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ARTICLE / ARTÍCULO

Ibero-American research into Educational Technology as a vehicle for official recontextualisation (2019–2025). A quantitative study of three Spanish journals

La investigación Iberoamericana en Tecnología Educativa como vehículo de recontextualización oficial (2019-2025). Estudio cuantitativo en tres revistas españolas

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Abstract: This quantitative study examines the structure of an Ibero-American academic research field on Education Technology, based on a corpus of 538 articles published in three regional journals indexed in the first quartile of Scopus —PIXEL-BIT, RIED and Educación XX1— between 2019 and 2026. The theoretical framework combines Basil Bernstein's theory of the pedagogic device —distribution, recontextualization (ORF and PRF) and evaluation rules, together with the concepts of classification, framing and vertical discourse— with Fernanda Beigel's concept of segmented academic circuits and the Ibero-American critical perspective on educational platformization. A multi-method design is proposed combining bibliometric analysis, semantic co-occurrence network analysis of keywords with community detection via the Louvain algorithm, rule-based lexical classification of methodological and discursive orientation applied to abstracts, and exploratory epistemological analysis using unsupervised clustering (K-Means) and Bernsteinian lexical classifiers. Results show a field with 9 conceptual communities articulated around a single hub-bridge (higher education), a markedly quantitative methodological distribution (60.8%) and instrumental discourse (61.7%), with marginal presence of critical traditions (5.3%) and almost total absence of theoretical production (0.5%). The emergence of generative artificial intelligence between 2024 and 2026 reorganizes the vocabulary and densifies the network without altering the recontextualizing structure or the formal grammar of the circuit.

Keywords: Educational Technology, Semantic Network Analysis, Pedagogic Device, Recontextualization, Academic Circuits, Generative Artificial Intelligence.

Resumen: Este estudio analiza desde una perspectiva cuantitativa la estructura del campo de investigación en Tecnología Educativa partir de un corpus de 538 artículos publicados en tres revistas iberoamericanas indexadas en el primer cuartil de Scopus —PIXEL-BIT, RIED y Educación XX1— entre 2019 y 2025. El marco teórico articula la teoría del dispositivo pedagógico de Basil Bernstein —reglas de distribución, recontextualización (ORF y PRF) y evaluación, junto con los conceptos de clasificación, enmarcación y discurso vertical— con el concepto de circuitos académicos segmentados de Fernanda Beigel y la perspectiva crítica iberoamericana sobre plataformaización educativa. Se propone un diseño multimétodo que combina análisis bibliométrico, análisis de redes semánticas de co-ocurrencia de palabras clave con detección de comunidades mediante el algoritmo de Louvain, clasificación metodológica y discursiva mediante clasificadores léxicos basados en reglas aplicados sobre resúmenes y análisis epistemológico exploratorio mediante agrupamiento no supervisado (K-Means) y clasificadores bernsteinianos. Los resultados muestran un campo con 9 comunidades conceptuales articuladas en torno a un hub-puente único (educación superior), una distribución metodológica marcadamente cuantitativa (60,8%) y discursivamente instrumental (61,7%), con presencia marginal de tradiciones críticas (5,3%) y ausencia prácticamente total de producción teórica (0,5%). La irrupción de la inteligencia artificial generativa entre 2024 y 2025 reorganiza el vocabulario y densifica la red sin alterar la estructura recontextualizadora ni la gramática formal del circuito.

Palabras-clave: Tecnología Educativa, Análisis de redes semánticas, Dispositivo pedagógico, Recontextualización, Circuitos académicos, Inteligencia Artificial Generativa.

1. Introduction

In recent decades, Educational Technology (ET) has grown remarkably in terms of both the volume of scientific output and its institutional presence, to become a well-established field within the educational sciences. This growth has intensified considerably since the onset of the COVID-19 pandemic, with education systems undergoing mass digitalisation, and the widespread adoption of virtual environments, digital platforms and, more recently, generative artificial intelligence (GenAI) (Bozkurt et al., 2024). However, this quantitative expansion has not been matched by sufficient problematization on the structure of the field itself. Various studies in recent years have consistently characterised the ET field as fragmented (Lai & Bower, 2019) with a marked emphasis on quantification (Baydas et al., 2015) and heavily influenced by concerns regarding practical design, to the detriment of a solid theoretical foundation (Zawacki-Richter et al., 2019). This lack of theoretical commitment appears to be a structural trend within the field: Hew et al. (2019) found that, of 503 articles analysed, only 35% had a solid theoretical framework, while more than 40% lacked one entirely.

In this context, Hannon and Al-Mahmood (2014) identify four major trends shaping research in educational technology: a) a focus on practical implementation centred on identifying 'what works' with insufficient attention paid to the structural, cultural and political conditions surrounding educational technology (Castañeda et al., 2020); b) the rise of learning analytics and the big data paradigm, which prioritise detecting patterns in large volumes of data, often at the expense of robust interpretative frameworks; c) the persistence of instructional design as the dominant tradition, rooted in positivist approaches; and d) innovation-oriented research, frequently criticised for its weak theoretical grounding. Similarly, Baydas et al. (2015) highlight the predominance of studies focusing on online learning environments and samples of university students.

The pressure to produce applicable, visible and immediately transferable results, coupled with the growing prominence of impact indicators, has favoured research focused on implementing and evaluating technologies in specific contexts. This has come at the expense of critical, theoretically informed or systemic approaches (Biesta et al., 2019; Lai & Bower, 2019). Added to this is the influence of a technology market that steers agendas towards commercial interests and reinforces technocentric discourses (Castañeda et al., 2020).

Against this backdrop, it is necessary to identify not only what Educational Technology researches, but also to question the conditions under which this knowledge is produced: What kind of knowledge does it produce? Under what rules is it accepted and circulated? What relationship does it have with frameworks imported from adjacent disciplines or supranational agencies? What scope does it allow for critical problematization?

1.1. Rules governing the production and circulation of knowledge in Educational Technology

The theory developed by Bernstein (1990, 2000), and recently revised by Barrett (2024) and Maldonado-Díaz (2022) in Spanish, offers a particularly productive conceptual framework for addressing the above questions regarding the production and

circulation of knowledge in ET. Its categories — pedagogical device, recontextualization, classification, framing and vertical discourse — enable us to analyse not only what a field says, but also the rules that determine what can be said. From this perspective, pedagogical discourse does not produce original knowledge, but rather takes knowledge produced in other fields - the intellectual field of discourse production - and transforms it through a specific process termed 'recontextualization' by Bernstein (Bernstein, 1990). This process is overseen by two distinct fields: the field of official recontextualization (ORF), which encompasses state and supranational agencies, and the field of pedagogical recontextualization (PRF), which includes professional and academic spaces such as faculties of education and specialist journals. In recent decades, several authors have documented the process by which the ORF has colonised the PRF: generic frameworks of competence, quality, and effectiveness are gradually replacing the traditional disciplinary discourses that underpin educational fields (Apple, 2019; Maton, 2014; Singh, 2002).

Furthermore, the concepts of classification and framing allow us to describe how this mechanism is realised in specific practices (Bernstein, 1971, 2000). Classification denotes the strength of the boundaries between categories, such as disciplines, content and agents. When classification is strong (+C), the boundaries are actively maintained, whereas when it is weak (–C), they become blurred. Framing refers to control over the selection, organisation, sequencing, and evaluation of pedagogical communication. +F indicates strong control (in the classroom, the teacher controls everything; in the academic field, there is strict adherence to the validation paper canon), while –F indicates weak control (in the classroom, there are invisible pedagogies; in the academic field, there are diverse formats, such as essays, autoethnographies, and investigative narratives).

Distinguishing between vertical and horizontal discourse, and between hierarchical structures (Bernstein, 1999), allows us to classify the modes of organisation of knowledge. Bernstein (2000) proposes a typology of vertical discourse comprising four modes: disciplinary singulars, applied regions, generic discourses of the ORF, and critical traditions. Educational technology is a region by its very nature: it articulates knowledge drawn from various singulars and is oriented towards a field of practice.

Furthermore, the concepts of classification and framing allow us to describe how pedagogical and academic practices are regulated. A high level of framing, for example, is evident in strict adherence to the standardised format of the scientific article.

This brings us to the concept of the validation paper, referring to the IMRaD format. This historically established genre (Bazerman, 1988; Latour & Woolgar, 1986) acts as a regulatory mechanism, defining which claims are legitimate and under what conditions. In the current context, its adoption has become virtually mandatory in indexed journals, operating as a mechanism for validating knowledge and authorship.

All recontextualization takes place within a social space for the circulation of knowledge with its own geography, hierarchies, and asymmetries. Fernanda Beigel (2014) distinguishes four types of circuit within the global academic system: (i) international mainstream circuits supported by major publishing houses such as Elsevier, Springer and Taylor & Francis (indexed in Web of Science and Scopus); (ii) transnational open-access circuits; (iii) regional circuits in the Global South such as

Latindex, SciELO, Redalyc and CLACSO; and (iv) national circuits based on local publications. This segmentation is not horizontal; rather, it constitutes an unequal, hierarchical structure in which the mainstream's evaluation criteria tend to dominate regional academic circles through mechanisms such as indexing, impact factors, and university rankings (Beigel, 2014). Academic dependency is the concept that describes this structural asymmetry between peripheral producers of knowledge and the theoretical and methodological frameworks produced in centres (Beigel & Persia, 2024; Beigel & Sabea, 2014). Within this framework, the recontextualization of Educational Technology occurs in a space regulated by two factors: the internal logic of the pedagogical system and the external dynamics of global academic assessment.

1.2. Research in ET and the Recontextualization of the Field

The application of this theoretical framework to educational technology has given rise to a significant body of critical literature, particularly in the context of digital platforms and generative artificial intelligence. Williamson (2024) and Williamson et al. (2023) have demonstrated that the celebratory discourse surrounding digital transformation, and more recently AI in education, functions as a generic ORF discourse imported from technology industries and supranational bodies. This discourse colonises the pedagogical field. Selwyn (2024) has emphasised the epistemological and political limitations of AI in education, cautioning against the dominance of the datafication paradigm in modern education systems. Recent work by Pangrazio et al. (2023) on data infrastructures in schools and contributions to the Critical EdTech Studies volume by Komljenovic et al. (2025) point in the same direction: digitalisation is not merely the aggregation of technologies, but a mechanism, and European competence frameworks are central to this mechanism. In Latin American contexts, Dussel (2020) has demonstrated how pandemic-driven digitalisation has reshaped schools in favour of private platforms. Neut et al. (2024) and Miño-Puigcercós et al. (2026) highlight the normalisation of platform monoculture and the loss of pedagogical sovereignty as key concerns in the context of corporate platformization. Bozkurt et al. (2024) and the RIED special issue (2025) have documented the critical risks that AI poses to the pedagogical framework, such as uncritical dependence and algorithmic biases.

However, these categories have not yet been systematically analysed in the context of the Ibero-American research field on Educational Technology. There remains a lack of studies that integrate empirical analysis with a structural understanding capable of accounting for the organisation, regulation, and legitimisation of knowledge dynamics. This research addresses this gap and aims to answer the following question: How is the Ibero-American Educational Technology research field structured, and how does that structure evolve across the three techno-pedagogical waves that run through it between 2019 and 2025? This general question has been broken down into four specific questions, which are set out in Table 1.

2. Method

We propose a multi-method design that combines a mixed bibliometric approach with performance analysis and scientific mapping (Donthu et al., 2021), as well as computational content analysis and exploratory epistemological analysis. A corpus of high-impact scientific publications in the field of educational sciences with an Ibero-American scope is used to apply four sequential and interlinked phases of analysis

(Table 1). Each phase incorporates the information produced in the previous one, allowing the field to be approached from different, complementary perspectives.

Table 1. Study design: phases, research questions and techniques used

Phase	Research question	Technique / procedure	Input / output data
PH1	Who produces, where, and on what topics?	Descriptive bibliometric analysis: temporal distribution, geographical affiliation, international collaboration, frequency of normalised keywords	Input: metadata (year, authors, countries, keywords). Output: distribution tables, collaboration indicators, term frequencies
PH2	What are the conceptual trends in the field and how do they evolve over the period?	Semantic networks of keyword co-occurrence; centrality metrics (degree, betweenness, eigenvector); Louvain (Q) community detection; networks by time period	Input: normalised keywords (frequency ≥ 5 ; edge weight ≥ 2). Output: global network (66 nodes, 140 edges), 9 communities, centrality metrics per term
PH3	How is the field investigated methodologically, and from which discursive perspective?	Rule-based lexical classifiers applied to abstracts: (a) methodological classifier (6 categories); (b) discursive classifier (4 perspectives); (c) NMF topic modelling (6 latent themes)	Input: text of the abstract. Output: 'method' and 'discourse' labels for each article; global and temporal distributions
PH4	How does the field relate to external conceptual frameworks? (exploratory)	K-Means clusters (k=9) based on TF-IDF of keywords; Bernsteinian lexical classifiers applied to abstracts; validation using full text (n=27 articles, 3 per cluster)	Input: keywords (TF-IDF) + abstracts. Output: 9 thematic clusters, estimated epistemological profile, percentages of automatic/manual agreement per cluster

2.1. Corpus

The corpus consists of 538 articles published between 2019 and 2025 in three Spanish education journals ranked in the first quartile of the JCR: RIED-Revista Iberoamericana de Educación a Distancia (n=177), Educación XX1 (n=183) and Pixel-Bit. Revista de Medios y Educación (n = 186) from which eight online articles scheduled for publication in 2026 have been excluded.

The journal data were extracted manually by the research team. For each article, the following information was recorded: identification code; title; year; authors; country of affiliation per author; keywords in Spanish and English; and abstract. The full text was renamed using the assigned code and stored.

2.2. Analysis

The analysis is organised into four sequential and complementary phases (see Table 1). Phase 1 focuses on the descriptive bibliometric aspects of performance analysis (Donthu et al., 2021), including output, authorship, and geographical distribution. Phase 2 involves constructing and analysing a semantic network of keyword co-occurrence to identify the conceptual structure of the field and its thematic communities. Phase 3 classifies each article according to its methodological and discursive orientation using lexical classifiers applied to the abstracts. Phase 4 is exploratory in nature and examines the epistemological orientation of the field through independent thematic clusters and Bernsteinian classifiers.

All computational analyses were carried out in Python with the help of generative AI tools, namely Claude (Anthropic) and GitHub Copilot (OpenAI). The results were systematically cross-checked against each other and the reference literature. The research team was responsible for all methodological decisions and disciplinary interpretation (Bayram et al., 2025).

Descriptive bibliometric analysis (PH1)

Indicators of annual output, the geographical distribution of author affiliations and international collaboration were calculated. Keywords were standardised using a 60-entry English–Spanish table that harmonises synonyms and orthographic variants (e.g. ‘digital competence’ and ‘competencia digital’, or ‘teacher education’ and ‘formación del profesorado’). International collaboration was defined as the presence of authors with affiliations in at least two different countries within the same article.

Semantic network analysis (PH2)

The co-occurrence of terms within the keywords of the same article indicates an explicit conceptual association. Accumulating co-occurrences across the corpus enables us to construct a network where the terms are the nodes and the co-occurrences are the weighted edges. Two filtering thresholds were applied to eliminate lexical noise whilst preserving stable conceptual associations: a minimum term frequency of ≥ 5 articles and a minimum edge weight of ≥ 2 co-occurrences.

Three centrality metrics were then calculated for this network: degree centrality (the number of terms directly connected to a given term), betweenness centrality (the frequency with which a given term appears on the shortest path between any two nodes in the network), and eigenvector centrality (influence weighted by the influence of neighbouring nodes). To identify conceptual communities — groups of terms that co-occur more frequently with one another than with the rest of the network — the Louvain algorithm (Blondel et al., 2008) was applied. This algorithm optimises the Q-modularity of the partition, which is an index that compares the internal connection density of each community with that expected in a random network of the same size (range: 0–1; Q values >0.2 are considered indicative of a non-random community structure). A random seed (seed=42) was set, and 100 initialisations were carried out to ensure reproducibility of the partition. Additionally, networks were constructed for sub-periods (2019–2021, 2022–2023 and 2024–2025) using a reduced threshold (freq ≥ 3), examining the temporal dynamics of the field.

Methodological and discursive classification (PH3)

Two rule-based lexical classifiers were designed to analyse the abstract text of each article. In both cases, each category is associated with a list of regular expressions that are characteristic of that category. The article is assigned to the category whose expressions yield the most matches. The methodological classifier distinguishes between the following six categories: quantitative (scales, questionnaires, ANOVA and SEM); qualitative (interviews, focus groups and case studies); mixed; systematic reviews; design and development; and theoretical. The discursive classifier distinguishes between the following four orientations: instrumental (effectiveness, performance and optimisation); interpretative (meanings and experiences); critical (inequality, power and justice); and techno-systemic (technical architecture, algorithms and analytics). Articles without sufficient lexical cues are classified as 'Unclassifiable'.

Exploratory epistemological analysis (PH4)

Lexical classifiers were applied to the combined text of abstracts and keywords to identify four dimensions: functional position (primary production, recontextualization of external frameworks and contested recontextualization); classification strength (+C: own educational theoretical frameworks; -C: frameworks imported from other disciplines or from supranational policy); framing strength (+F: alignment with the empirical-quantitative canon; -F: open formats) and type of vertical discourse (applied region, generic supranational policy discourse, disciplinary singularity, critical tradition). These classifiers are based on the operationalisation of pedagogical devices proposed by Bernstein (1990).

In parallel, nine independent thematic clusters were constructed using K-Means clustering ($k=9$; $n_{init}=50$; $seed=42$), based on the TF-IDF representation of the keywords in each article ($min_df=3$; $max_df=0.85$; $n_gram=1-2$; sublinear TF; L2 normalisation). This procedure is methodologically independent of the PH2 network analysis, thereby avoiding the circularity that would arise if the same instrument were used to construct the categories and classify the articles. The quality of the clustering was assessed using the Silhouette Index (Cosine Metric), and agreement with Louvain communities was evaluated using the Adjusted Rand Index (ARI) and Normalised Mutual Information (NMI).

To validate the automatic classifications based on the abstracts, the full texts of the three most representative articles from each cluster were used ($n=27$; determined by maximum cosine similarity with the cluster centroid). For each article, the Bernstein dimensions were coded with AI assistance using textual quotations from the article itself. The percentages of agreement between the automatic classification and the AI-assisted reading are reported by cluster, enabling us to identify which claims are supported by the available data and which require further work. This phase is exploratory in nature and its results should be interpreted as hypotheses emerging from the data.

3. Results

3.1. Bibliometric structure (PH1)

The corpus's output remains stable throughout the period analysed. The year with the highest output is 2020 (n=89; 16.5% of the corpus), coinciding with the onset of the COVID-19 pandemic and the surge in publications on emergency digitalisation in education. From 2021 onwards, output has fluctuated between 78 and 92 articles per year, with no sustained trend of growth or decline.

Table 2. Distribution of articles by year

2019	2020	2021	2022	2023	2024	2025
17	89	78	92	91	87	84
3,2 %	16,5 %	14,5 %	17,1 %	16,9 %	16,2 %	15,6 %

The geographical distribution reveals a significant concentration in Spain. Of the 1,558 author entries recorded, 1,225 correspond to authors with a Spanish affiliation (78.6%). The next five countries are Mexico (60 authors; 3.9%), Chile (47 authors; 3.0%), Ecuador (40 authors; 2.6%), Colombia (32 authors; 2.1%) and Portugal (30 authors; 1.9%). All other countries in the Ibero-American region have a marginal presence of less than 1%.

International collaboration is limited: 54 articles (9.9% of the corpus) have authors from more than one country. The structure of collaboration is radial, with Spain as the central node in all frequent pairs: Spain-Mexico (12 articles), Chile-Spain (n=9), Spain-Portugal (n=8) and Ecuador-Spain (n=4). The average number of authors per article is 2.86 for the entire corpus. Keyword analysis reveals that 'higher education' is by far the most frequent term in the corpus (n=117, 21.4% of the total), followed by 'digital competence' (n=47), 'ICT' (n=47), 'educational technology' (n=43), and 'artificial intelligence' (n=34). Table 3 lists the fifteen most frequent terms and their temporal distribution at either end of the period.

Table 3. Most frequent keywords in the corpus (top 15) with a comparison of 2019–2021 vs. 2023–2025

Normalised term	Total N	% of corpus	2019-21	2023-25
Educación superior	117	21,4 %	43	73
Competencia digital	47	8,6 %	18	29
TIC	47	8,6 %	22	20
Tecnología Educativa	43	7,9 %	18	24
Inteligencia artificial	34	6,2 %	3	31
Enseñanza superior	28	5,1 %	13	13
Género	20	3,7 %	9	11
Redes sociales	18	3,3 %	7	9
Formación del profesorado	19	3,5 %	8	10
Educación a distancia	17	3,1 %	8	8
Estudiantes universitarios	17	3,1 %	7	10
Innovación educativa	16	2,9 %	7	9
Educación secundaria	15	2,7 %	7	7
Motivación	14	2,6 %	6	7
Aprendizaje en línea	13	2,4 %	5	7

The term 'artificial intelligence' warrants specific attention due to its temporal dynamics. Virtually absent until 2022 ($n=3$ in the 2019–2021 subperiod), it experienced rapid growth in 2024 ($n=11$ articles published that year; 12.6%), which intensified in 2025 ($n=21$; 25% of all articles published that year). This growth is unprecedented for any other term in the corpus during the analysed period and does not reflect a gradual trend, but rather two distinct jumps: one in 2024 and another in 2025.

3.2. Semantic co-occurrence network of keywords (PH2)

The global network, constructed using established thresholds, comprises 66 nodes and 140 edges. Only 6.5% of the 2,145 possible connections between these 66 terms are actually present (density=0.065). The average clustering coefficient (0.074) is low: terms that share a neighbour are not usually directly connected to one another. These two indicators are consistent with a field in which vocabulary is widely shared across subfields and conceptual boundaries are porous.

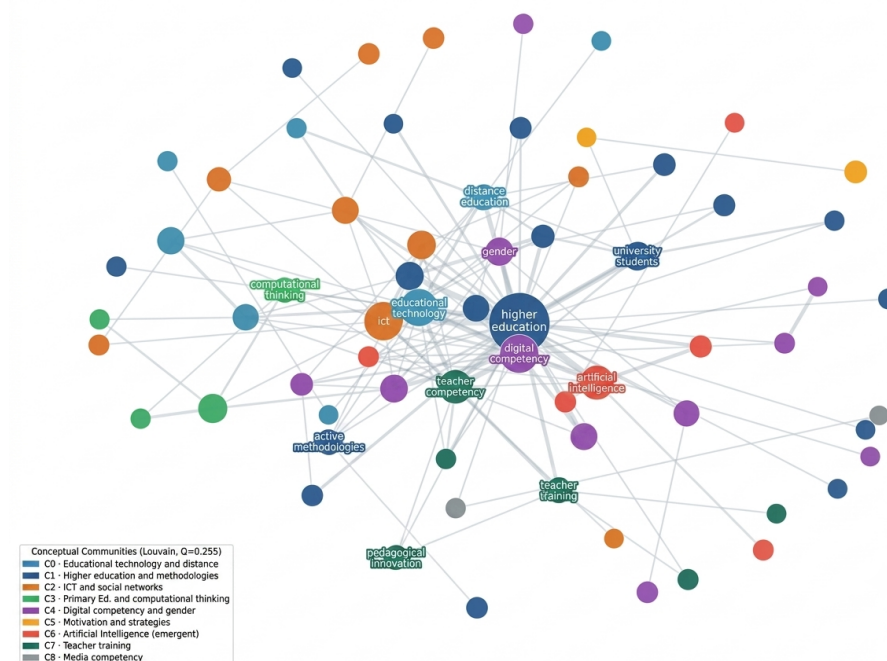


Figure 1. Global co-occurrence network of keywords ($n=546$ articles; 66 nodes; 140 edges)

The Louvain algorithm identified nine conceptual communities with a modularity of $Q=0.255$, which is above the reference threshold ($Q>0.2$) and indicates a non-random community structure. Table 4 lists the communities and their central terms.

Table 4. Conceptual communities identified by the Louvain algorithm

C	Label	Terms with the highest betweenness centrality	Size (n terms)
C0	Educational technology and distance learning	Educational technology, distance learning, augmented reality	8
C1	Higher education and methodologies	Higher education, active methodologies, online learning, university students	18
C2	ICT and social media	ICT, social media, university, teaching skills	9
C3	Primary education and computing	Computational thinking, primary education, STEM/STEAM	4
C4	Digital competence and gender	Digital competence, gender, academic performance, teaching staff	11
C5	Motivation and strategies	Learning strategies, motivation	2
C6	Artificial intelligence	Artificial intelligence, ethics, critical thinking, ChatGPT	6
C7	Teacher education	Teacher education pedagogical innovation	6
C8	Media competence	YouTube, media competence	2

The centrality analysis reveals a radial structure. The term 'higher education' ranks first in both degree centrality (0.600) and betweenness centrality (0.427): it is directly connected to 6 out of every 10 terms in the network and appears on the shortest path between almost half of all possible pairs of terms. This pattern indicates that 'higher education' is not only the most frequent topic in the corpus, but also the concept that structurally articulates the network: the bridge through which most conceptual associations are connected. The terms with the second and third highest betweenness are 'ICT' (0.176) and 'educational technology' (0.158), which are also context or domain labels rather than theoretical concepts.

Table 5 lists the ten terms with the highest betweenness centrality. The position of 'artificial intelligence' in fifth place (betweenness = 0.104), above more established terms such as 'teacher education' (0.079), suggests that it acts as a bridge node, connecting conceptual communities that would otherwise be unrelated.

Tabla 5. Diez términos con mayor centralidad de intermediación en la red global.

Term	Degree centrality	Betweenness centrality	Eigenvect or	Frequency (no. of articles)
Higher education	0,6	0,43	—	139
ICT	0,23	0,18	—	47
Educational technology	0,23	0,16	—	43
Digital competence	0,28	0,14	—	47
Artificial intelligence	0,14	0,1	—	34
Active methodologies	0,08	0,1	—	12
Gender	0,12	0,09	—	21
Distance learning	0,14	0,08	—	17
Teacher education	0,2	0,08	—	34
University students	0,09	0,07	—	22

Analysis by sub-period shows that community C6 (Artificial Intelligence) exhibits the most pronounced dynamics: with a connection density of virtually zero in the 2019–2021 sub-period, it takes on a recognisable community structure in 2022–2023 and consolidates as a community with high betweenness in 2024–2025. During this period, its central terms (artificial intelligence, ChatGPT, ethics and critical thinking) experience the highest year-on-year growth rates in the corpus. No other community exhibits comparable temporal dynamics over the analysed period.

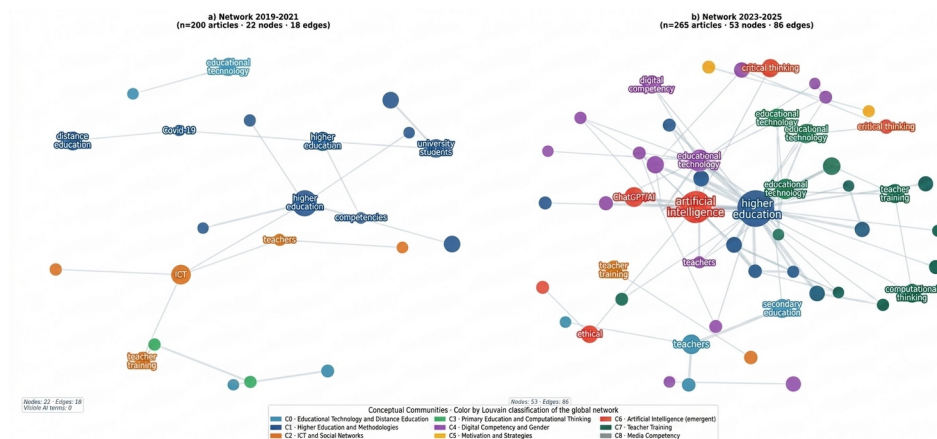


Figure 2. Comparison of semantic co-occurrence networks of keywords by sub-period: 2019–2021 (panel a) and 2023–2025 (panel b)

3.3. Methodological and discursive orientation (PH3)

The corpus is dominated by quantitative studies: 60.8% of the articles (n=332) employ empirical-quantitative designs using validated instruments and inferential statistics. Other methodological approaches are significantly less prevalent, with qualitative studies accounting for 11.5% (n=63), design and development studies accounting for 6.8% (n=37), systematic reviews 4.8% (n=26), mixed 2.0% (n=11), and theoretical 0.5% (n=3). 13% of the articles could not be classified due to insufficient methodological information in the abstract.

In terms of timing, 2020 accounted for the highest proportion of qualitative and design studies. From 2022 onwards, there has been a sustained upward trend in systematic reviews (from 1.1% in 2022 to 9.2% in 2024).

The instrumental-discursive orientation clearly dominates the corpus (61.7%; n=337): the central argument of these articles focuses on the effectiveness, performance, or optimisation of tools and strategies without reflecting substantively on the underlying conditions or values. The other approaches were less prevalent: interpretative 11.2% (n=61); critical 5.3% (n=29); and techno-systemic 5.5% (n=30). 16.3% of the articles could not be classified.

Techno-systemic discourse, which focuses on technical architecture, algorithms and learning analytics, deserves specific attention due to its trajectory: virtually absent in 2022 (0.0%), it reached 10.7% in 2025. This growth coincides exactly with that of the conceptual community of artificial intelligence within the semantic network, and it is

the only discursive shift with a temporal dynamic comparable to the emergence of AI as a research topic.

Table 6. Methodological and discursive distribution of the corpus

Category	n	%	2020 (% year)	2025 (% year)
Methodological Orientation				
Quantitative	332	0,61	0,54	0,64
Qualitative	63	0,12	0,16	0,1
Design and development	37	0,07	0,08	0,07
Unclassifiable	74	0,14	0,14	0,12
Systematic review	26	0,05	0,01	0,1
Mixed	11	0,02	0,05	0,01
Theoretical	3	0,01	0	0,01
Discursive Orientation				
Instrumental	337	0,62	0,63	0,64
Unclassifiable	89	0,16	0,16	0,13
Interpretative	61	0,11	0,11	0,1
Techno-systemic	30	0,06	0,05	0,11
Critical	29	0,05	0,06	0,02

3.4. Exploratory epistemological analysis: thematic clusters and field orientation (PH4)

The silhouette index for K-Means clustering ($s=0.055$) is low and stable for k between 4 and 11. This indicates that articles share vocabulary across subfields, and that no method can clearly distinguish between them. Agreement with the Louvain communities is generally low ($ARI=0.077$; $NMI=0.204$), but it does follow an interpretable pattern. Clusters with specific terminology converge across methods (e.g. Augmented/Virtual Reality: 88%; Online Learning: 71%), while those with generic vocabulary diverge (e.g. ICT and Information: 9%; Teacher Training: 13%). This indicates clearer conceptual boundaries where subfields deal with specific technological objects.

Bernsteinian classifiers applied to the overall corpus reveal a consistent profile across the dimensions best captured by the abstracts: a predominance of strong framing (+F: 65.8 per cent of articles), which characterises conformity to the empirical-quantitative article canon.

There is also a predominance of vertical discourse in the applied region (69.6 per cent), which characterises the importation of frameworks from adjacent disciplines without any pedagogical reformulation. Finally, there is the previously described dominance of instrumental orientation. 84% of the articles are classified as 'Undeterminable' in the functional position dimension, indicating that academic abstracts rarely explicitly state the article's theoretical position within the field.

Table 7. Results of the full-text validation of the K-means clusters

Cluster	Label	No. of articles	Position agreement	Frame agreement	Main finding of the manual validation
KM0	Digital competence	52	46084	46083	It is based entirely on European ORF frameworks (DigComp, DigCompEdu). Discrepancy: the editorial is classified as an empirical article.
KM1	ICT and information	56	46082	46083	The most heterogeneous cluster. Classifier confusion: empirical rigour ≠ theoretical output; adoption of ORF terminology ≠ alignment with it
KM2	Teacher education	52	46082	46082	Classifier fails on qualitative articles and systematic reviews (few markers in the abstract)
KM3	Augmented/virtual reality	17	46084	46084	Full confirmation. Systematic discrepancy in vertical discourse: TAM and psycholinguistics ≠ supranational ORF
KM4	Artificial intelligence	38	46084	46084	Perfect agreement. Only cluster with disputed recontextualization (1 article)
KM5	Higher education in general	155	46084	46084	Perfect agreement. Modal profile of the field: +F, applied region, uncritical recontextualization
KM6	Primary education and STEM	72	46084	46082	Coexistence of genuine +F articles and descriptive –F essays using the same STEM lexicon
KM7	Online learning	40	46084	2,5/3	High concordance. The mobilised ORF varies between articles (OECD, UTAUT, UNESCO/ISTE)
KM8	Higher education and social media	64	46083	46084	The primary production predicted by the classifier is an artefact of imported theoretical density.

Full-text validation revealed two patterns of systematic error that have implications for the overall interpretation. The first pattern is confusion between methodological rigour and original theoretical output. Articles with a large sample size and complex statistics are automatically classified as 'primary production' when, in fact, they are applied studies without any new theoretical contribution. Secondly, there is a confusion between the formal adoption of supranational language and ideological alignment with it. The classifier fails to detect when an article uses the ORF's vocabulary

to challenge it because the challenge is expressed through the content and choice of terminology rather than lexical signals of confrontation.

4. Discussion and conclusions

The results of this study allow us to describe the field of Educational Technology research in Ibero-America as 'applied', as defined by Bernstein (2000): an area that combines knowledge from various disciplines without forming a single discipline with its own organisational principles. This situation is not problematic in itself; what is important is how this integration takes place. In the analysed corpus, recontextualization predominantly appears uncritical and dependent, in line with previous work (Hew et al., 2019; Zawacki-Richter et al., 2019). This suggests the adoption of external frameworks, whether psychological, technological, or from supranational bodies, without any substantive pedagogical transformation. The strong presence of frameworks such as DIGCOMP or technology adoption models does not result in strictly pedagogical theoretical development, but rather in their instrumental application. This predominance of dependent recontextualization is linked to a specific structure of the pedagogical framework: the combination of weak classification (–C) and strong framing (+F).

The low density and porosity of the semantic network demonstrate, on the one hand, that the field lacks robust conceptual boundaries, in line with Maton's (2014) description of regions with low epistemological density. Within this framework, the near-universal adoption of the IMRaD format and the validation paper (Bazerman, 1988; Latour & Woolgar, 1986) indicates a significant level of control over the structure of scientific discourse (60.8% quantitative, 61.7% cent instrumental and 0.5% theoretical). This asymmetry — weak conceptual structuring and strong formal regulation — not only organises production, but also determines what kind of knowledge can be recognised as valid. Inclusion in the first quartile (Q1) of the studied journals acts as an epistemological filter that favours mainstream formats and frameworks. This allows us to hypothesise that the observed uncritical recontextualization is not a choice made by individual authors, but rather an effect of the circuit's position within the global system (Beigel & Sabea, 2014). The marginalisation of critical writing in the corpus (5.3%) suggests that dominant evaluation rules, such as the validation paper and its psychometric requirements, are reluctant to accommodate critical writing formats, such as the essay, investigative narrative and autoethnography (Beigel, 2014; Selwyn, 2024).

From a temporal perspective, the results show that, between 2019–2021 and 2024–2025, the field shifted from the lexicon of distance learning, MOOCs and pandemic communication to a focus on GenAI, ChatGPT and prompts, whilst there was an increase in psycho-educational terms such as 'performance', 'motivation', 'perception' and 'emotional state'. Within this framework, the topology of the network itself is being reorganised around an emerging core of university-digital-AI-education, which is interwoven with other communities in the graph. The emergence of GenAI coincides with sustained growth in techno-systemic discourse (rising from 0% in 2022 to 10.7% in 2025) and systematic reviews (rising from 1.1% in 2022 to 9.2% in 2024). However, there has been no equivalent growth in critical discourse or theoretical output. If this trend continues, it suggests that the field is adopting AI in an instrumental manner rather than problematising it. Its rapid rise to prominence

indicates its capacity to convey the generic discourse of the ORF: a rhetoric of innovation and efficiency that directs research agendas towards what is technically possible rather than what is pedagogically necessary (Selwyn, 2024). This is particularly relevant because, unlike previous technologies, GenAI operates directly on discourse, generating texts, assessments, plans, and feedback, and thus intervening at the very heart of the pedagogical apparatus (RIED, 2025; Williamson et al., 2023). This shift has an additional geopolitical dimension: GenAI is a technology produced at the centre of the global system (OpenAI, Anthropic, Google) and predominantly trained in English. Recontextualising it uncritically within the Ibero-American sphere would reinforce academic dependence at a time when the technology itself could destabilise the rules governing validation papers and open up a space for new forms of knowledge production (Beigel & Persia, 2024).

The structural stability of the 'higher education' context label as a bridging node within the field suggests that all discourse passes through these signifiers, regardless of technology or historical period. This suggests that while technology changes, the nominal pedagogical subject and the institutional context of the field remain fixed — a manifestation of the strength of regulatory framing. Pedagogical discourse is anchored in a fixed matrix, with technological and methodological variations superimposed upon it (Maldonado-Díaz, 2022).

One methodological contribution that deserves to be highlighted is that the available indicators — low lexical separability between subfields, dominance of applied regional discourse and a high rate of 'Undeterminable' in functional position — are consistent with the hypothesis of a field with weak conceptual autonomy. This field's theoretical agenda is defined more by available technologies and supranational policy frameworks, such as DigComp and OECD, than by questions arising from within the field itself. However, this hypothesis would require verification through full-text analysis and coding by independent pairs.

Finally, it is worth noting that the incorporation of computational techniques (TF-IDF, Louvain, K-Means and NMF) in this study is justified by their ability to process large amounts of data and detect structures that manual methods cannot. However, this methodological choice recognises its limitations in light of the finding that, when AI appears as a research subject in the analysed journals, it is predominantly framed in instrumental and techno-systemic terms (26.0% in the AI cluster compared with 5.5% overall), lacking critical reflection. This automated analysis may demonstrate that computational tools can be used to critically interrogate the uncritical recontextualization of imported technologies without reproducing the same instrumental logic.

5. Contributions of the authors

AGB: conceptualisation, analysis, drafting of the original manuscript, critical review and final editing of the text. UR: Methodology, analysis, critical review. AGV: State of the art, analysis, drafting

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