

Visualization Analysis of Hotspots and Trends in Chinese and Foreign Digital Teaching Research Based on CiteSpace (2015–2025)

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Abstract: This study employs CiteSpace to perform a visual comparative analysis of digital teaching literature from CNKI and Web of Science spanning 2015 to 2025. It systematically elucidates the evolutionary trajectories, structural characteristics, and theoretical orientations present in both Chinese and international research. The findings reveal significant disparities: Chinese research predominantly emphasizes practical applications, concentrating on “digital literacy” and “vocational education” within specific teaching contexts. In contrast, international research prioritizes theoretical frameworks related to “technology integration,” “teacher competence,” and “online learning,” demonstrating greater theoretical depth and interdisciplinary integration. Since 2017, international publications have consistently outpaced China’s output, achieving a volume 2.3 times greater than that of China by 2025. This trend indicates notable advantages in adapting to technological advancements and enhancing academic productivity. Therefore, this study advocates for the strengthening of complementarity and integration between these research paradigms to promote the coordinated development of global educational digitalization across both theoretical and practical dimensions.

Keywords: Digital teaching; CiteSpace; Visual analysis; Bibliometrics

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1. Introduction

The integration of AI, big data, and cloud computing is transforming education from a model of standardization to one of personalization. This shift is consistent with the goals outlined in China Education Modernization 2035, which emphasizes the need to “accelerate educational reform in the information age” ^[1]. In practical terms, the National Smart Education Platform has compiled more than 7,000 digital resources, thereby establishing a strong infrastructure for educational modernization ^[2].

Globally, leading education systems emphasize the enhancement of teachers’ digital instruction capabilities. Key policies illustrate this focus: the U.S. National Education Technology Plan (2024) aims to close the digital divide and empower educators ^[3]; the UK’s Education Technology Strategy seeks to

cultivate a world-class edtech ecosystem^[4]; and the EU's DigCompEdu establishes a pan-European digital competence framework^[5]. Collectively, these initiatives underscore a worldwide dedication to advancing education through improved digital literacy.

A systematic analysis comparing China's digital teaching research trends with those of other countries offers valuable insights into global educational digitalization.

2. Research design

2.1. Data sources

To ensure data integrity, this study gathered publications from the CNKI Core/CSSCI and WOS Core Collection, with searches conducted until October 26, 2025. The subject term "digital teaching" resulted in 687 valid Chinese documents and 1,432 international documents.

2.2. Research tools and methods

CiteSpace 6.4.R1 facilitated bibliometric analysis by integrating co-occurrence mapping and burst detection to illustrate research hotspots, keyword associations, and evolutionary pathways, uncovering structural and temporal distinctions between Chinese and international research^[6,7].

3. A visualization analysis of research hotspots

3.1. Annual publication trend analysis

Figure 1 depicts the annual publication trends from 2015 to 2025. Throughout this decade, over 2,000 high-quality publications emerged, establishing digital teaching as a significant global research focus in education.

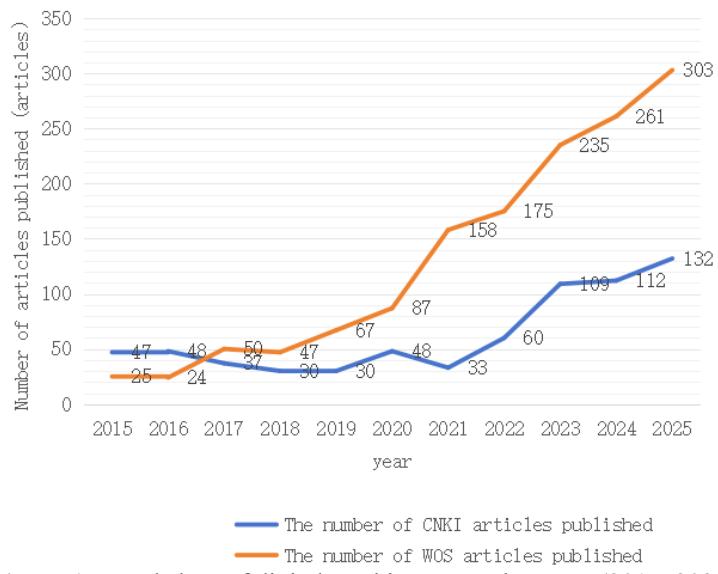


Figure 1. Trend chart of digital teaching research papers (2015–2025)

Domestic publications, as recorded by CNKI, increased from 47 in 2015 to 132 in 2025. The initial slow growth from 2015 to 2019 reflected exploratory practices and fragmented theoretical frameworks. The pandemic catalyzed growth during the period from 2020 to 2022, while subsequent national digitization

strategies post-2023 further propelled publications to 132 by 2025, indicating sustained growth potential.

In contrast, international publications indexed in WOS surged from 25 in 2015 to 303 in 2025. Following a period of slow growth from 2015 to 2018, output accelerated significantly from 2019 onward. A critical shift occurred in 2017, when WOS volumes surpassed those of CNKI, resulting in a 2.3-fold gap by 2025, which underscores a more rapid technological adaptation and enhanced research momentum.

3.2. Keyword co-occurrence analysis

Keyword co-occurrence analysis elucidates core research themes and hotspot correlations^[8].

The keyword co-occurrence map (Figure 2) displays a network comprising 275 nodes and 259 connections, with a density of 0.0069. Through Tree Ring History visualization, node size indicates keyword frequency, ring color represents temporal activity (inner rings denoting earlier periods and outer rings indicating recent periods), and ring thickness corresponds to frequency per period. “Digital literacy,” “digitization,” and “vocational education” emerge as central nodes, establishing extensive connections with peripheral terms such as “teaching resources,” “teaching mode,” “personnel training,” and “informatization.” This illustrates a well-established research framework in the realm of domestic digital teaching studies.

Figure 3 presents the keyword co-occurrence map for international digital teaching research, featuring 405 nodes, 2,253 connections, and a network density of 0.0275, which is significantly higher than that of the domestic network. This disparity signifies stronger inter-keyword relationships and increased interdisciplinary integration. Core nodes include “technology,” “education,” and “students,” which are closely linked to theoretical methods (e.g., “model,” “framework”) and outcome evaluation terms (e.g., “attitudes,” “engagement”). The network underscores a dual focus on “people,” addressing students’ “skills” and “attitudes,” while also emphasizing teachers’ “professional development” and “competence.” This creates a refined research structure centered on human development, underpinned by theoretical frameworks and data-driven effectiveness, thereby reinforcing the logic of technology-subject integration^[9].

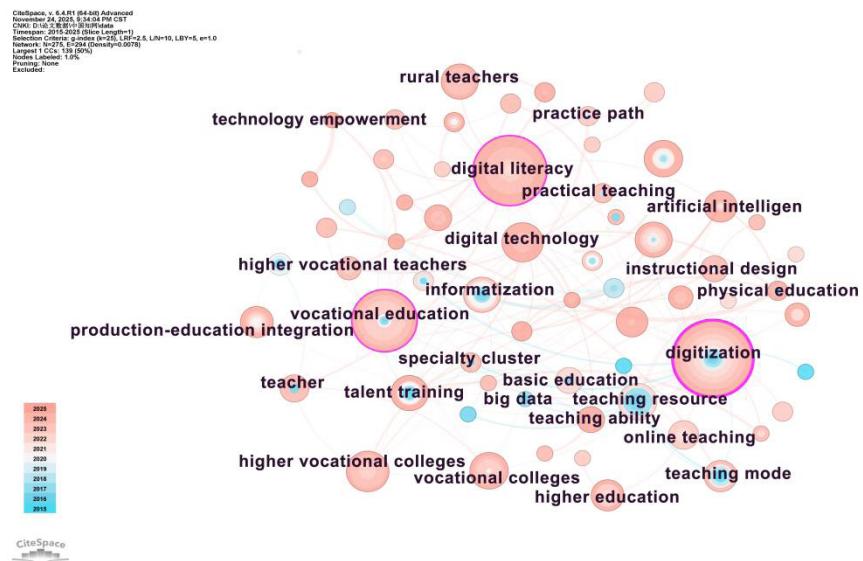


Figure 2. CNKI digital teaching keyword co-occurrence map (2015–2025)

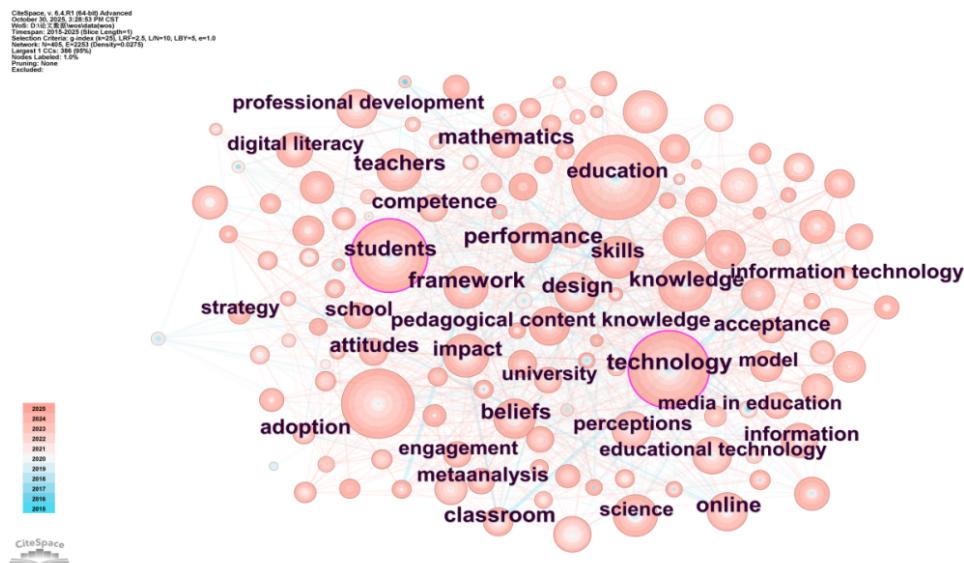


Figure 3. WOS digital teaching keyword co-occurrence map (2015–2025)

3.3. Keyword burst analysis

Keyword burst detection refers to the rapid increase in the frequency of a certain keyword within a specific period of time. It tracks the evolution of the cutting-edge by locking onto high-attention topics^[10].

Figure 4 illustrates the progression of domestic digital teaching research through keyword burst analysis. Early-stage keywords such as “teaching resources” (2015), “flipped classroom,” and “Internet+” (2016) highlight foundational developments in infrastructure and pedagogy. Notably, “Internet+” exhibited the longest duration of prominence (5 years), while “online teaching” maintained focus for 4 years, indicating sustained interest in technology-enhanced education. “Teaching resources” demonstrated the highest burst intensity (3.84), underscoring its significance in the early stages. The recent emergence of “higher vocational colleges” and “higher vocational teachers” (2022–2023) indicates a strategic shift toward vocational education, suggesting a forecast for specialized research in this area.

Figure 5 reveals distinct evolutionary trajectories in foreign digital education research. The analysis indicates a clear progression: research hotspots transitioned from foundational tools (“media,” 2015–2020) and instructional “design” to specific scenarios (“classroom teaching,” “devices”), and subsequently to “online learning” and psychological factors (“self-efficacy”). Burst intensity analysis identifies “ICT” (5.59), “online learning” (5.19), and “science” (4.71) as sustained priorities. This progression from technical tools to application models and ultimately to psychological constructs represents a conceptual shift from a technology-centered to a human-centered perspective, reflecting the maturation of the field toward holistic educational approaches.

Top 10 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2015 - 2025
teaching resource	2015	3.84	2015	2017	
flipped classroom	2016	2.06	2016	2018	
internet plus	2016	1.67	2016	2020	
cloud classroom	2017	1.77	2017	2018	
online teaching	2020	2.51	2020	2023	
production-education integration	2020	1.3	2020	2021	
informatization	2015	1.2	2020	2021	
higher vocational colleges	2022	2.45	2022	2025	
higher education	2022	2.28	2022	2023	
higher vocational teachers	2023	1.45	2023	2025	

Figure 4. CNKI digital teaching keyword burst map (2015–2025)

Top 10 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2015 - 2025
media in education	2015	3.93	2015	2020	
design	2015	3.09	2015	2018	
improving classroom teaching	2017	5.05	2017	2021	
devices	2018	3.17	2018	2021	
literacy	2018	3.15	2018	2019	
ict	2019	5.59	2019	2021	
science	2016	4.71	2019	2020	
distance education	2015	3.27	2019	2021	
online learning	2020	5.19	2021	2022	
self efficacy	2021	3.03	2021	2023	

Figure 5. WOS digital teaching keyword burst map (2015–2025)

4. Conclusion and prospects

This study identifies significant divergences in the trajectories of digital teaching research between China and the international community. Research in China exhibits a practical orientation, emphasizing digital literacy, vocational education, and resource development. In contrast, international research demonstrates greater theoretical depth, interdisciplinary integration, and a balanced focus on both technological applications and human factors, such as student engagement and teacher competence.

An analysis of publication volume indicates that since 2017, international research has not only outpaced Chinese output but has also adapted more rapidly to emerging trends. Co-occurrence and burst analyses further highlight structural differences: Chinese research centers on vocational and resource-oriented themes, while international studies progress toward inquiries that are more psychologically informed and theoretically grounded.

To advance global educational digitization, Chinese researchers should prioritize theoretical innovation

and interdisciplinary collaboration, whereas international scholars may benefit from engaging with practice-oriented models. Future studies should aim to develop hybrid approaches that integrate these strengths, promote international collaboration, and investigate the long-term impacts on diverse learners. Such efforts will contribute to a more inclusive and globally informed digital education ecosystem.

Disclosure statement

The authors declare no conflict of interest.

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