills. It is essential to continue addressing ethical concerns and ensuring equity in access to technology, in order to maximize the positive impact of AI in education, simplifying the path to a more efficient and inclusive educational future, where AI becomes a fundamental ally in the training process.

Bibliography

- [1] Aguilar, S. (2005). Formulas for sample calculation in health research. *Health in Tabasco*, 11(1-2), 333-338. Retrieved from <https://www.redalyc.org/pdf/487/48711206.pdf>
- [2] Aparicio, W. (2023). Artificial intelligence and its impact on education: Transforming learning for the twenty-first century. *International Journal of Pedagogy and Educational Innovation*, 3(2), 217-229. Retrieved from <https://editic.net/ripie/index.php/ripie/article/view/133>
- [3] Arana, C. (2021). Artificial Intelligence Applied to Education: Achievements, Trends and Perspectives. *INNOVA UNTREF. Argentine Journal of Science and Technology*, 1(7). Retrieved from <https://revistas.untref.edu.ar/index.php/innova/article/view/1107>
- [4] Arias, A. (2023). *Chatgpt and its influence on learning in 5th grade EGB students June 14 of the canton Vinces 2022-2023*. Retrieved from <http://dspace.utb.edu.ec/handle/49000/15166>
- [5] Chávez, G., Castro, J., Ibarra, M., & Tobar, Y. (2024). Artificial intelligence in higher education: opportunities and threats. *RECIAMUC*, 8(1), 71-79. doi:[https://doi.org/10.26820/reciamuc/8.\(1\).Jan.2024.71-79](https://doi.org/10.26820/reciamuc/8.(1).Jan.2024.71-79)
- [6] Cruz, G., & Gamboa, F. (2005). Exploring student learning using collaborative environments: teaching Artificial Intelligence. *Ibero-American Journal of Distance Education*, 8(1-2), 147-158. Retrieved from <http://hdl.handle.net/11162/91490>
- [7] Flores, J., & García, F. (2023). Reflections on the ethics, potentialities and challenges of Artificial Intelligence in the framework of Quality Education (SDG4). *Comunicar: Scientific Journal of Communication and Education*, 31(74), 37-47. doi:<https://doi.org/10.3916/C74-2023-03>
- [8] Forero, W., & Bennasar, F. (2023). Techniques and applications of Machine Learning and Artificial Intelligence in education: a systematic review. *RIED-Revista Iberoamericana de Educación a Distancia*, 27(1), 209-253. Retrieved from <https://www.redalyc.org/journal/3314/331470794017/331470794017.pdf>
- [9] García, J., Sakibaru, L., Ortega, Y., García, B., Guevara, Y., & Vargas, C. (2023). *Artificial intelligence in teaching praxis: link between technology and the learning process*. Lima, Peru: Caribbean Sea. doi:<https://doi.org/10.17613/vqt1-cp64>
- [10] García, J. (2023). Digital connections: technologies as learning bridges. Dykinson S.L. Retrieved from <https://books.google.com.ec/books?id=VNXwEAAAQBAJ&newbks=0&lpg=PA574&dq=dependencia%20excesiva%20de%20la%20tecnologia&hl=es&pg=PA1#v=onepage&q=dependencia%20excesiva%20de%20la%20tecnologia&f=false>

- [11] García, V., Mora, A., & Ávila, J. (2020). Artificial intelligence in education. *Science Mastery*, 6(3), 648-666. doi:<http://dx.doi.org/10.23857/dc.v6i3.1421ç>
- [12] Gonzáles, J., Villota, F., Moscoso, A., Garces, S., & Bazurto, B. (2023). Application of Artificial Intelligence in Higher Education. *Domain of the Sciences*, 9(3), 1097-1108.
- [13] González, C. (2023). The impact of artificial intelligence on education: transforming the way we teach and learn. *Curriculum Magazine*, 36, 51-60. doi:<https://doi.org/10.25145/j.qurricul.2023.36.03>
- [14] Huang, J., Saleh, S., & Liu, Y. (2021). A Review on Artificial Intelligence in Education. *Academic Journal of Interdisciplinary Studies*, 10(206), 206-217. doi:<https://doi.org/10.36941/ajis-2021-0077>
- [15] Incio, F., Capuñay, D., Estela, R., Valles, M., Vergara, S., & Elera, D. (2022). Artificial intelligence in education: a review of the literature in international scientific journals. *Apuntes Universitarios*, 12(1), 353-372. doi:<https://doi.org/10.17162/au.v12i1.974> Revista de Investigación Revista de Investigación Revista de Investigación Apuntes Universitarios Apuntes Universitarios Apuntes Universitarios Apuntes Universitarios
- [16] Jara, I., & Ochoa, J. (2020). *Uses and effects of artificial intelligence in education*. doi:<http://dx.doi.org/10.18235/0002380>
- [17] León, G., & Viña, S. (2017). Artificial intelligence in higher education. Opportunities and threats. *NNOVA Research Journal*, 2(8.1), 412–422. doi:<https://doi.org/10.33890/innova.v2.n8.1.2017.399>
- [18] Liz, A. (2020). A new world? Virtual reality, augmented reality, artificial intelligence, enhanced humanity, Internet of Things. *Arbor*, 196(797), 572. doi:<https://doi.org/10.3989/arbor.2020.797n3009>
- [19] Magallanes, K., Plúas, L., Aguas, J., & Freire, R. (2023). Artificial intelligence applied to educational innovation in the teaching and learning process. *LATAM Latin American Journal of Social Sciences and Humanities*, 4(2), 1597–1613. doi:<https://doi.org/10.56712/latam.v4i2.706>
- [20] Padilla, R. (2019). The arrival of artificial intelligence in education. 7(14), 260-270. doi:<https://doi.org/10.36825/RITI.07.14.022>
- [21] Reyes, J. (2023). Artificial Intelligence in the Classroom: Promotion of Inclusion, Equity and Educational Quality. *Artificial Intelligence for the transformation of education*, 14-23. Retrieved from https://books.google.es/books?hl=es&lr=&id=G2LoEAAAQBAJ&oi=fnd&pg=PA14&dq=La+inteligencia+artificial+contribuye+a+la+equidad+e+inclusi%C3%B3n+en+el+sistema+educativo&ots=vvVB4wS6UD&sig=UV16BfY_DfV alAZQnrHh6yhiKkQ
- [22] Rodríguez, Á., Orozco, K., García, J., Barros, H., & Rodríguez, S. (2023). The Implementation of Artificial Intelligence in Education: Systematic Analysis. *Science Mastery*, 9(3), 2162-2178. doi:<https://doi.org/10.23857/dc.v9i3.3548>
- [23] Rodríguez, H. (2017). Importance of teacher training in educational institutions. *Ciencia huasteca boletín científico de la Escuela Superior de Huejutla*, 5(9). Retrieved from <https://repository.uaeh.edu.mx/revistas/index.php/huejutla/article/view/2219>
- [24] Rojas, R. (2021). *Supervised Machine Learning Model to Identify Patterns of Low Academic Performance in Entrants to the Institute of Public Pedagogical Higher Education–Juliaca*. Retrieved from <https://repositorio.upeu.edu.pe/handle/20.500.12840/4505>
- [25] Sanchez, E. (2008). Information and communication technologies (ICTs) from a social perspective. *Revista electrónica educare*, 12, 155-162. Retrieved from <http://www.redalyc.org/articulo.oa?id=194114584020>
- [26] Sánchez, E., & Lama, M. (2007). Monograph: Artificial Intelligence Techniques Applied to Education. *Artificial intelligence. Ibero-American Journal of Artificial Intelligence*, 11(33), 7-12. Retrieved from <https://www.redalyc.org/pdf/925/92503302.pdf>
- [27] Tomalá, M., Mascaró, E., Carrasco, C., & Aroni, E. (2023). Incidences of artificial intelligence in education. *RECIMUNDO*, 7(2), 238-251. doi:[https://doi.org/10.26820/recimundo/7.\(2\).Jun.2023.238-251](https://doi.org/10.26820/recimundo/7.(2).Jun.2023.238-251)
- [28] Torres, E., Torres, F., Torres, J., Basurco, T., Mamani, O., López, M., . . . Coyla, L. (2023). *Impact of artificial intelligence on university education*. Digital Scientific Editor.
- [29] UNESCO. (2023). *Artificial intelligence in education*. Retrieved from <https://www.unesco.org/es/digital-education/artificial-intelligence>
- [30] Urquijo, S., & López, L. (2020). miMente AI. Adaptive tools for learning management. *Appropriate*, 5, 5-8. Retrieved from <https://revistas.udem.edu.co/index.php/apropia/article/view/3665>
- [31] Vera, F. (2023). Integration of Artificial Intelligence in Higher Education: Challenges and Opportunities. *Transform*, 4(1), 17-34. Retrieved from <https://www.revistatransformar.cl/index.php/transformar/article/view/84>