ICTs as pedagogical tools in Latin America: A systematic review

Las TIC como herramientas pedagógicas en Latinoamérica: una revisión sistemática

Emanuel Arroyo Cabeza
https://orcid.org/0009-0009-5313-7151
luis.ecu.facso@hotmail.com
Universidad César Vallejo. Peru

REVISTA INVECOM ISSN: 2739-0063
Received: 20-02-2025 Accepted: 30-04-2025
2026. V6. N1.

Abstract

The incorporation of Information and Communication Technologies (ICTs) in education has significantly transformed teaching and learning processes. In this sense, this article analyzes the impact of these technologies as a pedagogical tool, highlighting their benefits in supporting both teachers and students in Latin American countries. To carry out this analysis, the PRISMA method was applied through a systematic review, in which databases such as Google Scholar and ScienceDirect were consulted. The objective was to locate scientific articles and research published between 2020 and 2025, selecting only those that met the specific theme and context of Latin America. As a result of the search, more than 15,000 works were identified; however, after a rigorous selection process, 17 documents were ultimately chosen for detailed analysis. This analysis concluded that an assertive implementation of ICTs can strengthen students' capacities, allowing them to learn with greater quality. Teachers also benefit from this integration, as the continuous adaptation of technologies in the educational field makes it possible to maximize the benefits within the classroom, improve academic performance, and prepare students to face current challenges with appropriate skills and competencies. Ultimately, by effectively integrating

ICTs in the classroom, we not only improve educational quality but also make a strategic investment in education and the society of the future.

Keywords: technologies, pedagogy, students, teachers.

Resumen

La incorporación de las Tecnologías de la Información y Comunicación (TIC) en la educación ha transformado significativamente los procesos de enseñanza y aprendizaje. En este sentido, el presente artículo analiza el impacto de estas tecnologías como herramienta pedagógica, destacando sus beneficios al brindar apoyo tanto a docentes como a estudiantes en los países de Latinoamérica. Para llevar a cabo este análisis, se aplicó el método PRISMA mediante una revisión sistemática, en la cual se consultaron bases de datos como Google Académico y ScienceDirect. El objetivo fue localizar artículos científicos e investigaciones publicadas entre los años 2020 y 2025, seleccionando únicamente aquellos que cumplían con la temática y el contexto específico de Latinoamérica. Como resultado de la búsqueda, se identificaron más de 15,000 trabajos; sin embargo, tras un proceso riguroso de selección, se eligieron finalmente 17 documentos para su análisis detallado. De este análisis se concluyó que una implementación asertiva de las TIC puede fortalecer las capacidades de los estudiantes, permitiéndoles aprender con mayor calidad. Asimismo, los docentes se benefician de esta integración, ya que la continua adaptación de las tecnologías en el ámbito educativo posibilita maximizar los beneficios dentro del aula, mejorar el rendimiento académico y preparar a los estudiantes para enfrentar los desafíos actuales con habilidades y competencias adecuadas. En definitiva, al integrar efectivamente las TIC en el aula, no solo se mejora la calidad educativa, sino que también se realiza una inversión estratégica en la educación y en la sociedad del futuro.

Palabras clave: tecnologías, pedagogía, estudiantes, docentes.

Introduction

Information and Communication Technologies (ICTs) emerged as tools that revolutionized the way of teaching and learning, whether through electronic devices or digital platforms and applications implemented in educational institutions, aimed at improving the quality of education and adapting it to the demands of this digital generation (Hernández, 2017).

However, despite the enthusiasm generated by their incorporation and the investments made in technological infrastructure, the integration of ICTs in education continues to face multiple challenges. This occurs despite the widespread recognition of their potential benefits, such as fostering collaboration in learning, personalizing instruction, and facilitating access to global resources (González, 2021). Therefore, introducing technology into the classroom does not guarantee an improvement in academic performance on its own, as its effectiveness largely depends on the educational context and the preparation and training of teachers (Mulloa, 2021).

In this regard, the implementation of educational innovations can positively impact students by offering opportunities for interactive and personalized learning (Aivazidi & Michalakelis, 2023). For instance, in primary education, the use of ICTs has been shown to enhance the delivery of instructions and increase student participation (Oladele, 2014). On the other hand, in higher education, ICTs not only facilitate the learning process but also influences administration and services within institutions (Balasubramanian et al., 2009).

Similarly, employing ICTs in educational settings has proven effective in improving students' knowledge retention compared to traditional methods (Hussain et al., 2017). This is because technologies facilitate access to information and enhance memorization through the dynamic presentation of content, which comprehensively benefits the educational process (Haleem et al., 2022).

In the context of these transformations, the future anticipates multiple innovations that will continue to change education and redefine the ways in which teaching and learning occur. Currently, for example, there is an emergence of technologies such as Augmented Reality (AR) and Virtual Reality (VR), which create three-dimensional and interactive learning environments, enhancing areas such as history, science, and art (Socrática, 2023).

Nevertheless, it is essential to recognize that technologies alone do not replace human interaction or the role of the teacher in the educational process. Therefore, appropriate training for teachers is crucial to ensure that ICTs are used in a meaningful and effective manner in this field (Alderete & Formichella, 2016). Consequently, this article aims to analyze the integration of technologies as pedagogical tools in Latin America through a systematic

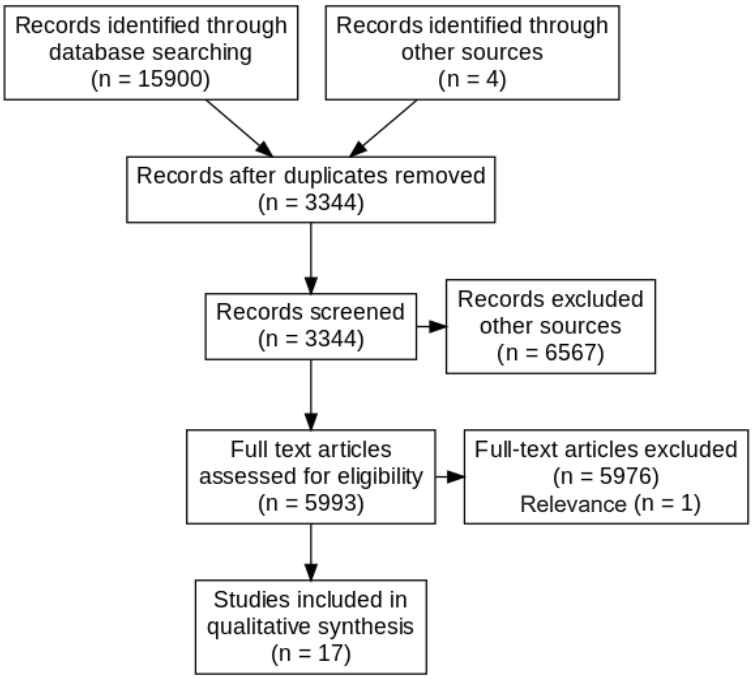
review of empirical studies based on evidence, given the growing relevance of this topic in the contemporary educational landscape.

Methodology

This study was developed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method, a guideline designed to facilitate systematic reviews by clearly documenting the motivations for the review, the approaches of the authors of the analyzed documents, and the findings obtained. In particular, the 2020 version updates and replaces the 2009 statement, incorporating improvements in the identification, selection, evaluation, and synthesis of publications related to scientific advancements (Page et al., 2020).

In this context, the search focused on scientific evidence published between 2021 and 2025 that addressed the impact of Information and Communication Technologies as pedagogical tools in Latin America. Inclusion criteria considered the publication period, thematic relevance, and regional context. Through the rigorous application of the PRISMA method (see Figure 1), a total of 17 studies were ultimately selected for a comprehensive and systematic analysis of the relevant literature.

Figure 1
PRISMA Diagram



Results

The review of studies on ICTs as a pedagogical tool in Latin America allowed for the analysis of various works and scientific articles from different countries and approached from multiple perspectives. For example, in Ecuador, Balderramo et al. (2024) present a pedagogical proposal centered on the use of Information and Communication Technologies in the teaching of Natural Sciences, aimed at developing collaborative learning. In this regard, they designed a strategy that utilizes the Quizizz platform to teach Newton's Laws, applying innovative pedagogical approaches that promote collaborative learning. This proposal highlighted the importance of incorporating ICTs into teaching practices within educational institutions, also emphasizing the need for continuous training of teachers for its proper implementation.

In a similar context, Barcos & Santos (2022) studied the use of Digital Educational Resources (DER) and their influence on teachers' pedagogical competencies in history education during the SARS-CoV-2 pandemic. Their analysis revealed that the methodological handling of DER is closely linked to the development of teaching

skills in virtual environments. Meanwhile, Morales & Leguizamón (2022) conducted a literature review on pedagogical practice and the use of ICTs over the past two decades, especially in the context of the pandemic, identifying trends in advancements and demands for their application. They also noted that the adverse effects of these technologies can be minimized through best practices and adequate teacher training.

Regarding the pandemic context, Asmal (2023) carried out a theoretical analysis and critical reflection on the role of the teacher in the use of ICTs during the teaching-learning process, generating innovative experiences. Their study evaluated the strengths and limitations in the implementation of technological resources, concluding that ongoing training is fundamental to improving teaching competencies and effectively responding to the needs of the educational environment in a digitalized society.

It is important to highlight that ICTs in education open up multiple pedagogical possibilities, especially evident during the COVID-19 pandemic. These technologies aim to achieve meaningful learning that complements and strengthens face-to-face classes, which in turn demands the exploration of various research lines to deepen their impact and application (Mariaca et al., 2022).

In Peru, Saavedra et al. (2024) focused on teaching thermodynamics, emphasizing its abstract nature and the mathematical requirements it entails. Their study proposes innovative methodologies, such as the use of ICTs combined with practical applications that foster critical thinking, problem-solving, and enhance students' understanding and relevance of this content. Similarly, Mora et al. (2023) highlighted the importance of technology in facilitating mathematics learning, promoting collaborative work through networks for exchanging ideas and experiences. These tools enable teachers to plan and monitor learning using devices such as smartphones, computers, and televisions.

On another note, De la Ese Burgos (2023) emphasizes the need to adapt the educational model to the information society, implementing tools that leverage the pedagogical benefits of Web 2.0. In this context, he highlights the role of ICTs, Technologies for Learning and Knowledge (TAC), and Technologies for Empowerment and Participation (TEP), which develop problem-solving skills in students. Additionally, Dávila & Del Campo (2024) identified the theoretical foundations of English teaching in a Virtual Learning Environment (AVA), underscoring the fundamental role of the teacher and recommending specific training programs to strengthen their performance.

In Colombia, Vente & Vallecilla (2022) analyzed how ICTs serve as a pedagogical strategy to strengthen the School Environmental Project (PRAE), integrating institutional, biophysical, and communicative resources into the learning process. They implemented a digital didactic platform aimed at enhancing cognitive and communicative competencies. However, they noted a disconnection between environmental education policies and the structure of the PRAE, as well as technological limitations within the institution, leading to a disconnect between environmental education and the local context, affecting its relevance for students.

Bernal & Rengifo (2021) examined innovative pedagogical practices involving ICTs, observing that teachers apply innovations incrementally based on curricular needs and daily practice, but do not continuously utilize Web 2.0 tools or Virtual Learning Environments (EVA) for out-of-class activities. In this context, Sandoval et al. (2023) provided Colombian teachers with a repertoire of over 150 free technological tools, including forms, surveys, digital platforms, photo and video editing programs, digital books and magazines, mobile applications, presentations, and converters, among other resources that can enhance pedagogical practices across various subjects.

Furthermore, Bueno (2023) studied the use of ICTs tools to develop mathematical thinking and processes through websites, YouTube, and mobile applications. His research concluded that there is currently a wide variety of websites, applications, and channels that energize learning, alongside teaching methods that educators should employ to leverage these resources. In line with this, Largo et al. (2024) presented an intervention in chemistry teaching mediated by ICTs, achieving a satisfactory response from higher education students. Their results indicate that educational processes supported by these tools foster motivation for the subject, especially when accompanied by adequate teacher support.

Additionally, Bejarano & Guerrero (2021) evaluated students' capabilities and skills for solving mathematical problems, aiming to implement a technological tool that, through a structured strategy, strengthens these skills and enables students to successfully face challenges in this area. In this regard, it is emphasized that the incorporation of ICTs contributes to the transformation of pedagogical practices oriented toward the development of logical-mathematical thinking. These technologies constitute a motivating tool that, if used appropriately, can significantly enhance learning and competencies across various disciplines (Salamanca & López, 2021).

On another front, Julio et al. (2024) investigated the contribution of ICTs to the development of fine and gross motor skills, demonstrating that their integration as pedagogical tools strengthens motor abilities and

promotes greater incorporation of technologies in educational practice, benefiting both the physical and cognitive development of students.

Finally, Muñoz et al. (2025) analyzed, through a systematic review, the benefits and challenges faced by ICTs in secondary education. Although educational policies promote their integration, obstacles to effective adoption exist, such as the lack of teacher training and insufficient technical support. Nevertheless, it is acknowledged that these technologies transform teaching, facilitate interactive and collaborative learning, improve knowledge retention, and develop essential digital skills for the future.

In summary, the review of studies reveals that the impact of ICTs as a pedagogical tool is reflected in academic performance, improved understanding and retention of content, as well as in the development of cognitive and metacognitive skills, among other benefits arising from their implementation in various educational contexts and levels.

Conclusions

In conclusion, it is emphasized that the incorporation of ICTs in the pedagogical practices implemented by teachers fundamentally arises from the need for adequate training and preparation for their effective use. This is particularly relevant, as it has been clearly demonstrated that technologies provide significant benefits across different educational levels and various fields of knowledge, both in the exact sciences and in the humanities and social sciences.

Moreover, the use of ICTs as pedagogical tools experienced a notable surge during the COVID-19 pandemic, when, in an unprecedented manner, various technologies were utilized to ensure educational continuity under confinement conditions. This experience showcased a positive effectiveness in the development of competencies, skills, memorization, and practical application of content within the educational environment.

Ultimately, it can be affirmed that a proper and strategic implementation of ICTs strengthens students' capabilities, enabling them to learn effectively in both face-to-face and virtual modalities. Additionally, teachers benefit from this integration, as the continuous adaptation of technologies in education maximizes the advantages in the classroom. This not only contributes to improved academic performance but also prepares students to face the challenges of the 21st century. Therefore, the effective integration of ICTs represents a key action for the future of education and for the holistic development of students.

References

Aivazidi, M., & Michalakelis, C. (2023). Information and Communication Technologies in primary education: Teachers' perceptions in Greece. *Informatics (MDPI)*, *10*(3), 57. https://doi.org/10.3390/informatics10030057

Alderete, M. V., & Formichella, M. M. (2016). The effect of ICTs on academic achievement: the Conectar Igualdad programme in Argentina. *CEPAL Review,* 119, 83-100. https://doi.org/10.18356/f23c6662-en

Anele (2021). ¿Qué impacto tiene el uso de las TIC en el rendimiento escolar en matemáticas? *Anele***.** https://anele.org/ventana-de-anele/noticias/que-impacto-tiene-el-uso-de-las-tic-en-el-rendimiento-escolar-en-matematicas

Asmal Lozano, K. N. (2023). La formación docente y el uso de las TIC para el desarrollo de prácticas pedagógicas innovadoras. *Ciencia Latina Revista Científica Multidisciplinar*, 7(1), 1352-1363. https://doi.org/10.37811/cl_rcm.v7i1.4485

Balasubramanian, K., Clarke Okah, W., John, D., Ferreira, F., Kanwar, A., Kwan, A., Lesperance, J., Mallet, J., Umar, A., & West, P. (2009). *ICTs for higher education: background paper from the Commonwealth of Learning*. https://unesdoc.unesco.org/ark:/48223/pf0000183207

Balderramo-Vélez, H. F., Cárdenas-Sari, A. P., Belén-Godino, C. M., & Álzate-Peralta, L. A. (2024). Aprendizaje colaborativo potenciado por las TIC como metodología de enseñanza del siglo XXI. *MQRInvestigar*, *8*(1), 3217–3239. https://doi.org/10.56048/MQR20225.8.1.2024.3217-3239

Barcos, E., & Santos, E. (2022). Uso de recursos educativos digitales para mejorar las competencias pedagógicas en la enseñanza de Historia. *Episteme Koinonía, 5*(10). https://doi.org/10.35381/e.k.v5i10.1850

Bejarano Cordoba, A. S., & Guerrero Godoy, R. S. (2021). Uso de herramientas tecnológicas para la resolución de problemas en el área de las matemáticas. *Revista EDUCARE - UPEL-IPB - Segunda Nueva Etapa 2.0*, *25*(3), 7–27. https://doi.org/10.46498/reduipb.v25i3.1522

Bueno, M. (2023). las TIC como mediadoras didácticas en los procesos de aprendizaje del área de matemáticas. *Revista Docentes 2.0, 15*(2). https://doi.org/10.37843/rted.v15i2.318

Dávila Acevedo, M. R., & Del Campo Machado, R. M. (2024). Tendencias pedagógicas para el fortalecimiento de las habilidades de habla y escucha para docentes de inglés en preescolar, a través de herramientas digitales. *Ciencia Latina Revista Científica Multidisciplinar*, *8*(3), 11286-11308. https://doi.org/10.37811/cl_rcm.v8i3.122

De La Ese Burgos, T. D. (2023). Los Retos de la Educación en el siglo XXI: TIC, TAC, TEP en las competencias pedagógicas. *Revista REVICC*, *3*(5), 63–73. https://doi.org/10.59764/revicc.v3i5.78

González Vidal, I. M. (2021). Influencia de las TIC en el rendimiento escolar de estudiantes vulnerables. *RIED Revista Iberoamericana de Educación a Distancia*, *24*(1), 351–365. https://doi.org/10.5944/ried.24.1.27960

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hernandez, R. M. (2017). Impacto de las TIC en la educación: Retos y perspectivas. *Propósitos y Representaciones*, *5*(1), 325. https://doi.org/10.20511/pyr2017.v5n1.149

Hossain Khan, S., & Hasan, M. (2013). Introducing ICT into Teacher-Training Programs: Problems in Bangladesh. *Journal of Education and Practice*, *4*(14), 79–86. https://core.ac.uk/download/pdf/234634544.pdf

Julio Licona, K., Petro Guzmán, M., & Garavito Campillo, E. (2024). Las TIC como herramientas pedagógicas para el desarrollo de la motricidad en estudiantes de transición. *Revista Latinoamericana de Calidad Educativa*, *2*(1), 19-29. https://doi.org/10.70625/rlce/54

Largo, W., Zuluaga, J., López, M., & Grajales, Y. (2024). Enseñanza de la química mediada por TIC: un cambio de paradigma en una educación en emergencia. *Revista Interamericana, 15*(2). https://doi.org/10.15332/25005421.6527

Mariaca, M., Zagalaz, M., Campoy, T., González, C. (2022) Revisión bibliográfica sobre el uso de las TIC en la educación. *Revista Internacional de Investigación en Ciencias Sociales, 8*(1). https://revistacientifica.uaa.edu.py/index.php/riics/article/view/1115

Medium (2023). Future trends in digital education: A glimpse into the next decade. *Medium*. https://socratica.medium.com/future-trends-in-digital-education-a- glimpse-into-the-next-decade-38407feea21d

Mora Pluas, P. M., Dueñas Macias, L. B., Ruiz Ley, R. G., Suarez Herrera, J. V., & Conde Suarez, L. O. (2023). Incidencia de la tecnología como herramienta pedagógica para facilitar el aprendizaje de las matemáticas. *Ciencia Latina Revista Científica Multidisciplinar*, *7*(4), 2171-2193. https://doi.org/10.37811/cl_rcm.v7i4.7039

Morales, O., & Leguizamón, M. (2022) Revisión de reflexiones documentadas de las TIC en las prácticas pedagógicas disertaciones vigentes en tiempos de pandemia. *Revista Academia y Virtualidad, 5*(2). 57-76.

Muñoz Baldeón, V., Moreno Barzola, V., Goyes Castillo, G., & Castro Diaz, I. (2024). El uso de las TIC como herramienta de enseñanza en la educación secundaria: beneficios y retos. *Revista Social Fronteriza, 4*(6), e543. https://doi.org/10.59814/resofro.2024.4(6)543

Oladele, O. I. (2014). Effect of Information Communication Technology (ICT) on agricultural information access among extension officers in North West Province South Africa. *South African Journal of Agricultural Extension (SAJAE)*, *43*(2). https://www.academia.edu/8005123/Effect_of_Information_Communication_Technology_in_Primary_Schools

Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffmann, T., Mulrow, C., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S., Chou, R., Glanville, J., Grimshaw, J., Hróbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo-Wilson, E., McDonald, S., McGuinness, L., Stewart, L., Thomas, J., Tricco, A., Welch, V., Whiting, P., Moher, D., Yepes, J., Urrútia, G., Romero, M., Alonso-Fernández, S. (2020). Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. *Revista Española de Cardiología, 74*(9), 790-799. https://doi.org/10.1016/j.recesp.2021.06.016

Parra, L., Rengifo, K. (2021) Prácticas pedagógicas innovadoras mediadas por las TIC. *Educación, 30*(59) http://dx.doi.org/10.18800/educacion.202102.012

Saavedra-Mera, K. A., Valverde-Medina, L. M., Caicedo-Perlaza, L. C., & Puyol-Cortez, J. L. (2024). El estudio de la termodinámica química desde una perspectiva pedagógica. *Journal of Economic and Social Science Research*, *4*(3), 89-104. https://doi.org/10.55813/gaea/jessr/v4/n3/122

Salamanca, D., & López, A. (2021). Las TIC en la práctica pedagógica como estrategia de fortalecimiento, motivación y desarrollo del pensamiento lógico matemático en los niños de grado segundo del colegio Sierra Morena IED. [Tesis de Maestría], Universidad Cooperativa de Colombia.

Sandoval, A., Pulido, M., Alba, P. (2023) Categorización de las TIC para la mediación pedagógica en el aula de clase. *Revista Académica Creatividad e Innovación en Educación,* *2*(1). https://revistas.unicyt.org/index.php/cie-academic-journal/article/view/92

Vente, Y. C., & Vallecilla, C. K. (2022). TICs, estrategias pedagógicas para fortalecer el PRAE en la institución educativa Simón Bolívar de Buenaventura. *Ciencia Latina Revista Científica Multidisciplinar*, *6*(2), 208-225. https://doi.org/10.37811/cl_rcm.v6i2.1880