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Current panorama of technological tools applied to university learning: A systematic review

Panorama actual de las herramientas tecnológicas aplicadas al aprendizaje universitario: una revisión sistemática

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Abstract

The aim of this research is to conduct a systematic and critical review of the current state of technological tools applied to university learning. The methodological process was guided by the PRISMA protocol, applying inclusion criteria that prioritized empirical and theoretical research developed in Spanish-speaking contexts. Thirty scientific articles indexed in Scopus and published between 2019 and 2025 were selected and analyzed. The findings reveal a wide variety of digital resources, such as virtual platforms, gamified environments, immersive technologies, mobile applications, and automatic feedback systems, which have a direct impact on university teaching and learning methods. However, persistent challenges are also identified, such as limited pedagogical appropriation, poor teacher training, and gaps in access to these technologies. It is concluded that the educational impact of technological tools does not depend solely on their level of technical sophistication, but fundamentally on their critical integration into well-structured teaching models aimed at developing meaningful, autonomous, and contextualized learning.

Keywords: educational innovation, digital environments, pedagogical transformation.

Resumen

La presente investigación tiene como objetivo realizar una revisión sistemática y crítica del estado actual de las herramientas tecnológicas aplicadas al aprendizaje universitario. El proceso metodológico se rigió por el protocolo PRISMA, aplicando criterios de inclusión que priorizaron investigaciones empíricas y teóricas desarrolladas en contextos hispanohablantes. Se seleccionaron y analizaron 30 artículos científicos indexados en Scopus, publicados entre los años 2019 y 2025. Los hallazgos evidencian una amplia variedad de recursos digitales, tales como plataformas virtuales, entornos gamificados, tecnologías inmersivas, aplicaciones móviles y sistemas de retroalimentación automática, que inciden de manera directa en los modos de enseñanza y aprendizaje universitario. No obstante, también se identifican desafíos persistentes, como la limitada apropiación pedagógica, la escasa capacitación docente y las brechas en el acceso a estas tecnologías. Se concluye que el impacto educativo de las herramientas tecnológicas no depende únicamente de su nivel de sofisticación técnica, sino fundamentalmente de su integración crítica en modelos didácticos bien estructurados, orientados al desarrollo de aprendizajes significativos, autónomos y contextualizados.

Palabras clave: innovación educativa, ambientes digitales y transformación pedagógica.

Introduction

In the last decade, the university educational context has witnessed profound and disruptive changes; the incorporation and implementation of technological tools not only modify the way of teaching but also redefine the very essence of learning. Today, the classroom is no longer confined to four walls or rigid schedules; it extends into dynamic, ubiquitous, and interconnected digital ecosystems. In this new paradigm, learning is woven into a network, and technologies emerge not merely as auxiliary tools but as key players in the educational process. Far from being a passing trend, this reconfiguration reveals itself as an inevitable necessity for institutional, pedagogical, and student adaptation.

Numerous recent studies highlight that the use of digital platforms, mobile applications, multimedia resources, academic social networks, artificial intelligence, and even immersive environments like augmented reality is generating new opportunities for personalized learning, the development of digital competencies, and students' intrinsic motivation. For instance, the study by Pozo-Sánchez et al. (2020) demonstrates how the flipped learning model, mediated by audiovisual tools and asynchronous transmissions, enhances critical thinking and student autonomy in university contexts. However, this technological evolution has not been free from tensions, resistances, and structural challenges.

As revealed by Cedeño et al. (2022), the widespread use of smartphones in higher education, while useful for ensuring access and flexibility, has also generated an ambivalent phenomenon, where self-directed learning coexists with digital distraction, largely depending on the pedagogical intent of the instructor and the self-regulation of the student. Similarly, research by Andrade et al. (2024) emphasizes that social networks like YouTube and Instagram have been appropriated by innovative educators as educational resources, but this usage requires solid media competencies to avoid leading to superficial or merely informative experiences.

The COVID-19 pandemic marked an irreversible turning point. Within weeks, thousands of universities had to virtualize their teaching without prior precedents or structured planning. Although this shift was, in many cases, chaotic, it also opened a massive gateway to educational platforms, videoconferencing systems, collaborative virtual classrooms, and automated assessment tools. The work of Salas Rueda et al. (2023), focused on the integration of technology in the "Clinical Method" course, illustrates how data science allowed the analysis of interaction patterns that were previously invisible, thus providing new pathways to understand and optimize the teaching-learning process.

In the current context of profound transformation driven by digitalization and educational innovation, this article aims to conduct a systematic and critical review of the current state of technological tools applied to university learning. It seeks to analyze, from a comprehensive perspective, how these tools have impacted teaching-learning processes, identifying both significant advances and persistent challenges. Furthermore, the study intends to examine the effectiveness of digital technologies in enhancing educational quality, developing digital competencies in students and educators, and adapting university institutions to new educational environments. Finally, it aims to identify best practices, emerging trends, and areas of opportunity for future research, in order to provide recommendations that facilitate the effective integration of technology in contemporary higher education.

Methodology

This study was developed under the framework of a systematic review, a methodological tool that allows for the organization, examination, and synthesis of available scientific knowledge on a given phenomenon. In this case, the aim was to understand how technological tools are being applied in university learning processes through a rigorous analysis of published research from recent years. To this end, the guidelines proposed by the PRISMA 2020 protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) were adopted, recognized for providing clarity, coherence, and traceability in scientific review processes.

The review was conducted between January and April 2025, focusing exclusively on peer-reviewed scientific articles. The search was carried out in the Scopus database, chosen for its extensive coverage of updated scientific literature and its inclusion of high-impact journals in the fields of education, technology, and social sciences. To ensure precise and relevant document retrieval, search strings were defined that combined the key terms "technological tools" and "university learning," using Boolean operators (AND) and filters for date, document type, and language. Inclusion criteria were established to ensure the relevance and consistency of selected studies. Only original scientific articles of empirical or theoretical nature, published between 2019 and 2025, that directly addressed the use of technological tools in university contexts were accepted. Additionally, only works written in Spanish were included, focusing the analysis on research conducted in the Spanish-speaking realm,

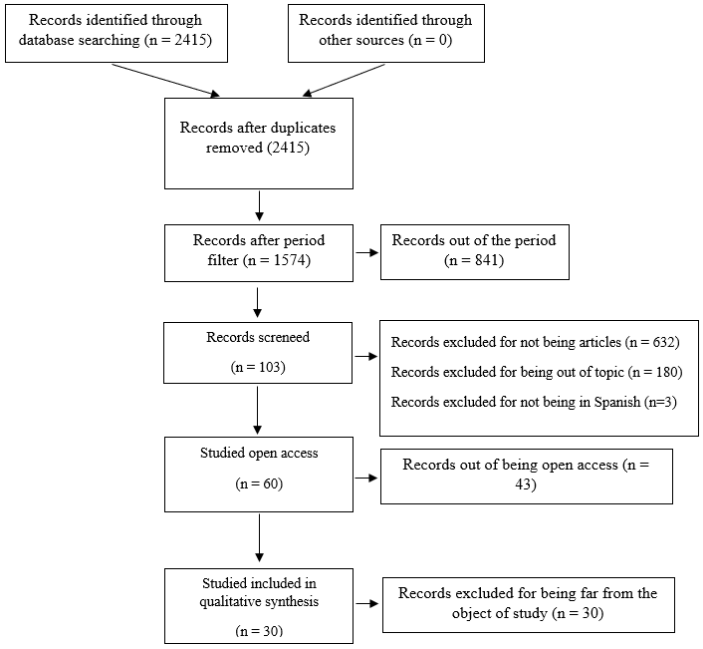
primarily in Latin America and Spain. The applied search pathway was as follows: TITLE-ABS-KEY ("technological tools") AND TITLE-ABS-KEY ("university learning") AND PUBYEAR > 2018 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "Spanish")).

Among the exclusion criteria, all articles published before 2019 were discarded, as well as duplicates or those lacking a clear methodological foundation. Studies that did not explicitly address the link between educational technologies and university learning or that pertained to educational levels other than higher education were also excluded. The selection process followed a structured sequential logic divided into stages. In the initial identification phase, 2,415 potential documents were located. During the screening stage, duplicates, irrelevant articles, or those lacking substantial information in their abstracts were removed. In the third phase, publication date, document type, and language filters were applied, resulting in 60 articles that met basic relevance criteria. Finally, after a complete reading of each of these documents, 30 scientific articles were selected that fulfilled all standards of quality, rigor, and direct relevance to the study object.

The use of this methodological strategy not only allowed for the gathering of varied and recent evidence on the phenomenon in question but also facilitated the identification of points of convergence, conceptual tensions, and theoretical gaps in the available literature. Thus, this systematic review does not merely compile information but proposes an interpretative and critical reading that enables understanding how technological tools are shaping, mediating, or transforming teaching-learning processes in contemporary universities.

Figure 1

Flowchart of the article selection process using the PRISMA method



Results and discussion

Based on the analysis of the thirty selected articles, a set of patterns has been identified that reflects a progressive, albeit uneven, evolution in the use of technological tools within the university context. The trajectory of these experiences reveals that while technological adoption has accelerated, its effective pedagogical integration depends on multiple contextual variables: digital competencies of faculty, curricular alignment, resource access, and student acceptance. Three major themes emerge from this review: (1) the functionality of technological tools to enrich teaching and assessment; (2) their capacity to motivate and personalize learning; and (3) the persistent challenges in their sustainable implementation. Recurrent technologies identified include LMS platforms, AR, VR, mobile applications, academic social networks, simulators, and authoring software, each having varied impacts on the educational experience.

This plurality of tools, rather than constituting a homogeneous trend, reveals a mosaic of approaches. While some experiences stand out for their transformative innovation, others demonstrate a more instrumental and marginal use. Thus, between the promise of educational digitalization and the actual conditions of its adoption, a constant antithesis emerges between potential and practice.

Consequently, the incorporation of technological tools in the university sector has ceased to be a mere sign of modernity and has become a structural necessity that reconfigures teaching practices and redefines the role of the student. In light of the reviewed articles, a non-linear, sometimes contradictory transition is evident between technological availability and its pedagogical appropriation. This transition, mediated by didactic intent, faculty training, and institutional conditions, results in diverse experiences that oscillate between transformative innovation and the mere digitalization of traditional practices.

In the document by Campón et al. (2023), it is proposed that LMS platforms act as integrative environments for content, tasks, forums, and assessments. Moodle, as a paradigmatic case, is configured as a space that enables both asynchronicity and traceability of learning. However, the transformative potential of these environments is limited when their use is reduced to mere file uploads or notifications, without any methodological redesign. This finding is consistent with the assertions of González et al. (2023), which indicate that the use of academic social networks like Edmodo can create a more collaborative environment than some traditional LMS, especially when horizontal peer interaction is privileged. Thus, a first contradiction emerges: the most technologically robust platforms are not always the most pedagogically effective, reinforcing the idea that educational value lies not in the tool itself but in its contextualized appropriation.

Regarding the impact of gamified and digital authoring tools, Kahoot and Genially have become emblems of a new educational aesthetic characterized by visual, dynamic, and participatory nature. According to Ortí (2024), gamification enhances motivation and attention, acting as a didactic "hook"; however, its long-term effectiveness depends on its alignment with clear learning objectives and coherent assessment strategies. Meanwhile, Arango and Manrique (2023) demonstrate how tools like Genially or Canva allow students to create interactive presentations that reflect more complex and creative thought processes. The difference between these experiences lies in the degree of student agency: while gamification often keeps the student as a recipient of external dynamics, digital authorship positions them as sense-makers. This comparison highlights that extrinsic motivation (play) cannot replace the intrinsic construction of knowledge (creation).

With respect to the potential of immersive technologies, Hernández et al. (2025) analyze the use of virtual simulators in laboratory contexts, particularly in health sciences, while another study delves into the experience of Virtual Reality (VR) in psychology. Both studies agree that sensory immersion amplifies conceptual understanding, especially in abstract or high-risk practical content. In the case of the simulator, students can practice procedures without risking real patients; in the case of VR, they can explore extreme psychological situations safely. However, Gómez (2021) warns about the inequality of access to these technologies, which can lead to a learning gap between those who access immersive experiences and those who do not. This asymmetry compels a reevaluation of technological equity, not merely as access to devices but as access to quality formative experiences.

López et al. (2023) introduce another element into the discussion: the mobility of learning. The use of mobile applications for teaching foreign languages has enabled everyday, continuous, and personalized practices. Learning is no longer confined to the classroom or class schedule; it becomes integrated into the student's daily life. However, this ubiquity poses new challenges: what happens when autonomy turns into isolation? The study reveals that while applications allow for frequent practice, the lack of teacher guidance creates pedagogical gaps. This finding can be contrasted with the work of Arellano et al. (2021), where flipped classrooms, by modifying traditional class time, require intense prior planning from teachers so that students can work independently with specifically designed materials. Here, a structural tension is visible: greater autonomy does not equate to a lesser need for pedagogical mediation.

An emerging dimension in the studies is the automation of educational processes through artificial intelligence, as shown by Romero et al. (2021). This technology promises instant and personalized feedback but raises ethical questions about the dehumanization of teaching. Can a platform, however precise it may be, interpret the emotions, comprehension gaps, or semantic misunderstandings of a student? Automated feedback may be effective for objective tasks but insufficient for transversal competencies like argumentation or empathy. In contrast, Rayón et al. (2022) analyze tools like Socrative, which, while also automating processes, allow the teacher to interpret results and act accordingly, reconfiguring strategies in real-time. The difference lies in the role of professional judgment: in Socrative, the teacher remains a mediator; in AI systems, this role tends to diminish.

In Martí (2025), the use of interactive digital whiteboards (IDWs) is described as elements that not only replace chalk but also amplify the classroom experience through multimedia resources. However, this technological advancement becomes an empty tool when used as a passive projective support, reproducing traditional practices. The same contrast is observed in Andrade et al. (2024), where the use of Google Docs and other co-authoring tools not only enables real-time collaboration but also reinforces metacognitive processes by requiring students to make their decisions visible, justify their arguments, and review their work under the scrutiny of others. In other words, while in the first case technology is limited to "showing," in the second, it allows for

"thinking with others," highlighting that pedagogical depth does not depend on the tool itself but on the type of interaction it promotes. On another note, George and Glasserman (2022) demonstrate Moodle's potential as a space for continuous assessment, particularly through automated rubrics, assignment submissions, and formative feedback.

A particularly significant contribution is found in Criado (2024), which examines the use of digital technologies for formative assessment in hybrid environments. Unlike traditional approaches focused on certifying knowledge, this study highlights how digital tools, such as automated rubrics, interactive platforms, or immediate feedback applications, enable teachers to monitor the learning process in real-time, adjust their strategies, and offer personalized guidance. This formative use of assessment transforms the classic paradigm of "assessing at the end" into a logic of "assessing to learn."

Ruiz (2020) examines the role of the teacher as author and tutor in virtual environments, based on the methodological design of massive open online courses (MOOCs) supported by platforms like Moodle. This study is key because it shifts the focus from the tool to the agent: the teacher is no longer a mere transmitter of content but an instructional designer, a mediator, and a curator of experiences. This perspective is complemented by Mascarell (2022), who reconstructs the evolution of ICT in university art education from 1980 to the pandemic. It is noted that technological advancements have always faced resistance, and only when they are articulated with teacher motivation do they impact pedagogical practice. Both studies support the idea that technological change in universities is fundamentally a cultural shift: without training, time, and recognition for digital teaching work, tools remain underutilized or, worse, instrumentalized without pedagogical meaning.

The need to critically review tools also appears in Salcines et al. (2022), who present a longitudinal study on the use of smartphones in university contexts. Initially enthusiastic teachers become more skeptical over the years, perceiving that while mobile phones are useful for communication and access to information, they do not guarantee an automatic improvement in teaching methodologies. This change in perception contrasts with Salas et al. (2023), where machine learning algorithms are employed to analyze how the combined use of Moodle and smartphones enhances motivation, satisfaction, and knowledge assimilation in a physics course. Both articles engage in a central antithesis: the same device can be a facilitator or a distractor, depending on the context, purpose, and pedagogical mediation. The challenge, therefore, is not to prohibit or idolize technology but to educate for its critical, situated, and ethically oriented use.

This reflection is deepened in Pozo et al. (2020), who revisit traditional media such as radio and television in a flipped learning environment, which the authors call "retro-innovation." Here, the paradox is powerful: the "old" is re-signified as an innovative resource when inserted into a new methodological framework. The comparison with Salas et al. (2022), which integrates contemporary technologies like Zoom, Padlet, or Moodle in the pandemic context, shows that it is not the technology itself that determines innovation but how it is articulated with a clear, flexible, and student-centered pedagogical proposal.

Martínez and Hunt (2020) provide another relevant perspective by studying the use of Netflix and subtitles as tools for foreign language learning in multimodal environments. The combination of the CLIL approach with streaming platforms opens the door to a type of transversal didactics situated in students' cultural interests. Here, motivation is achieved not by imposing content but through the intersection of culture, language, and technology. This type of convergence connects with Salas (2023), who systematizes technological experiences in teacher training and proposes critical digital literacy as a transversal axis. Both studies agree that preparing future professionals involves not only teaching them to use tools but also helping them understand their social, communicative, and epistemological implications.

The line of thought concludes with Quivio et al. (2024), who analyze the impact of hybrid education on mathematics teaching in higher education. The study demonstrates improvements in understanding, problem-solving, and mathematical argumentation thanks to the combination of in-person and virtual sessions. This hybrid approach, beyond being a response to the pandemic, reveals itself as a sustainable proposal for the flexibility and personalization of learning. Similarly, in Romero et al. (2023), the application of augmented reality in biology is evaluated, showing how learning is enhanced by the three-dimensional manipulation of digital objects. Compared, both studies reflect the richness of hybrid and immersive experiences: one from the perspective of the temporal and spatial organization of learning, and the other from the sensory and cognitive reconfiguration of content.

Ultimately, the cross-sectional analysis of the thirty examined studies reveals that technology applied to university learning does not constitute a one-size-fits-all recipe or an automatic solution but rather a constellation of possibilities whose value lies in its conscious, critical, and contextualized pedagogical integration. Far from representing a dichotomy between the traditional and the digital, technological tools expand the methodological repertoire of educators and diversify the learning pathways of students. However, the effectiveness of these tools is conditioned by structural factors—such as institutional infrastructure, teacher training, organizational culture,

and equity in access—and by subjective factors, such as motivation, autonomy, and the technological appropriation of the involved actors. Thus, contemporary universities are called not only to adopt emerging technologies but to rethink their educational models from a more participatory, multimodal, and situated logic that understands technology not as an end in itself but as a means to humanize, flexibilize, and enrich university learning in the 21st century.

Conclusions

This systematic review has allowed for the identification, classification, and interpretation of the main trends and patterns related to the use of technological tools in the context of contemporary university learning. Based on the analysis of thirty recent empirical studies, it is evident that digital technologies have ceased to be mere auxiliary resources and have become true media structures of the educational process, capable of reorganizing time, space, and roles in higher education.

One of the central findings is that the pedagogical value of these tools does not reside in their technical sophistication but in their articulation with clear and sustained methodological strategies. Successful experiences with LMS platforms, flipped classrooms, simulators, mobile resources, or immersive environments demonstrate that technology, when aligned with intentional didactic goals, can promote more meaningful, collaborative, autonomous, and contextualized learning. However, the same studies caution that, in the absence of teacher training, institutional support, or pedagogical planning, many of these tools are reduced to mere operational use, lacking real impact on learning.

Moreover, this review highlights a growing diversification of approaches and media, ranging from re-signified traditional resources (such as radio and television) to applications based on artificial intelligence, augmented reality, or gamified environments. This plurality should not be understood as dispersion but rather as a response to the multiple ways of learning and teaching in a digital, mobile, and complex society. In this regard, university learning is projected as a hybrid phenomenon that occurs both inside and outside the classroom, in various formats, channels, and devices, and that demands new frameworks for evaluation, support, and knowledge construction.

Finally, the analyzed results also reveal unresolved tensions: persistent digital divides, inequalities in access to innovation, fragility in the processes of technological appropriation, and a lack of sustained educational policies. Therefore, it is concluded that the integration of technologies in higher education should not be limited to the incorporation of resources but should be conceived as part of a deeper transformation that includes curricular redesign, continuous teacher training, active student participation, and a critical review of traditional educational models.

Consequently, this study invites a rethinking of the role of the university as a flexible, inclusive, and creative space, where technology is not an end in itself but a means to enhance teaching-learning processes, strengthen the intellectual autonomy of students, and build new forms of knowledge committed to the challenges of the 21st century.

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