REVISTA INVECOM
ISSN en línea: 2739-0063

AI for the improvement of Blended Learning in the redefinition of hybrid teaching: a systematic review

IA para el mejoramiento del Blended Learning en la redefinición de la enseñanza híbrida: una revisión sistemática

Received: 18/04/2025 - **Accepted:** 17/07/2025

Freddy Edward Rueda Chavez
https://orcid.org/0000-0002-6803-2215
fruedach@ucvvirtual.edu.pe
Universidad César Vallejo. Lima, Peru

Shermelly Herliht Tovar Mendoza
https://orcid.org/0009-0000-8115-4463
stovarm@ucvvirtual.edu.pe
Universidad César Vallejo. Lima, Peru

Abstract

This study analyzes the impact of artificial intelligence (AI) as a transformative tool in hybrid teaching, with an emphasis on its application in educational contexts in Latin America. To this end, a systematic review was conducted using the PRISMA approach, considering open-access articles published between 2020 and 2025, in different languages, and available in the Scopus, SciELO, and Web of Science databases. A total of 434 articles were identified (175 from Scopus, 162 from SciELO, and 97 from Web of Science), of which 21 were selected that met the inclusion and thematic relevance criteria, considering the thesaurus descriptors: "*Blended Learning*" AND "artificial intelligence." The results show that AI enhances the personalization of learning, improves feedback, and optimizes the management of virtual environments, generating significant advances in academic performance and student autonomy. It also allows teachers to optimize curriculum planning and manage their time more efficiently. The literature reviewed highlights the use of chatbots and virtual assistants as key resources for enriching educational experiences in the hybrid model. Furthermore, it is emphasized that the incorporation of AI favors the creation of more inclusive and adaptive learning environments, responding to the individual needs of students and promoting educational equity. It is concluded that artificial intelligence not only improves digital learning environments, but also serves as a strategic tool for consolidating the *Blended Learning* model as a priority in Latin American education systems.

Keywords: blended learning, artificial intelligence, virtual environments.

Resumen

El presente estudio analiza el impacto de la inteligencia artificial (IA) como herramienta transformadora en la enseñanza híbrida, con énfasis en su aplicación en contextos educativos de América Latina. Para ello, se realizó una revisión sistemática bajo el enfoque PRISMA, considerando artículos de acceso abierto publicados entre 2020 y 2025, en distintos idiomas, y disponibles en las bases de datos Scopus, SciELO y Web of Science. Se identificaron 434 artículos (175 de Scopus, 162 de SciELO y 97 de Web of Science), de los cuales se seleccionaron 21 que cumplían con los criterios de inclusión y pertinencia temática, considerando los descriptores del tesauro: "*Blended Learning*" AND "inteligencia artificial". Los resultados evidencian que la IA potencia la personalización del aprendizaje, mejora la retroalimentación y optimiza la gestión de los entornos virtuales, generando avances significativos en el rendimiento académico y en la autonomía del estudiante. Asimismo, permite al docente optimizar la planificación curricular y gestionar de forma más eficiente su tiempo. La literatura revisada destaca el uso de chatbots y asistentes virtuales como recursos clave para enriquecer las experiencias educativas en el modelo híbrido. Además, se resalta que la incorporación de la IA favorece la creación de entornos de aprendizaje más inclusivos y adaptativos, respondiendo a las necesidades individuales de los estudiantes y promoviendo la equidad educativa. Se concluye que la inteligencia artificial no solo mejora los entornos digitales de aprendizaje, sino que también se configura como una herramienta estratégica para consolidar el modelo de *Blended Learning* como prioridad en los sistemas educativos de América Latina.

Palabras clave: blended learning, inteligencia artificial, entornos virtuales.

Introduction

Blended Learning, also known as combined learning, has established itself as a methodology that integrates face-to-face teaching with virtual activities, facilitating a flexible and accessible learning experience (Winfield & Whitelaw, 2024). According to Rocha et al. (2024), this educational approach enhances critical thinking and student autonomy, proving to be a key strategy for addressing the educational challenges of inclusivity and quality in the 21st century. Moreover, the COVID-19 pandemic played a significant role in accelerating and adopting hybrid teaching modalities in institutions worldwide, highlighting its inclusive potential (Govender et al., 2024).

Tools such as chatbots and virtual assistants are revolutionizing combined learning by providing solutions to optimize interaction and feedback between teachers and students (Núñez et al., 2024). In this context, the need arises to understand: How does artificial intelligence contribute to improving the quality of Blended Learning for the redefinition of hybrid teaching in educational models in Latin America?

Methodology

This study was conducted through a systematic review following the PRISMA method, with the aim of analyzing and synthesizing scientific evidence related to the application of artificial intelligence (AI) in the Blended Learning model within educational contexts in Latin America. Specific methodological criteria were considered for this type of review, including the use of descriptors in both English and Spanish: “Blended Learning” AND “Artificial Intelligence.” The selected databases were Scopus, Scielo, and ProQuest, prioritizing open-access articles published between 2020 and 2025 in both Spanish and English. The logical operator AND was employed to refine the search and ensure thematic relevance. Exclusion criteria included restricted-access articles or those that did not address the relationship between AI and education.

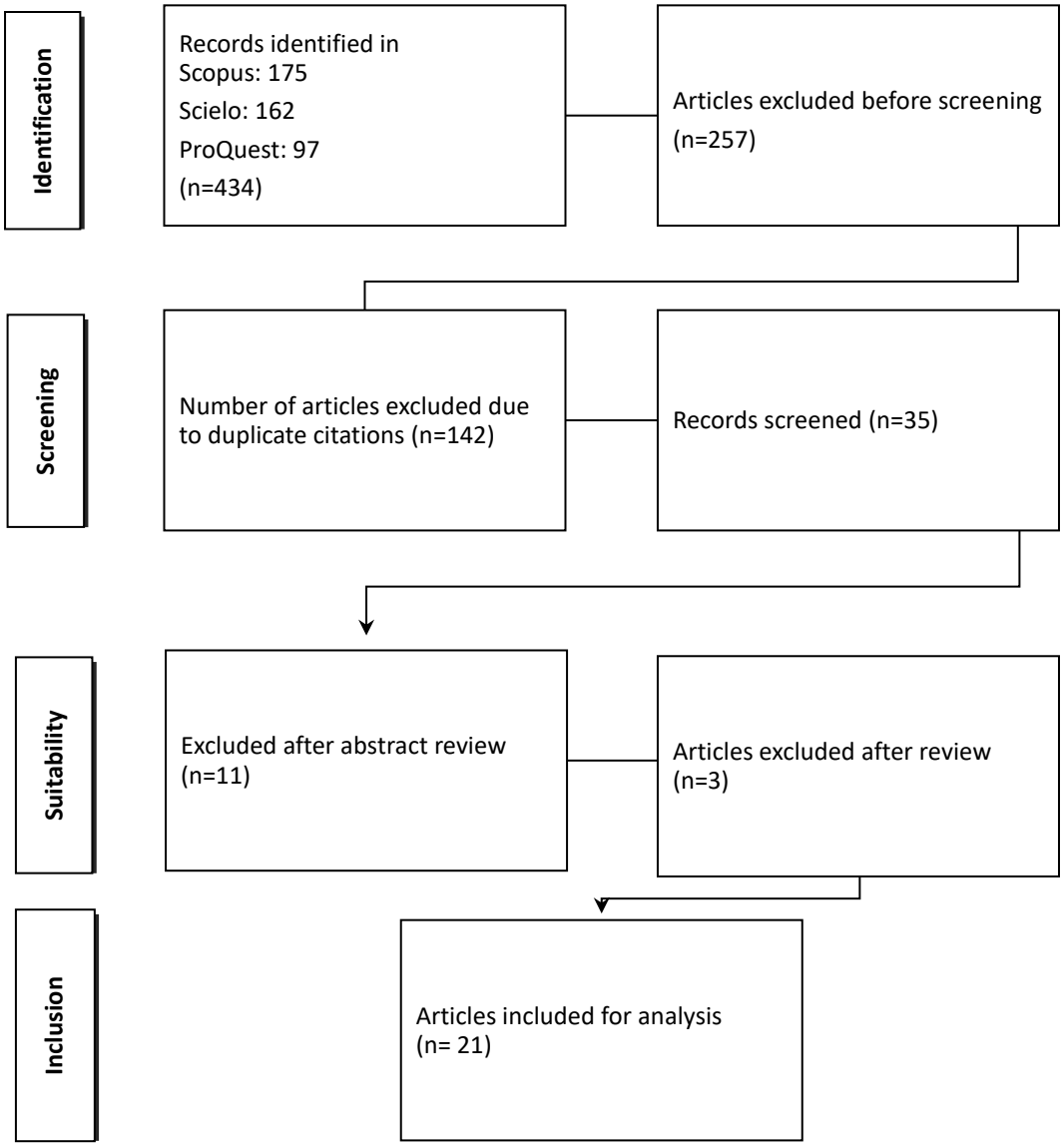
The initial search process yielded a total of 434 articles: 175 in Scopus, 162 in Scielo, and 97 in ProQuest. After applying the inclusion filters, 21 articles were selected for detailed analysis: 7 from Scopus, 9 from Scielo, and 5 from ProQuest (see Table 1).

Table 1

Search keywords in database articles

Database	Search term	Results	Selected
Scopus	“*Blended Learning*” AND “AI”	175	7
Scielo	“B. Learning” AND “IA”	162	9
ProQuest	“*Blended Learning*” AND “Artificial Intelligence”	97	5
	Total	434	21

Figure 1
PRISMA flow diagram



* Table formatted according to PRISMA with original data

Results

Table 2
AI for improving blended learning in the redefinition of hybrid teaching

No.	Author	Artificial intelligence in the redefinition of hybrid teaching
1	Khalil et al. (2024).	The educational landscape is rapidly transforming with the use of AI, which plays a crucial role in the transition to blended learning by providing a vast array of tools that facilitate the shift from in-person instruction to remote learning experiences. The approach is structured around four key pillars: teaching practice, the virtual classroom, assessment-feedback, and personalized student support. These aspects

		must be applied to train educators interested in using AI to design engaging blended learning courses with improved pedagogical planning.
2	Diez-Gutierres & Joaquin-Ramirez (2025).	Generative AI presents a significant challenge for universities, requiring a more holistic approach that does not view AI as a neutral tool. This technology currently operates within a context of digital capitalism driven by data from large tech companies, which may lead to the expropriation of knowledge produced socially. Today, there are data capture and mining tools that feed these systems to enhance their responsiveness, conditioning the field of knowledge toward a future designed by the creators of this new intelligent technology.
3	Makarenko et al. (2024)	The study indicates that artificial intelligence (AI) will play an important role in transforming 21st-century education, positively impacting the teaching process, particularly in the personalization of planning and accessibility of information, which better prepares students for the new job market. While AI opens new pathways for optimizing learning, it also presents relevant challenges, such as data security and teacher training for ethical use.
4	Lyu & Huang (2024).	The review indicates that AI is a potentially effective tool for improving English language proficiency among university students, particularly in blended learning models. A study conducted with 275 students at the Guangzhou Institute of Science and Technology yielded clear results regarding the improvements AI generates in the development of communication skills, vocabulary expansion, intonation, and understanding of terms for translation and writing. This technology allows students to use intelligent assisted learning tools and conversational chats to practice pronunciation.
5	Suresh et al. (2025)	The integration of AI in education promises a significant transformation of students' academic experiences. It also enables teachers to personalize their lesson planning, adapting teaching to different learning styles and paces. AI facilitates the creation of intelligent tutoring systems and offers adaptive learning platforms with tools capable of processing information in natural language. Ultimately, the study demonstrates AI's potential to optimize learning processes and improve academic outcomes, provided its use is ethical and responsible.
6	Shete et al. (2024).	Currently, teachers have access to tools that allow them to personalize their curricular planning. The study concluded that personalization of planning through AI positively impacts students' academic performance. The results showed a favorable relationship between improved academic performance, increased engagement, and greater satisfaction among students interacting with content generated by this new technology, demonstrating that individually tailored learning experiences by AI have the potential to transform teaching methodologies.
7	Kuleto et al. (2021).	This research aims to demonstrate the transformative role of how students access personalized and synthesized information using chatbots that operate under machine learning models. The study analyzed the results of a survey conducted with 103 students in Serbia to assess their level of knowledge and their stance on the use of artificial intelligence (AI) and machine learning (ML) in their professional studies. It concluded that AI and ML are fundamental technologies that help enhance the learning process, developing skills and promoting collaborative work within higher education institutions (HEIs).

8	Pei et al. (2025).	The study also proposed and evaluated a professional development program for university faculty aimed at fostering a sense of community in blended learning environments. It suggested implementing a solid theoretical foundation that provides practical teaching strategies with a teamwork approach to improve the quality of blended learning. Additionally, it emphasizes the need for institutional commitments to sustain the program in the long term.
9	Muhamad et al. (2025).	Another relevant finding is based on research conducted in Indonesia, which demonstrates that the combination of Blended Learning and AI in teaching-learning processes significantly influences five prior factors: the structure and support system, the schedule of blended learning, pedagogical support, the method applied in learning, and assessment within the environment. According to surveys administered to 625 teachers, a positive correlation was identified between these five factors and the effectiveness of blended learning with the use of AI. These results establish a new empirical basis for future educational strategies in hybrid contexts.
10	Tinoco-Plasencia (2025).	The research also focuses on the constant advancement of technology, particularly AI, and how it is integrated into the education sector. The study aimed to verify existing documentation on the use of AI in higher education, highlighting the need to explore in depth the factors influencing its application in educational processes. Furthermore, it calls for consideration of the inherent challenges in its implementation to achieve tangible benefits in the teaching-learning process of university students.
11	García-Martínez et al. (2024).	Artificial intelligence, along with computational sciences, exerts a positive impact on students' academic performance, motivating them to develop meaningful learning in the STEAM (Science, Technology, Engineering, Arts, and Mathematics) areas. However, the researchers concluded that significant challenges remain in incorporating this technology into teaching processes, particularly in ethical terms. This challenge presents itself both for teachers in design and planning and for students in the responsible development of their academic activities.
12	Govender et al. (2024).	Finally, the study demonstrated that students value certain elements offered by hybrid teaching, such as class recordings and permanent access to digital materials from the virtual classroom, allowing them to study at their own pace. The research emphasizes that, from a blended learning approach, South African universities must align with new global trends, which requires a strategic combination of technology and pedagogy.
13	Valencia & Figueroa (2023).	The research focuses on the implementation of AI in education as a tool that allows for the adaptation of educational models to current trends. The researchers highlight the significant challenge faced by teachers and tutors in managing this new technology, suggesting an updated training process in the use of these tools for content production and planning.
14	Muñoz (2023).	The study reveals that AI is generating an unprecedented educational transformation in higher education, enabling web content to be obtained more accurately and personalized. It concluded that AI significantly enhances the experience in a hybrid teaching model that utilizes a digital environment programmed by the teacher with the help of this new technology, which includes innovative tools such as virtual assistants for conducting online tutoring, automating tasks, and analyzing data.

15	Dimitriadou & Lanitis (2023).	The reviewed literature on AI relates to the study of smart classrooms, along with teaching methodologies and technologies enhanced by AI, such as virtual and augmented reality. Effective management of virtual classrooms with artificial intelligence helps understand new methods and techniques that can be implemented in such educational virtual environments (VLE). Finally, the study was directed toward educators and AI programmers, informing the former about the potential and limitations of this technology in the academic field and inspiring the latter with the challenges and particularities of AI-based educational systems.
16	Punar & Yangin (2024).	The use of ChatGPT, one of the most widely used chatbots for acquiring academic knowledge, has been relevant for performing linguistic tasks in various academic areas, especially in English. Regarding language, it was determined that this AI model is useful for formal learning but not for informal writing. The researcher aims to highlight the enormous potential of AI to generate learning assistants during the writing process on specific topics.
17	Bolaño-Garcia & Duarte-Acosta (2024).	The study demonstrated that the use of artificial intelligence offers various advantages that promote improved personalization of learning in hybrid environments, helping educators provide more effective feedback and automated assessment of academic results. However, it is considered that there are still many limitations regarding AI models, such as bias in information, which can lead to incorrect responses.
18	Moskvin (2023).	The research theoretically grounds the development of a structural model for profiling secondary education in hybrid learning conditions, aiming to incorporate it into teaching models, thereby improving learning processes. The researcher concluded that this profiling model for education, utilizing blended learning technologies, is not only viable but also significantly enhances the quality of learning, as demonstrated by experimental work.
19	Winfield & Whitelaw (2024).	The use of the Flipped Classroom methodology alongside video classes with lightboard in a blended learning scenario shows a significant improvement in students' academic performance, particularly for those living far from their institution. This demonstrates that proper structuring of activities using new technologies like AI will transform how academic content is presented in virtual classrooms, significantly improving understanding of the topics studied in class.
20	Roll & Wylie (2021).	The study mentions two parallel lines of research that will impact education in the next 25 years. The first line indicates that the implementation of AI is an evolutionary process centered on current classroom practices and collaborative work among teachers using technologies. The second represents a process that will revolutionize education by integrating new technologies into practical work to achieve objectives that generate a deep and lasting impact on students' learning.
21	Zheng (2020).	The study presents AI as a transformative tool for blended learning due to its reasoning capabilities and deep learning ability to analyze complex situations. Its main impact lies in its capacity to transcend the limitations of physical space, fostering the creation of virtual environments with more flexible interaction between teachers and students, promoting the development of critical thinking. Essentially, the study underscores how AI facilitates the creation of personalized teaching resources to enhance interactive teaching between face-to-face education and hybrid learning.

Generative artificial intelligence and its impact on learning

From the theoretical framework of Piaget's constructivism and Vygotsky's socio-constructivism, it is recognized that learning arises from meaningful experiences in social contexts. Artificial intelligence facilitates this process by offering adaptive and personalized learning environments that respond to the individual rhythms and styles of students (Martínez-Álvarez & Martínez-López, 2024).

The advancement of generative AI has substantially improved educational outcomes by enabling a more personalized search for information, preparing students for a dynamic digital environment (Ahmed & Hamdan, 2024). According to UNESCO (2023), student diversity, curricular load, and time constraints represent challenges in teaching practice. In this context, AI emerges as a strategic tool that optimizes lesson planning, adapting it to the specific needs of each group.

Intelligent learning platforms, such as Microsoft Education and Google Classroom, integrate AI features that facilitate the selection of teaching resources, propose methodological strategies, and suggest evaluation rubrics aligned with learning objectives (López, 2023). However, as Tramallino and Marize Zeni (2024) warn, excessive reliance on these tools can lead to dependency and limit teacher creativity, making ethical and technical training for effective implementation essential.

On the other hand, smart classrooms integrate technological resources such as mobile devices, interactive projectors, augmented reality, and facial recognition sensors, enriching the educational experience. The role of teachers in these environments goes beyond simply incorporating technology; it involves designing meaningful experiences that promote critical thinking and active student participation (Palanisamy et al., 2020; Mircea et al., 2021).

AI, unlike other educational technologies such as ICT or mobile learning, represents the core of Education 4.0 due to its capacity to generate personalized content, automatically assess, and facilitate autonomous and interactive learning (Aymane et al., 2022). As Saini and Goel (2020) suggest, these tools also allow for the evaluation of work based on pedagogical criteria through automated systems, reinforcing teacher support.

Nevertheless, implementing AI requires designing institutional policies that include teacher training, appropriate tool selection, and an ethical understanding of its use (Nuryadin & M, 2023).

Application of AI in hybrid environments and VLE

In the context of hybrid teaching, artificial intelligence has taken on a leading role thanks to advances in generative models, such as ChatGPT, which allow for the creation of educational content, personalization of activities, and real-time responses to student inquiries (Cánovas, 2023).

These developments open a wide range of possibilities aimed at significantly improving the quality of the teaching-learning process at all levels (Cotrina-Aliaga et al., 2021). AI's ability to analyze large volumes of data and transform it into useful information has revolutionized the way research and learning occur in educational settings (Tomalá et al., 2023).

According to Pascuas-Rengifo et al. (2020), the integration of AI favors the creation of virtual classrooms that complement in-person teaching and strengthen the hybrid model. Tools such as educational chatbots that utilize natural language processing (NLP) provide immediate responses to academic questions, enriching the formative process (Ogosi, 2021).

Virtual Learning Environments (VLE) have become key scenarios for post-pandemic education, overcoming barriers of space and time while fostering new forms of interaction and knowledge construction (Arango-Vásquez & Manrique-Losada, 2023). However, Pei et al. (2024) caution that while hybrid learning improves accessibility, it can also lead to social isolation and demotivation among some students.

Technology is an integral part of contemporary lifestyle, and consequently, teaching methodologies have evolved to adapt to this new reality (Cabaleiro & Vera, 2020). AI in VLEs enhances interaction at three levels: between the student and the content, between the teacher and the student, and among peers (López, 2023).

Finally, as Sabulsky (2019) suggests, AI allows for the collection, processing, and analysis of educational data generated in virtual environments, facilitating more precise feedback and the creation of personalized teaching strategies. This methodological evolution marks a transition toward a more adaptive, data-driven, student-centered education.

Conclusions

The study concludes that artificial intelligence (AI) is a fundamental tool for redefining hybrid teaching models, enabling the personalization of every aspect of the educational experience. AI facilitates the adaptation of content according to the rhythms and learning styles of students, considering their individual contexts and

needs. This represents a significant advancement over traditional models, where such adaptations are limited due to the absence of emerging technologies.

Moreover, generative tools based on AI not only increase student motivation and engagement but also optimize teachers' working time, allowing educators to focus on tasks that require greater human interaction, such as personalized support, academic tutoring, and the development of higher-order skills like critical thinking.

Additionally, it was evidenced that virtual environments, an essential element of Blended Learning, are transformed into more dynamic and interactive spaces through the use of AI. Its analytical capabilities enable the identification of patterns in student performance, predicting difficulties in the learning process and offering immediate, specific feedback. This enriches the semi-presential experience, also providing complementary resources such as intelligent tutoring and adaptive activities that keep students actively involved in their education.

References

Ahmed, N. S. J. I., & Hamdan, A. (2024). *Exploring the impact of artificial intelligence on education: A perspective on future learning* (pp. 645–652). https://doi.org/10.1007/978-3-031-62102-4_54

Arango-Vásquez, S. I., & Manrique-Losada, B. (2023). Interacciones comunicativas y colaboración mediada por entornos virtuales de aprendizaje universitarios. *Revista de Educación a Distancia (RED), 23*(76). https://doi.org/10.6018/red.544981

Aymane, E., Fouad, K., Aziz, D., Abdelhak, A., & Abdelfatteh, H. (2022). Inteligencia artificial en educación: Estado del arte. https://n2t.net/ark:/32155/IJCEDS.v2i2.37

Cabaleiro-Cerviño, G., & Vera, C. (2020). The impact of educational technologies in higher education. *GIST – Education and Learning Research Journal, 20*, 155–169. https://doi.org/10.26817/16925777.711

Cánovas Reverte, Ó. (2023). Explorando el papel de la IA en la educación universitaria de la informática a través de una conversación. http://hdl.handle.net/10045/137117

Cotrina-Aliaga, J. C., Vera-Flores, M. Á., Ortiz-Cotrina, W. C., & Sosa-Celi, P. (2021). Uso de la inteligencia artificial (IA) como estrategia en la educación superior. *Revista Iberoamericana de Educación*. https://doi.org/10.31876/ie.vi.81

Govender, S., Kyarkanaye, T., & Eslick, C. (2024). The perceptions of Speech-Language Pathology and Audiology students towards online learning during the COVID-19 pandemic: Considerations for the future professoriate. *South African Journal of Higher Education, 38*(5). https://doi.org/10.20853/38-5-6412

Li, X., Wang, M., Zeng, W., & Lu, W. (2019). A students' action recognition database in smart classroom. *2019 14th International Conference on Computer Science & Education (ICCSE)*, 523–527. https://doi.org/10.1109/ICCSE.2019.8845330

López Umaña, L. I. (2023). El análisis del aprendizaje aplicado como estrategia para mejorar la educación en los entornos virtuales. *Revista Educación*. https://doi.org/10.15517/revedu.v47i2.53945

Martínez-Álvarez, N., & Martínez-López, L. (2024). Sinergia Piaget, Vygotsky y la inteligencia artificial en la educación universitaria. *Vinculatégica EFAN, 10*(4), 70–84. https://doi.org/10.29105/vtga10.4-948

Mircea, M., Stoica, M., & Ghilic-Micu, B. (2021). Investigating the impact of the Internet of Things in higher education environment. *IEEE Access, 9*, 33396–33409. https://doi.org/10.1109/ACCESS.2021.3060964

Núñez-Rojas, N., Meoño-Ballena, J. L., Valdivieso-López, E. J., & Canchumanya, D. C. (2024). Percepciones sobre la aplicación de las aulas Hyflex, Zoom y Canvas: Aportes para el modelo formativo onlife. *Formación Universitaria, 17*(2), 35–46. https://doi.org/10.4067/s0718-50062024000200035

Nuryadin, R., & M, M. (2023). The use of artificial intelligence in education (Literature Review). *Indonesian Journal of Primary Education, 7*(2), 143–156. https://doi.org/10.17509/ijpe.v7i2.64290

Ogosi Auqui, J. A. (2021). Chatbot del proceso de aprendizaje universitario: Una revisión sistemática. *Alpha Centauri, 2*(2), 29–43. https://doi.org/10.47422/ac.v2i2.33

Palanisamy, P., Paavizhi, K., & Saravanakumar, A. R. (2020). Habilidades tecnopedagógicas para el proceso de enseñanza-aprendizaje en la clase inteligente. https://www.researchgate.net/publication/342467314

Pascuas-Rengifo, Y. S., García-Quintero, J. A., & Mercado-Varela, M. A. (2020). Dispositivos móviles en la educación: Tendencias e impacto para la innovación. *Revista Politécnica, 16*(31), 97–109. https://doi.org/10.33571/rpolitec.v16n31a8

Pei, L., Poortman, C., Schildkamp, K., & Benes, N. (2024). Teachers' and students' perceptions of a sense of community in blended education. *Education and Information Technologies, 29*(2), 2117–2155. https://doi.org/10.1007/s10639-023-11853-y

Rocha-Gómez, M. M., Quiroga-García, M. Á., Gloria-Garza, M. A., Espinosa-Rivera, M. C., Cruz-Palma, G., & Rangel-Padilla, E. E. (2024). Aprendizaje combinado: ¿Una alternativa en odontología? *International Journal of Odontostomatology, 18*(4), 450–456. https://doi.org/10.4067/S0718-381X2024000400450

Rojas Castro, P. (2017). *Learning analytics. Una revisión de la literatura*. *Educación y Educadores, 20*(1), 106–128. https://doi.org/10.5294/edu.2017.20.1.6

Sabulsky, G. (2019). Analíticas de aprendizaje para mejorar el aprendizaje y la comunicación a través de entornos virtuales. *Revista Iberoamericana de Educación, 80*(1), 13–30. https://doi.org/10.35362/rie8013340

Saini, M. K., & Goel, N. (2020). How smart are smart classrooms? A review of smart classroom technologies. *ACM Computing Surveys, 52*(6), 1–28. https://doi.org/10.1145/3365757

Silva Acuña, M., Correa Rojas, R., & Mc-Guire Campos, P. (2024). Metodologías activas con inteligencia artificial y su relación con la enseñanza de la matemática en la educación superior en Chile: Estado del arte. *Revista Iberoamericana de Tecnología en Educación y Educación en Tecnología, 37*, e2. https://doi.org/10.24215/18509959.37.e2

Tomalá De La Cruz, M. A., Mascaró Benites, E. M., Carrasco Cachinelli, C. G., & Aroni Caicedo, E. V. (2023). Incidencias de la inteligencia artificial en la educación. *RECIMUNDO, 7*(2), 238–251. https://doi.org/10.26820/recimundo/7.(2).jun.2023.238-251

Tramallino, C. P., & Marize Zeni, A. (2024). Avances y discusiones sobre el uso de inteligencia artificial (IA) en educación. *Educación, 33*(64), 29–54. https://doi.org/10.18800/educacion.202401.M002

UNESCO. (2023). *La inteligencia artificial en la educación*. https://www.unesco.org/es/digital-education/artificial-intelligence

Winfield, J., & Whitelaw, E. (2024). Blended, flipped and lit: Student perceptions and performance under blended learning with a flipped classroom and a lightboard. *South African Journal of Higher Education, 38*(6). https://doi.org/10.20853/38-6-5970