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Umbrella Review on Advanced Instructional Design in Distance Higher Education

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ABSTRACT

Digital transformation has brought about a profound change in learning spaces, placing instructional design as a central element for the quality of learning in distance contexts. This article shows an umbrella review that follows the strategy of iterative search with Boolean operators and truncations, according to the PRISMA protocol and evaluating quality through AMSTAR2, re-aliased in Scopus, WoS and EBSCO international databases. It analyses 18 reviews out of a total of 196 identified in the recent literature, offering a transversal and critical reading of the knowledge produced in recent years on digital teaching, articulating the pedagogical, technological and cognitive evidence in the same interpretative framework. The results show that digital learning is consolidated as a structural component of education systems, characterized by flexibility, multimodal feedback and cognitive mediation, which confirms a trend towards the development of a comprehensive digital pedagogy understood as the coherent articulation between didactic design, active strategies, technological resources and human accompaniment, thus guaranteeing a more sustainable training experience. inclusive, personalized, and meaningful. In conclusion, contemporary digital education must be oriented towards a comprehensive digital pedagogy that combines innovation, pedagogical design and equity as pillars of inclusive, transformative and sustainable education.

Keywords: Digital Pedagogy, Instructional Design, Umbrella Review, Educational Technology, Inclusive Education.

INTRODUCTION

Over the last two decades, education has undergone an accelerated digitalization process that has transformed the way it is taught, learned, and assessed (Facer & Selwyn, 2021; Redecker & Punie, 2017). This transformation of higher education has caused a profound change in the way learning spaces are designed, inhabited and experienced. They are no longer conceived as physical structures but have expanded into hybrid or digital environments in which digital instructional and pedagogical curriculum design takes on a central role in learning experiences.

Recent literature shows a paradigm shift from the tool-centric approach to digital didactic design as the core of innovation (Gamage et al., 2023). In this context, the online curriculum not only organizes content and activities,

but also configures the complete learning experience that determines how students participate, collaborate and build their knowledge. In this transition, teachers' digital competencies emerge as key axes: however, many studies approach them from an instrumental perspective, focused on the mastery of digital tools, leaving their pedagogical dimension in the background. Although some teachers show high technical proficiency, challenges persist in their didactic application (Gaona et al., 2024).

We often encounter poor pedagogical design (Sánchez-Romero et al., 2025), characterized by the use of inadequate resources and the lack of a clear and inclusive learning structure, which directly hinders learning. This often manifests itself in a lack of clarity in objectives, overload of unstructured information, and the absence of active methodologies that limit the effectiveness of learning.

To guide teacher development, the European DigCompEdu Framework (Redecker & Punie, 2017) offers a structured reference. Cabero-Almenara and Palacios-Rodríguez (2020) adapted and translated the "DigCompEdu Check-In" questionnaire to assess digital competencies from a teaching perspective, highlighting the need to integrate conceptual frameworks into teacher training.

However, having digital skills does not guarantee a quality curriculum design. When online courses aren't designed with student diversity in mind, they become an exclusion factor. Here Universal Design for Learning (UDL) becomes relevant in its third version (CAST, 2024), which proposes to design from the beginning to address the cognitive and functional diversity of students. We must therefore talk about a Digital Universal Design for Learning.

The UDL invites us to reconsider the digital curriculum not as a container of resources but as an accessible, flexible and sustainable design, which integrates usability, diversity and adaptability. Thus, the contemporary challenge of higher education combines three dimensions: (a) rethinking the digital space from the pedagogical point of view; (b) to train teachers in design beyond technological use; (c) to ensure that technology is a means to the service of learning and not as an end.

This transformation has driven a massive production of research on technology-mediated learning, teachers' digital competence, and the effectiveness of teaching strategies in virtual environments (Bozkurt & Sharma, 2022). Given the proliferation of systematic reviews and meta-analyses on digital learning, it is necessary to synthesize and reinterpret the accumulated knowledge from an integrative perspective.

This study proposes to reconceptualize the digital curriculum as an educational space, through a thematic sub-analysis derived from an umbrella review on teachers' digital competencies. The objective is to identify, in recent literature, the frameworks, models and strategies of pedagogical and digital design that allow the construction of inclusive, usable and sustainable virtual spaces for education.

METHOD

This paper is a thematic sub-analysis derived from an ongoing Umbrella Review project (Choi & Kang, 2023) on teachers' digital competences, developed between March and September 2025. The purpose of the Umbrella review was to critically analyse and synthesize the evidence from systematic reviews and meta-analyses focused on teachers' digital competence to present the available evidence on digital learning and teacher development. The sub-analysis presented here focuses specifically on the pedagogical and digital design of teachers, conceived as an advanced instructional design oriented to cognitive mediation, accessibility and quality of learning in digital environments.

This methodology is appropriate when the volume of secondary literature is high and dispersed, allowing the identification of cross-sectional patterns, research gaps and lines of theoretical convergence. Strategies of narrative synthesis and thematic integration were combined, following the PRISMA 2020 guidelines (Page et al., 2021). The choice of a narrative-thematic approach is justified by the heterogeneity of the reviews included, which prevents traditional statistical aggregation, but favours the conceptual interpretation of trends.

Search strategy

The literature search was carried out in three high-impact international databases: Scopus, Web of Science (WoS) and ERIC (EBSCO). An iterative and controlled strategy was used with Boolean operators and truncations, in accordance with the PRISMA 2020 guidelines (Page et al., 2021) and quality assurance with the AMSTAR 2 tool (Shea et al., 2017), both adapted for reviews of social science reviews. The main terms are combined with two conceptual nuclei as can be seen in Table 1.

Table 1 Descriptors used in the search strategy

Conceptual core	Descriptors
Teaching digital competence	("digital teach*" OR "e-teach*" OR "online teach*") AND ("teacher digital competence" OR "digital proficiency")
Digital pedagogical and curricular design (extended phase)	"instructional design" OR "digital pedagogy" OR "curricular design" OR "learning design" OR "educational design" OR "learning experience design" OR "usability"

Both groups were combined using the AND operator, limiting the results to systematic reviews or meta-analyses published between 2013 and 2025, in English or Spanish, within the areas of Education and Educational Research. The search was supplemented by manual cross-reference review and duplicate check.

Inclusion and exclusion criteria

Only studies that met the criteria listed in Table 2 were included.

Table 2 Inclusion and exclusion criteria applied

Criteria	Inclusion	Exclusion
Document Type	Systematic reviews or meta-analyses published in peer-reviewed scientific journals.	Narrative reviews, technical reports, unpublished theses and empirical articles without a review component.
Thematic focus	Studies focused on digital pedagogical design applied to teaching.	Works that address technologies unconnected to pedagogical design.
Language	English or Spanish.	Other languages
Period	Published between 2013 and 2025.	Studies prior to 2013
Minimum methodological quality	Score ≥ 12 in the adaptation of the AMSTAR 2 scale.	Reviews with a score of less than 12 or without evidence of rigorous methodological evaluation.

To ensure methodological quality, each review was assessed using an adapted version of the AMSTAR 2 tool (Shea et al., 2017). 12 criteria were applied (described in Table 3) and measured with a three-level ordinal scale: 0 (not compliant), 1 (partial compliance) and 2 (total compliance).

Table 3 Methodological evaluation criteria for systematic reviews of education

Dimension to be measured	Evaluation criteria
Clear definition of the research question	The question is specific, with PICO components or adapted to the educational context
Explicit and justified inclusion and exclusion criteria	They are clearly defined and consistent with the question
Protocol Log (OSF, PROSPERO, etc.)	A registered or publicly available protocol exists
Systematic and reproducible search (bases, strategies)	Clearly describe sources, terms, and criteria applied
Transparent revision selection process (double review, flow)	The inclusion/exclusion process and decisions are documented
Systematic data extraction with clear template	The extracted data allows answering the research question

Assessing the quality of included reviews	At least one consistent tool is applied (adapted AMSTAR 2, quick checklist)
Proper synthesis (narrative, categorization, visualizations)	The results are organized and synthesized according to categories or themes
Critical discussion of results (strengths, limitations, quality)	The limitations of the reviews and of the synthesis itself are discussed
Evaluation of overlap between reviews (optional but desirable)	The degree of overlap of primary studies is analysed if possible
Transparency in its own methodological limitations	The limitations of the process and its implications are recognized
Adapted PRISMA reporting guide application	PRISMA 2020 is followed and justifiably adapted

Note. Authors' elaboration based on AMSTAR2 (Shea et al., 2017)

The final scores of the selected reviews ranged from 12 to 23 points, ensuring an acceptable level of reliability and consistency.

Process of filtering results and analysis

The screening process was developed in six main phases: study search, duplicate removal, title review, abstract review, full-text review, and quality screening. The selection flow is presented in Figure 1 (Adapted PRISMA).

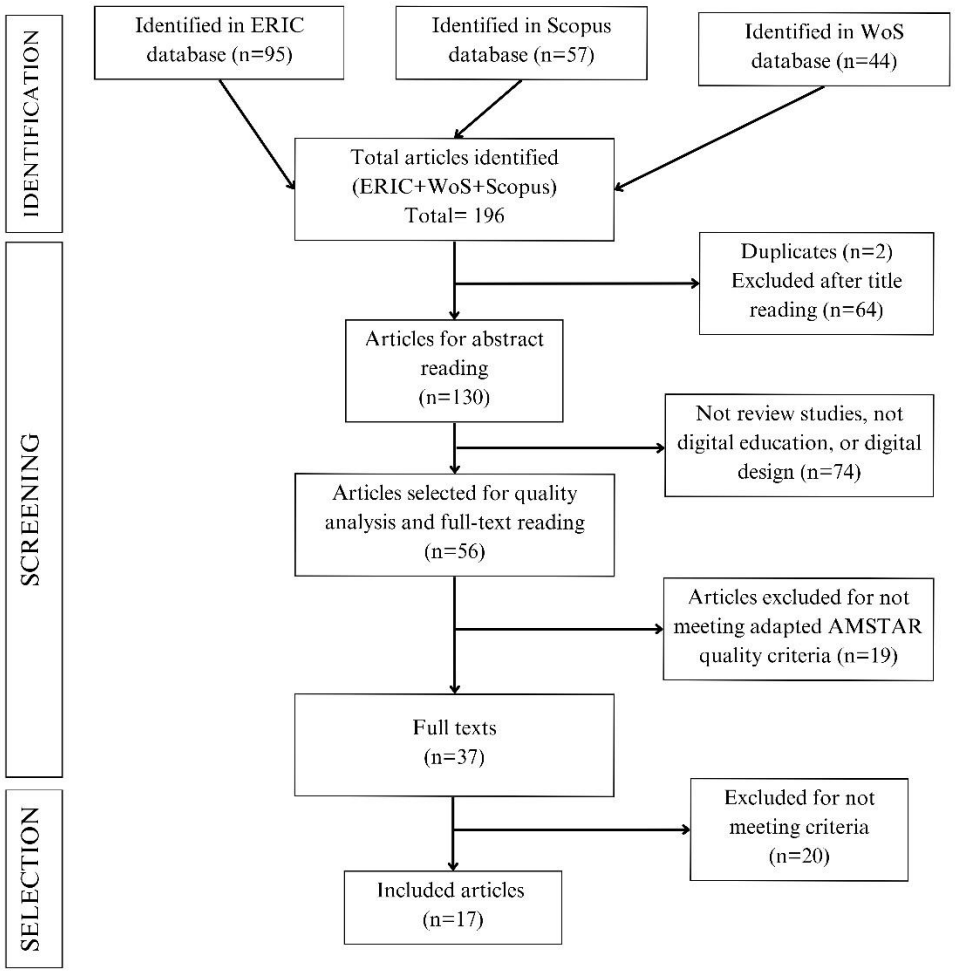

Figure 1. Adapted PRISMA Flow Diagram

Once the reviews were selected, the extraction of results and their analysis was carried out by applying an inductive-deductive process based on six dimensions of analysis (Design, Strategies, Feedback, Accessibility, Resources, Effectiveness and Impact). Each review was coded according to the relevant findings in each dimension.

RESULTS

The final corpus was composed of 17 reviews published between 2018 and 2025 and distributed in three main sources:

- ERIC (Education Resources Information Center): 7 reviews (ERIC10, ERIC16, ERIC20, ERIC23, ERIC33, ERIC47, ERIC74).
- SCO (Scopus): 5 revisions (SCO4, SCO11, SCO23, SCO40 and SCO51).
- WoS (Web of Science): 5 reviews (WoS4_1, WoS4_19, WoS4_23, WoS4_34 and WoS4_39).

These reviews cover topics such as teachers' digital competence, active learning, digital assessment, artificial intelligence, neuroeducation, adaptive environments, accessibility and inclusive education. Together, they cover a broad and representative sample of recent scientific production on digital pedagogy. Thanks to this, a panoramic view of the countryside has been obtained.

Table 4 *Studies included in the Umbrella review and their main characteristics*

Code	Study (year)	Nº Items	Keywords
ERIC23	Amelia et al. (2024)	26	Digital didactic design, pedagogical competence, primary education teacher
SCO51	Arantese et al. (2018)	29	Neuroanatomy, 3D learning, augmented reality, medical education, visualization
ERIC10	Azman et al. (2024)	25	Digital teaching, pedagogy, approaches, methodology, techniques, primary school teachers
SCO11	Gkintoni et al. (2025)	103	Cognitive load theory, neuroeducation, artificial intelligence, adaptive learning, higher education
WoS4_34	Hakkarainen et al. (2024)	9	Online Education, Nursing Degree, Distance Learning, Student Support, Mentoring
SCO4	Hasanov et al. (2019)	53	Adaptive learning, contextual systems, artificial intelligence, educational technology, intelligent environments
WoS4_23	Hwang et al. (2023)	22	Digital Learning Design, Occupational Therapy Training, Learning Technology, Learning Outcomes
ERIC74	Koh & Daniel (2022)	36	Online learning, e-learning, emergency teaching, COVID-19, digital competence teachers, online pedagogy
ERIC33	Leibold & Schwarz (2022)	12	Community of Inquiry (CoI); online teacher social presence; online teacher feedback; Feedback Medium
WoS4_1	Liu et al. (2023)	12	Virtual reality, nursing education, simulation, clinical competence, motivation
SCO23	Mancin et al. (2025)	12	Active teaching, distance learning, nursing students, critical thinking, simulation
WoS4_39	Marawa'a (2024)	14	E-learning, nursing students, online learning, digital literacy, student experience
WoS4_19	Mcgee et al. (2024)	27	Digital learning, clinical education, medical students, e-learning, hybrid pedagogy
ERIC16	Picasso (2024)	20	Technology-mediated evaluation and feedback; academic development; higher education; Models
ERIC47	Söderlund et al. (2023)	49	Digital Teaching · Digital Learning · Digital Simulation · practical skills · Health professions · Higher Education
SCO40	Urdaneta-Ponte et al. (2021)	98	Recommender systems, education, machine learning, personalized learning, adaptive systems
ERIC20	Yigit et al. (2024)	9	Professional development, online training, teacher learning, systematic review

In order to synthesize the large number of results, special attention has been paid to six emerging dimensions: design, strategies, feedback, accessibility, resources, effectiveness and impact.

Table 5 *Summary of emerging dimensions*

Dimension	Dominant trend	Facilitating factors
Design	Flexibility, adaptability, co-creation	Data analysis, teacher reflection
Strategies	Active, collaborative, personalized	Flipped, PBL, simulation
Feedback	Multimodal, immediate, dialogic	AI, rubrics, peer-to-peer feedback
Accessibility	Inclusive and cognitive	DUA, ubiquitous learning
Resources	Integrated and ethical	LMS, AI, RV, RA
Effectiveness and impact	Motivational and cognitive improvement, Cultural and institutional transformation	Teaching support, Sustainable innovation

Thoughtful and adaptive design

The studies analysed show an evolution of digital educational design from structured and prescriptive approaches to flexible and adaptive approaches. The ERIC23, ERIC16, SCO23 and WoS4_23 reviews highlight that effective design does not depend on the intensive use of platforms, but on pedagogical coherence between objectives, activities, resources and evaluation.

Design usually includes three fundamental components: planning, implementation and reflection. Planning addresses the selection of technological strategies and resources (ERIC10); the implementation is oriented to the interaction between teacher and student; and reflection is related to the evaluation of practice and continuous improvement. In some cases, co-design processes with students and the use of learning analytics for the dynamic adjustment of content (SCO11) are mentioned.

The SCO11, SCO4, and SCO51 reviews direct the design towards adaptive intelligence. Educational design is conceived as a dynamic process in which digital environments are adjusted to the cognitive and emotional needs of the student through machine learning algorithms and neuroeducational models. This shift involves the transition from prescriptive to generative design, in which systems learn from user behaviour and adapt the training experience.

In summary, digital pedagogical design is moving towards hybrid, flexible and adaptive models, where didactic planning is integrated with learning analytics and neuroeducation to optimize the cognitive load and promote meaningful learning.

Active strategies

The reviews highlight the emergence of blended, flipped, project- or problem-based models, and the use of virtual simulations and augmented reality (ERIC74, ERIC47, SCO23, WoS4_1). These approaches are based on theories of active and constructivist learning, which conceive the student as the protagonist in the construction of knowledge.

On the pedagogical level, the design focuses mainly on the organization of active learning experiences, which are also adaptive, personalized and collaborative, which promote student participation, autonomy and self-regulation (ERIC47, SCO23, WoS4_19, WoS4_34).

Technology reviews (SCO4, SCO40, SCO11) introduce the concept of adaptive learning, with personalized environments that adjust the content, sequence or difficulty of the tasks according to the progress and characteristics of the students. These experiences are supported using algorithms, sensors or recommendation systems using artificial intelligence.

Collaborative strategies are based on peer-to-peer interaction and the creation of virtual communities of practice (ERIC20 and ERIC23). Group work, co-evaluation and the joint construction of knowledge through forums, platforms and academic social networks are prioritized.

In all cases, the reviews highlight the importance of pedagogical planning and teacher support for digital strategies to achieve their training objectives.

Formative and multimodal feedback

Feedback emerges as the most studied and cross-cutting dimension in digital environments, as it occupies a place in most of the studies analysed. Different modalities (text, audio, video or visual indicators) are described

that vary depending on the type of environment and the educational level. The ERIC33 review identifies several essential characteristics of effective feedback such as speed, personalization, and clarity. Students especially value timely and constructive feedback that fosters understanding and allows for continuous improvement.

The ERIC systematic review16 expands on this vision by situating effective feedback within technology-enhanced assessment practices, which must be timely and clear, but also evidence-based on learning, supported by digital tools and articulated with the pedagogical competence of teachers. It underlines the importance of teachers integrating collaborative strategies.

The ERIC74 and WoS4_23 reviews show that teacher presence and formative feedback are decisive in sustaining student engagement in virtual environments. Training strategies such as the use of portfolios and checklists or electronic rubrics promote continuous, understandable feedback aimed at the development of the student's autonomy.

In summary, studies conclude that effective feedback mediated by technology is timely, clear, constructive, personalized and coherent with the needs and context of the student, in addition to promoting social and cognitive presence in online environments. The most recent studies point towards intelligent automated feedback. In technological studies (SCO4, SCO11, SCO40), the use of AI algorithms capable of analysing the student's performance and generating adapted responses in real time is observed. In addition, research in neuroeducation (SCO11) explores neurophysiological feedback, where indicators such as brain activity, eye monitoring or galvanic skin response allow instruction to be adjusted according to the student's cognitive load.

Expanded Accessibility

Accessibility appears as a cross-cutting dimension in numerous reviews. The technical, pedagogical and cognitive aspects that determine full participation in digital environments are addressed. The ERIC74 study analyses access and equity as central axes of teaching strategies during the pandemic, highlighting the "learning access equity strategies", that is, the actions that teachers implemented to ensure that all students could continue learning despite technological and environmental limitations. Teaching competencies must be adjusted to changing situations, to student profiles, and to variable technological and social conditions.

Several studies highlight the importance of adaptive and context-aware environments to personalize learning according to the needs, location, and conditions of the student (SCO4, SCO11, WOS4_39). Accessibility is approached from a technological and pedagogical perspective: adaptive systems make it possible to offer content tailored to different profiles, skill levels, devices and contexts. In some cases, platforms integrate physical accessibility features, such as screen readers, automatic captioning, or simplified interfaces.

SCO4 proposes that accessibility be enhanced through context-aware systems, capable of adapting interface and resources to the user's conditions (place, device, learning pace). This line is complemented by the results of the SCO11 review, which proposes cognitive accessibility: adjusting the flow of information so as not to overload working memory.

Most reviews agree that accessibility depends less on technological infrastructure than on intentional design that contemplates diversity and digital equity. Studies warn about the gaps and biases that can occur if artificial intelligence is not applied under ethical and inclusive principles.

Smart Resources

The technological resources used in the studies analysed are diverse and vary according to the educational context. Management platforms include learning platforms (LMS) used for content organization, task tracking, and communication facilitation (ERIC10, ERIC17, and ERIC47). The interaction resources include forums, videoconferences, wikis, blogs and collaborative environments that facilitate the exchange of information and the joint construction of knowledge.

Technology reviews (SCO4, SCO40, SCO51) highlight immersive resources such as virtual reality, augmented reality and digital simulation laboratories, which allow practical experiences in controlled environments and reproduce professional scenarios. Likewise, the use of tools based on artificial intelligence, learning analytics and recommendation systems is documented, as well as hybrid platforms that combine synchronous and asynchronous resources, integrating audiovisual materials, podcasts and interactive simulations.

The WoS4_19 and WoS4_39 reviews confirm that interactive multimedia resources and digital clinical simulations increase motivation and retention when integrated into coherent designs.

Effectiveness and impact

The reviews focus on measuring the effectiveness and impact of learning in digital environments compared to traditional modalities, although the results vary according to the type of strategy implemented, the discipline and the educational level (WoS4_34, WoS4_19).

In general, generalized improvements are reported in motivation, satisfaction and acquisition of skills by students (SCO23, WoS4_23, WoS4_1). The meta-analysis WoS4_1 showed that teaching using virtual reality significantly improves conceptual understanding and practical skills compared to traditional methods.
Similarly, SCO23 concludes that active online methodologies increase motivation and collaboration. Effectiveness depends on factors such as teacher support, the quality of the didactic design and the adequacy of the resources to the learning objectives. Although ERIC20 and ERIC23 point out that effectiveness depends on institutional support and continuous teacher training.
Technological evidence (SCO11, SCO4, SCO40) suggests that AI systems and adaptive environments achieve great effectiveness, by optimizing cognitive load and personalizing learning. However, they caution against the need for broader empirical validations and longitudinal studies.
Regarding impact, the results reflect a reconfiguration of the educational culture towards deeper technological integration, greater attention to digital equity and flexible use of time and space. Environmental benefits are also observed from the reduction of travel and the efficient use of digital resources (SCO11, SCO4, SCO51).

DISCUSSION

Currently, the boundaries between face-to-face and virtual are blurring, shaping an educational experience based on connectivity, multimodality, and interdependence (Fawns, 2022). This change calls for a systemic vision of educational innovation, where the pedagogical, technological and ethical dimensions are integrated into a common framework of responsibility and equity.

The notion of digital pedagogical design (Goodyear & Dimitriadis, 2013) has established itself as a central category for understanding technological mediation in teaching. Unlike classical instructional design, oriented towards content sequencing, digital pedagogical design emphasizes the orchestration of activities, interactions, and resources that generate deep learning experiences. The results indicate the consolidation of digital education as a structural part of education systems. Designs tend towards flexibility, strategies privilege active participation and feedback becomes more immediate and personalized.

The findings suggest that contemporary digital education is oriented towards an advanced instructional design, where technological innovation, social equity and sustainability converge, enabling digital education systems to remain resilient and adaptable. These principles shape a vision of education where technology acts as a means for personalization and inclusion.
This advanced instructional design (Figure 2) is characterized by six interdependent principles:

1. Thoughtful and adaptive design, focused on learning experience.
2. Active and metacognitive strategies, which promote student agency.
3. Formative and multimodal feedback, balancing automation and human guidance.
4. Expanded accessibility, based on universal design and digital justice.
5. Ethical and intelligent resources, integrated into sustainable and adaptable environments.
6. Contextualized effectiveness and systemic impact, understood as improved learning and educational well-being that transforms institutions, cultures, and policies.

The literature reviewed agrees that effective digitalization does not depend on the amount of technology, but on the teaching capacity to design meaningful experiences. Along these lines, Azman et al. (2024) and Picasso (2024) show that teacher training tends to focus on mastery of tools, relegating pedagogical thinking. This gap generates a superficial use of technology, characterized by replicative or transmissive tasks.

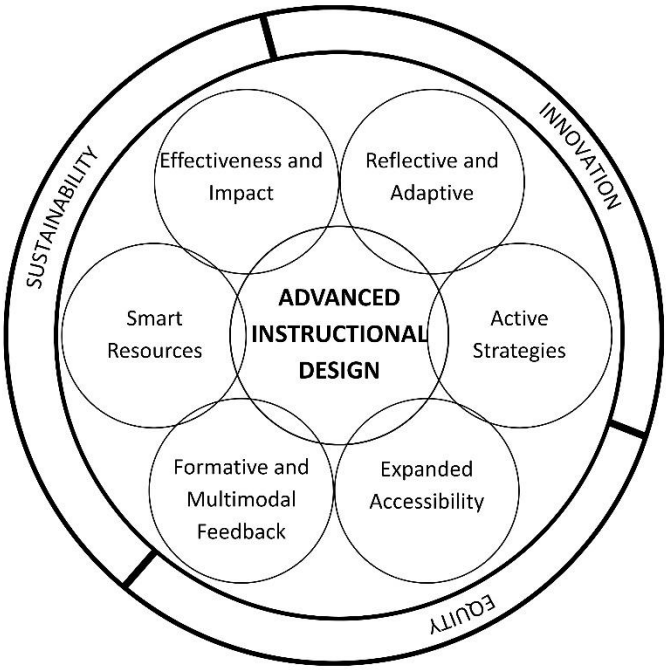

Figure 2. Dimensions and principles of advanced instructional design
Notes. Own elaboration.

The results confirm a sustained trend towards the consolidation of a comprehensive digital pedagogy, understood as the coherent articulation between didactic design, active strategies, technological resources and human accompaniment. This finding coincides with the theoretical shift described by Fawns (2022) from the simple instrumental incorporation of technologies to a deeper pedagogical understanding of digitally mediated learning.

Evidence suggests that digital environments are not effective on their own, but to the extent that they are integrated into a deliberate didactic framework. According to Goodyear and Dimitriadis (2013), digital pedagogical design involves planning that aligns intentions, activities, tools, and forms of evaluation. In most of the studies reviewed, educational achievements are associated with flexible, iterative and collaborative designs, where teachers act as designers and facilitators of meaningful experiences.

Digital educational design is consolidated as cognitive mediation. Beyond content sequencing, the design is aimed at managing cognitive load, favouring sustained attention and promoting meaningful learning. This orientation is related to the Cognitive Load Theory developed by Sweller in the 1980s, which postulates the need to balance mental demand with the student's processing capacity. Recent studies incorporate neuroeducation as a frame of reference (Tokuhama-Espinosa, 2021), which is consistent with the present review. In environments mediated by artificial intelligence or adaptive learning, the personalization of activities can improve cognitive efficiency, if the coherence between stimulus, complexity and educational objective is maintained.

In this sense, technology acts as a sensory and cognitive mediator, not as a substitute for human interaction. From a design perspective, there is a transition towards generative models, where systems adapt content based on the student's own data. Learning analytics redefines the role of the teacher as a designer and mediator of learning experiences rather than a transmitter of information.

The strategies identified support the predominance of constructivist and sociocultural approaches, in which learning is conceived as an active, collaborative and contextualized practice. The implementation of these strategies in digital environments requires redesigning traditional roles: the student adopts a position of agency and self-regulation, while the teacher assumes a role of guide, tutor or designer. This change is in line with the Self-Regulated Learning Theory (Zimmerman, 2000), which emphasizes the planning, monitoring, and self-evaluation of the learning process.

Feedback stands as a transversal axis of digital teaching. In virtual environments, feedback ceases to be a one-off event to become a continuous, multimodal and dialogic process that encourages self-regulation (Nicol, 2020). Reviews by Leibold and Schwarz (2022) and Picasso (2024) highlight that effective feedback combines speed, personalization, and dialogue. Although AI technologies and adaptive systems (Hasanov et al., 2019) allow

automated and predictive feedback to be generated, their effectiveness depends on the human component, especially on the empathy and communicative clarity of the teacher (Nicol, 2020).

Accessibility is positioned as a structural dimension of digital learning and transcends mere technological availability. Technological equity must be addressed from institutional policy and inclusive pedagogy. The principles of Universal Design for Learning (CAST, 2024) provide an ideal framework for building flexible experiences that respond to the diversity of the student body. While the notion of digital justice (Selwyn et al., 2020) emphasizes the right to participate in learning environments in conditions of equality and safety. From this perspective, accessibility not only implies technical access, but also critical and ethical participation in digital culture. Educational institutions must assume this responsibility as part of their social commitment and their democratizing function of knowledge.

Regarding effectiveness, digital learning outcomes cannot be reduced to academic performance indicators. The results of this review show positive effects on motivation, satisfaction and digital competence, but these findings must be interpreted within a broader framework of educational transformation. From the perspective of sustainable learning, effectiveness is linked to the capacity of the education system to generate lasting changes in teaching practices and institutional culture. Digitalization, when articulated with professional development policies and support structures, can promote stable and transferable innovations.

CONCLUSIONS

This review highlights the need to consolidate a comprehensive digital pedagogy in which pedagogical design, cognitive mediation, active strategies, multimodal, formative, immediate and personalised feedback prevail. Accessibility emerges as a fundamental requirement, technological resources are diversified and effectiveness is associated with the balance between innovation and pedagogical support. Finally, the impact manifests itself in cultural, organisational and professional changes that redefine teaching and learning in digital contexts.

The value of this review lies in offering a transversal and critical synthesis of the knowledge produced in recent years on digital teaching, articulating the pedagogical, technological and cognitive evidence in the same interpretative framework. The present sub-analysis is based on secondary reviews, which may limit empirical depth and introduce some degree selection bias. However, methodological consistency has been maintained through the use of the PRISMA and AMSTAR 2 criteria (Shea et al., 2017).

This review provides an integrative synthesis that transcends the fragmented approaches of previous literature, proposing comprehensive digital pedagogy as a framework for understanding digital instructional design from a systemic, inclusive and cognitive mediation-oriented perspective.

The challenge in the coming years will be to balance artificial intelligence with pedagogical intelligence, fostering learning that is both technologically advanced and humanly meaningful. The balance between automation and human interaction is one of the most relevant pedagogical challenges of contemporary digital learning. The trend points to hybrid models where technology manages immediacy and the teacher provides interpretation and reflective accompaniment.

The evidence reviewed confirms that the quality of digital education does not depend on the technology available, but on the capacity of teachers to design pedagogically coherent, inclusive and adaptive learning spaces. Consequently, teachers' digital competence be understood as a design and adaptation competence, and that the teacher assumes an active role as a designer and mediator of learning experiences. This conceptual change implies moving from instruction to situated educational design, where technological decisions depend on pedagogical intentionality.

In conclusion, the findings of this review of reviews allow us to affirm that contemporary digital education is oriented towards a comprehensive digital pedagogy model, in which technological innovation, pedagogical design and social equity converge.

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