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Status, Hotspots, and Trends of Teacher Competence Research in Education: A Bibliometric Analysis Based on CiteSpace

Hexin Meng *, Jianhua Guo

Guilin University of Technology, Guilin, Guangxi, China

*** Corresponding author:** Hexin Meng (Email: zm13878225053@163.com)

Abstract: Teacher competence has become an increasingly important topic in contemporary educational research, particularly in the context of educational digitalization and technology-supported teaching. This study employed CiteSpace and bibliometric methods to analyze teacher competence research in education based on publications indexed in the Web of Science Core Collection database from 2022 to early 2026. A total of 2,946 publications were included in the analysis. Publication trends, country and institutional distributions, keyword co-occurrence, clustering analysis, timeline visualization, and burst keyword detection were conducted to identify the major research hotspots and developmental trends in this field. The results indicate that teacher competence research has shown a continuous growth trend in recent years and has gradually expanded from traditional pedagogical competence toward more technology-related and interdisciplinary research areas. Major research topics include teacher education, higher education, medical education, nursing education, inclusive education, and self-determination theory, while digital competence and technology-enhanced teaching have emerged as important cross-cutting themes across different educational contexts. The keyword evolution and burst analyses further suggest that recent studies have increasingly focused on online learning, student learning outcomes, digital pedagogy, and teachers' psychological adaptability in changing educational environments. In addition, the findings reveal that teacher competence research has become increasingly contextualized and practice-oriented across different educational settings, including higher education, medical education, and inclusive education. Contemporary studies place growing emphasis on teachers' technological adaptability, instructional innovation, and continuous professional learning in digital educational environments. This study provides a systematic overview of the knowledge structure and evolutionary trends of teacher competence research and offers references for future teacher education, educational technology integration, and professional development research in the digital era.

Keywords: Teacher Competence; CiteSpace; Bibliometric Analysis; Educational Research.

1. Introduction

The concept of competence originated from competency theory proposed by McClelland, who emphasized the relationship between individual characteristics and job performance[1]. Boyatzis further conceptualized competence as a comprehensive structure influencing professional effectiveness and organizational performance [2]. In the field of education, Shulman introduced the theory of Pedagogical Content Knowledge (PCK), arguing that teachers require not only subject knowledge but also pedagogical knowledge [3]. This theory laid an important theoretical foundation for subsequent teacher competence research.

Teacher competence has become an important topic in educational research and generally refers to the knowledge, skills, attitudes, and practical abilities that teachers need in order to effectively accomplish teaching tasks in specific educational contexts [3]. With the continuous advancement of educational modernization and global educational reform, teacher competence has become a key indicator for evaluating teacher professionalism and educational quality. UNESCO emphasized that the development of high-quality teachers is essential for achieving quality education and the Sustainable Development Goals [4].

Traditional research on teacher competence mainly focused on pedagogical knowledge, classroom management, curriculum design, and teaching evaluation. However, with the rapid development of digital technology, artificial intelligence, and online education, the competence structure required for teachers has undergone significant transformation. Especially in the post-pandemic era, the widespread adoption of online and hybrid teaching models has required teachers not only to possess traditional instructional abilities but also to develop digital teaching competence, technology integration skills, and online learning support abilities [5]. Consequently, digital competence has gradually become one of the major hotspots in educational research.

Meanwhile, teacher competence research has become increasingly contextualized and diversified. Different educational stages and educational types require different teacher competencies. For example, higher education emphasizes instructional innovation and academic development abilities, while early childhood education focuses more on child development support skills and inclusive educational awareness [6]. Furthermore, with the integration of artificial intelligence into educational settings, researchers have begun to explore the transformation of teachers' roles in intelligent learning environments, including their roles as learning facilitators, curriculum designers, and learning data analysts [7].

In recent years, international publications on teacher competence have increased significantly, and research themes have expanded from traditional teaching skills to digital competence, AI literacy, and intercultural competence, demonstrating clear interdisciplinary and digitalized

characteristics. Teacher competence has become an important topic in educational research, particularly in the context of digital transformation, artificial intelligence, and ongoing educational reform. As research output in this field has increased rapidly in recent years, the knowledge structure, major research themes, and developmental trends of teacher competence have also become more diverse and complex. Therefore, it is necessary to conduct a systematic bibliometric analysis of recent studies in order to better understand the current research landscape and identify emerging directions in teacher competence research. However, systematic reviews of teacher competence research in Education in recent years remain relatively limited.

Therefore, this study employs CiteSpace and bibliometric methods to analyze teacher competence research indexed in the Web of Science Core Collection database from 2022 to 2026. By examining publication trends, country and institutional distributions, keyword co-occurrence, clustering analysis, and burst keyword detection, this study aims to reveal the knowledge structure, research hotspots, and emerging trends in teacher competence research, thereby providing references for future educational research and teacher professional development.

2. Methodology and data sources

2.1. Methods

CiteSpace is a widely used bibliometric visualization tool developed for identifying intellectual structures, research frontiers, and evolutionary trends within scientific literature [8]. Compared with traditional literature review methods, CiteSpace provides significant advantages in visualization analysis, dynamic trend detection, and knowledge mapping, enabling researchers to systematically identify research hotspots, distribution analysis and emerging themes.

In recent years, bibliometric analysis has become increasingly important in educational research because it allows scholars to quantitatively examine the development trajectory and knowledge structure of a research field. Therefore, this study employed CiteSpace to conduct a visualized bibliometric analysis of teacher competence research in education.

Specifically, this study aimed to address the following research questions:

(1) What are the publication trends and major distribution characteristics of teacher competence research in the field of education from 2022 to early 2026?

(2) What are the major research hotspots and thematic areas in teacher competence research in the field of education?

(3) What are the emerging research trends and evolving topics in teacher competence research in recent years?

2.2. Data Sources

This study maps the research landscape and evolutionary trajectory of teacher competence in education, covering publications from 2022 through early 2026. Data were sourced from the Web of Science (WoS) Core Collection, widely regarded as a premier global academic database. We specifically targeted the Social Sciences Citation Index (SSCI) and Science Citation Index Expanded (SCI-EXPANDED) to ensure high scholarly quality and comprehensive international coverage.

The search strategy employed a topic search (TS) with the following query: TS = ("teacher competence" OR "teacher competency" OR "teaching competence" OR "teacher competency model"). To maintain dataset integrity, we restricted results to English-language articles and review articles published between 2022 and 2026. The final retrieval was conducted on April 26, 2026.

Following data collection, irrelevant records, duplicates, and non-academic materials were manually screened and removed, yielding a final corpus of 2,946 valid publications. Each record retained essential bibliographic metadata, including authors, affiliations, abstracts, keywords, cited references, and publication years. Records were exported from WoS in plain text format and imported into CiteSpace for processing and visualization. Time slicing was set to one-year intervals spanning 2022–2026, and the Pathfinder pruning algorithm was applied to streamline network structure and enhance visual clarity [8].

Using this processed dataset, CiteSpace generated a suite of knowledge maps depicting annual publication trends, country/institutional distributions, keyword co-occurrence networks, clustering patterns, timeline views, and burst keyword detection. Collectively, these analyses systematically delineate the research hotspots, intellectual structure, and evolutionary trends that have shaped teacher competence research over the past five years.

3. Visualized Bibliometric Analysis

3.1. Annual Publication Trends

Figure 1 illustrates the annual publication volume of teacher competence research in education, drawing on Web of Science Core Collection records from 2022 through April 2026. The data reveal a pronounced upward trajectory: annual output climbed steadily from 45 papers in 2022 to a peak of 1,225 in 2025. The partial count for 2026 (227 publications) is an artifact of the April 26 data cutoff, not an indication of waning scholarly activity.

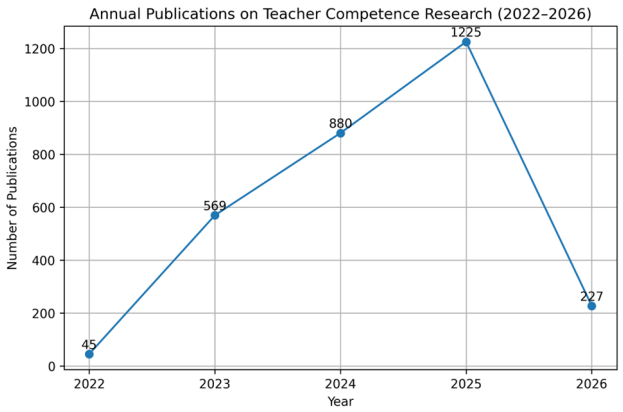

Figure 1. Annual Publications on Teacher Competence Research in education (2022-2026)

This growth affirms that teacher competence has become a core preoccupation in global educational research. The post-pandemic shift to online and hybrid teaching served as a primary catalyst, directing academic attention toward digital fluency, technology integration, and adaptive instructional strategies as educators navigated unfamiliar learning environments [5].

Policy frameworks have further sustained this momentum. UNESCO and the European Commission's guidelines on teacher professional development and digital competence

have provided institutional scaffolding for empirical inquiry [4, 12]. At the same time, the rapid adoption of AI, learning analytics, and immersive technologies has pushed the conceptual boundaries of teacher competence beyond traditional pedagogical skills, emphasizing dynamic, context-responsive capabilities instead [7].

The publication trend thus captures more than rising academic interest; it documents an ongoing restructuring of educational practice and teacher roles in response to digital transformation.

3.2. Country/Region Distribution Analysis

Table 1 outlines the geographic distribution of teacher competence research in education, revealing a landscape heavily concentrated in nations with mature educational research infrastructures. The United States leads with 560 publications and the highest betweenness centrality (0.36), followed closely by China (533 publications). Spain, Germany, Australia, and the United Kingdom also demonstrate substantial research productivity and network influence.

Table 1. Top 30 countries/regions by publication count and betweenness centrality in teacher competence research in education

Count	Centrality	Year	Countries
560	0.36	2022	USA
533	0.15	2022	CHINA
252	0.12	2022	SPAIN
242	0.10	2022	GERMANY
161	0.16	2022	AUSTRALIA
153	0.31	2022	UNITED KINGDOM
131	0.12	2022	CANADA
126	0.00	2023	TÜRKIYE
118	0.01	2023	TAIWAN
108	0.03	2023	NORWAY
97	0.18	2022	NETHERLANDS
75	0.07	2022	FINLAND
74	0.02	2022	SWEDEN
63	0.03	2023	BELGIUM
56	0.04	2022	IRELAND
54	0.04	2023	SOUTH KOREA
48	0.01	2023	IRAN
46	0.02	2022	SOUTH AFRICA
41	0.04	2023	ITALY
40	0.02	2022	SWITZERLAND
38	0.01	2023	BRAZIL
38	0.04	2023	INDONESIA
38	0.02	2023	MALAYSIA
35	0.00	2022	ISRAEL
34	0.04	2023	POLAND
31	0.02	2022	NEW ZEALAND
30	0.01	2023	DENMARK
30	0.03	2022	SAUDI ARABIA

This concentration reflects sustained investment in educational modernization and teacher development within these regions. In the United States, a longstanding tradition in teacher education and educational psychology has recently pivoted toward online learning, AI-assisted instruction, and digital competence [17]. China's rapid ascent is similarly policy-driven; national initiatives such as the "Education Informatization 2.0 Action Plan" have catalyzed extensive inquiry into teachers' digital literacy, technology integration, and smart education environments.

European scholarship, particularly from Spain, Germany, and the UK, exhibits a distinct thematic focus on inclusive education and digital pedagogical innovation. This trajectory has been significantly shaped by supranational frameworks like the European Commission's DigCompEdu, which has standardized competence-based teacher education across the continent [12]. Meanwhile, emerging contributors such as Türkiye, Taiwan, and Norway signal the gradual diversification of this field beyond traditional Western academic centers.

3.3. Institutional Distribution Analysis

Institutional analysis reveals that teacher competence research is concentrated within a relatively small group of universities, suggesting that the field is characterized by several influential research hubs. As shown in Table 2, leading institutions are mainly located in Hong Kong, China's mainland, the United States, Canada, and Germany, indicating broad international participation in this research area.

The Education University of Hong Kong (EdUHK) ranked first with 52 publications, while the University of Hong Kong and the Chinese University of Hong Kong also appeared among the top institutions. This concentration may suggest that Hong Kong has established a relatively active research community in teacher education and competence-related studies. Similarly, the strong performance of Beijing Normal University reflects the growing visibility of Chinese institutions in this field.

Several universities from the United States, including the University System of Ohio, the University of North Carolina, Harvard University, and the State University System of Florida, also ranked among the most productive institutions. Their presence indicates the continuing importance of teacher competence research within established educational research systems.

The inclusion of institutions from Canada and Germany further suggests that teacher competence has become a topic of international concern across different educational contexts. Overall, the institutional distribution indicates that contemporary teacher competence research is increasingly internationalized and supported by diverse higher education systems, although the specific factors influencing institutional productivity warrant further investigation.

Table 2. Top 10 institutions by publication count in teacher competence research in education

Ranking	Institutions	Count
1	Education University of Hong Kong (EdUHK)	52
2	University System of Ohio	44
3	University of Hong Kong	34
4	Beijing Normal University	34
5	Chinese University of Hong Kong	30
6	University of Toronto	29
7	University of North Carolina	29
8	Harvard University	28
9	State University System of Florida	27
10	University of Hamburg	26

3.4. Keyword Co-occurrence Analysis

The keyword co-occurrence network (Figure 2) shows that terms such as teacher competence, education, students, higher education, professional development, digital competence, technology, and self-efficacy occur frequently and occupy central positions in the network. These nodes form the core conceptual backbone of current research on teacher competence.

Notably, students exhibits the highest betweenness centrality among all keywords—a pattern suggesting a marked shift toward student-centered perspectives in recent work. Earlier studies primarily focused on teachers' instructional practices and classroom effectiveness. More recent research has increasingly examined how various teacher-related factors influence student learning outcomes and academic achievement, which have become important indicators for evaluating educational effectiveness [16]. This reflects a broader international move away from teacher-centered delivery toward learner-centered pedagogy.

The prominence of professional development underscores the enduring emphasis on sustained teacher learning. Professional development is increasingly viewed as a continuous and lifelong learning process rather than a series of isolated training activities. Teachers are expected to continuously update their professional knowledge and instructional practices to adapt to changing educational environments [18].

Similarly, the recurring presence of digital competence and technology signals that digital transformation is now a defining axis of the field. As online platforms, smart classrooms, and AI tools become routine in teaching settings, teachers' capacity to navigate these environments directly affects instructional quality [12]. Current research no longer treats digital competence as mere tool proficiency; instead, it examines how teachers meaningfully embed technology into curriculum design, assessment, and interaction. The TPACK framework (Mishra & Koehler) exemplifies this shift: it positions technological, pedagogical, and content knowledge not as separate domains, but as interdependent elements essential for effective teaching [9]. In effect, digital competence has matured from a technical add-on into an integral dimension of professional identity.

The inclusion of self-efficacy further reveals growing scholarly attention to teachers' inner lives. Motivation, professional commitment, and teachers' perceptions of competence have increasingly attracted scholarly attention. According to self-determination theory, the satisfaction of individuals' basic psychological needs is closely associated with motivation, engagement, and professional development [14]. In settings saturated with digital tools, teachers often face dual pressures: redefining their professional roles while adapting to rapidly evolving technologies. Under such conditions, psychological support and occupational well-being are no longer peripheral concerns but central to sustaining competent practice.

Taken together, the co-occurrence analysis points to a substantive evolution: teacher competence is no longer conceived primarily through the lens of classroom technique, but as a multifaceted construct shaped by digital demands, student needs, emotional resilience, and adaptive professionalism.

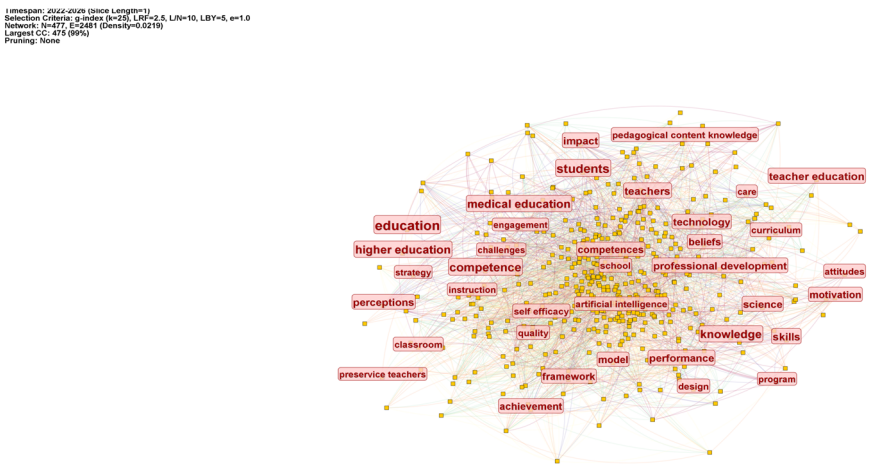

Figure 2. Keyword co-occurrence network of teacher competence research in education

Table 3 presents the high-frequency keywords and their betweenness centrality values in teacher competence research (2022 – 2026), revealing a richly layered intellectual architecture. The network is anchored by foundational terms — education (521 occurrences, centrality = 0.85), students (336, 0.87), competence (256, 0.60), and knowledge (227, 0.43) — which collectively define the field's core conceptual terrain.

Critically, the word students hold the highest betweenness centrality (0.87), confirming its role as the structural nexus of the research network: student outcomes, engagement, motivation, and holistic development are not merely outcomes but organizing principles for contemporary inquiry. This reflects a paradigmatic shift from teacher performance metrics toward learner - centered evaluation frameworks—a transformation aligned with global movements toward competency - based education and humanistic pedagogy [16].

The emergence of context-specific keywords — higher education (205), medical education (196), teacher education (149), and preservice teachers (61)—signals a decisive turn toward contextualized competence modeling. Research now explicitly acknowledges that competence is not universal but situated: the demands of medical educators differ fundamentally from those of K–12 or university instructors, requiring distinct epistemic, ethical, and pedagogical configurations [15].

Table 3. High-frequency keywords and betweenness centrality in teacher competence research in education

Count	Centrality	Year	Keywords
521	0.85	2022	education
336	0.87	2022	students
256	0.60	2022	competence
227	0.43	2022	knowledge
205	0.31	2022	higher education
196	0.49	2022	medical education
165	0.39	2022	teachers
155	0.34	2023	skills
149	0.38	2023	teacher education
148	0.71	2022	impact
135	0.54	2023	technology
130	0.27	2023	professional development
130	0.20	2022	perceptions
123	0.36	2023	performance
122	0.25	2023	science
110	0.19	2023	model
102	0.21	2023	motivation
101	0.20	2023	achievement
101	0.41	2022	framework
97	0.14	2023	beliefs
95	0.11	2022	competences
87	0.32	2023	attitudes
83	0.35	2022	curriculum
83	0.29	2023	self efficacy
81	0.42	2023	classroom
80	0.22	2023	pedagogical content knowledge
78	0.31	2023	design
72	0.10	2023	quality
71	0.05	2023	school
68	0.26	2022	care
67	0.00	2023	artificial intelligence
65	0.16	2022	program
62	0.29	2022	challenges
62	0.28	2023	engagement
61	0.13	2023	preservice teachers
59	0.09	2023	medical students
59	0.14	2022	instruction
57	0.17	2023	strategy
56	0.08	2023	language
56	0.21	2023	experiences
53	0.39	2023	children
51	0.06	2023	computational thinking
50	0.08	2023	digital competence

Technology-related terms — technology (135), artificial intelligence (67), computational thinking (51), and digital competence (50) — form a rapidly coalescing subnetwork. Though digital competence ranks modestly in frequency, its centrality (0.08) and 2023 emergence indicate it functions as a bridging concept, linking technical skills to pedagogical purpose. Crucially, the field has moved beyond tool proficiency to emphasize integrative capacity: how teachers synthesize AI, data literacy, and adaptive design to foster deeper learning [12, 9].

Psychological dimensions—self-efficacy (83), motivation (102), beliefs (97), attitudes (87), and engagement (62)—constitute a robust affective layer. Their prominence affirms that teacher competence is now understood as a triadic construct: cognitive (knowledge/skills), conative (motivation/beliefs), and affective (resilience/identity). In volatile educational ecosystems, psychological resources are no longer ancillary but constitutive of professional sustainability.

Finally, enduring pedagogical themes—curriculum (83), design (78), instruction (59), strategy (57), and framework (101) — demonstrate that instructional innovation remains central. Yet these terms increasingly co-occur with technology, AI, and adaptive modifiers, signaling a synthesis: traditional design logic is being reimagined through digital affordances and learner variability.

In sum, the keyword landscape reveals a field in dynamic reconfiguration: teacher competence research has become increasingly multidimensional, context-sensitive, and interdisciplinary.

3.5. Keyword Clustering Analysis

To further explore the internal knowledge structure of teacher competence research, this study conducted a keyword clustering analysis using the Log-Likelihood Ratio (LLR) algorithm in CiteSpace [8]. The clustering quality was evaluated by the modularity Q value and weighted mean silhouette S value.

The results show that the modularity Q value reached 0.3021, while the weighted mean silhouette S value was 0.5273. According to established bibliometric standards, a Q value greater than 0.3 indicates a significant clustering structure, whereas an S value above 0.5 suggests that the clustering results possess acceptable reliability and consistency [8]. Therefore, the clustering structure generated in this study can be considered acceptable clustering quality.

The clustering results reveal several major research themes, including “medical education,” “self-determination theory,” “teacher education,” “higher education,” “nursing education,” “early childhood education,” and “inclusive education.” These clusters reflect the increasing interdisciplinarity and contextualization of teacher competence research.

Among these clusters, “medical education” emerged as the largest research cluster. Compared with general education contexts, medical education places greater emphasis on practical competence, clinical supervision, and competency-based assessment. Teachers in medical education are expected not only to possess disciplinary expertise but also to demonstrate instructional competence in clinical guidance, simulation teaching, and case-based learning.

The “higher education” cluster reflects the growing complexity of university teachers’ professional roles. In the context of educational globalization and digital transformation, university teachers are increasingly required to integrate teaching, research, international collaboration, and digital instruction into their professional practices. Ongoing educational reforms and technological changes have further reshaped expectations regarding university teachers’ professional competencies and instructional practices [17]. Another important cluster is “digital competence,” which

indicates that digital transformation has profoundly reshaped teacher competence research. Recent studies increasingly emphasize teachers' abilities to integrate technology into instructional design, assessment, and student interaction rather than merely operating digital tools [12][16].

The appearance of the "self-determination theory" cluster reflects growing scholarly interest in teachers' intrinsic motivation, professional identity, and psychological well-being. In highly digitalized educational environments, teachers frequently experience technological stress and professional role transformation. Consequently, teacher motivation, professional identity, and psychological needs satisfaction have become important dimensions of contemporary teacher development research [14].

In addition, the "inclusive education" cluster demonstrates the continuing importance of educational equity and multicultural teaching competence. Teachers are increasingly expected to support students with diverse cultural backgrounds, learning needs, and educational abilities through differentiated instructional strategies and inclusive pedagogical approaches [6].

Overall, the clustering analysis demonstrates that teacher competence research has evolved from traditional pedagogical skill research into a comprehensive interdisciplinary field characterized by digitalization, contextualization, and psychological orientation.

Figure 3. Keyword clustering map of teacher competence research in education

3.6. Evolution of Research Hotspots

To examine thematic changes from 2022 to early 2026, this study created a keyword timeline in CiteSpace. The visualization displays shifts in research topics and their connections over the five-year period.

The timeline shows that the scope of teacher competence research has expanded. Early clusters focused on teacher education, higher education, professional development, curriculum, and medical education, which corresponds to an initial emphasis on instructional skills, training, and competency frameworks [3][16]. These early patterns suggest that research at the start of the period was largely situated within traditional educational contexts and capacity-building models.

Starting in 2023, technology-related keywords appeared with greater frequency. Terms including digital competence, technology, online learning, artificial intelligence, and computational thinking rose noticeably. This change likely relates to the wider adoption of digital tools in education systems. The post-pandemic shift toward online and hybrid teaching also seems to have directed more scholarly attention to teachers' technological adaptability and digital teaching practices [5].

The increasing prominence of digital competence points to a change in how teacher competence is understood. Recent literature does not treat subject knowledge and teaching techniques as sufficient by themselves. Instead, it highlights teachers' capacity to use digital tools in lesson design, classroom interaction, assessment, and student support [9][12]. Teachers are now more often described as facilitators of technology-supported learning rather than only as deliverers of content.

At the same time, affective and psychological aspects have received more attention. Keywords such as motivation, beliefs, engagement, and care appear repeatedly, indicating growing interest in teachers' professional identity, motivation, and psychological needs [14]. This suggests that teacher competence is increasingly viewed as multidimensional, combining technical and pedagogical skills with emotional adaptability and professional sustainability.

The literature also reflects greater contextual specificity and interdisciplinarity. The continued presence of medical education, health care, children, and inclusive education shows that competence requirements differ across settings. Researchers have accordingly focused on contextual responsiveness, adaptive teaching strategies, and cross-disciplinary skill development.

Across the five-year window, the timeline depicts teacher competence as an integrated construct that brings together digital literacy, psychological resilience, contextual adaptability, and technology-supported pedagogy. This development appears consistent with broader changes in global education systems associated with digitalization, AI integration, and educational modernization.

3.7. Keyword Burst Detection Analysis

The analysis of the 2022–early 2026 period suggests that teacher competence research has undergone continuous development and diversification. The burst keywords reveal changing research interests and indicate several emerging themes that have attracted increased scholarly attention in recent years.

The strongest burst was observed for the keyword care. This finding suggests growing scholarly attention to the relational and emotional dimensions of teacher competence. Recent studies have increasingly emphasized teachers' roles in supporting students' well-being, engagement, and learning

experiences, indicating that care is being recognized as an important component of professional competence rather than merely an auxiliary characteristic.

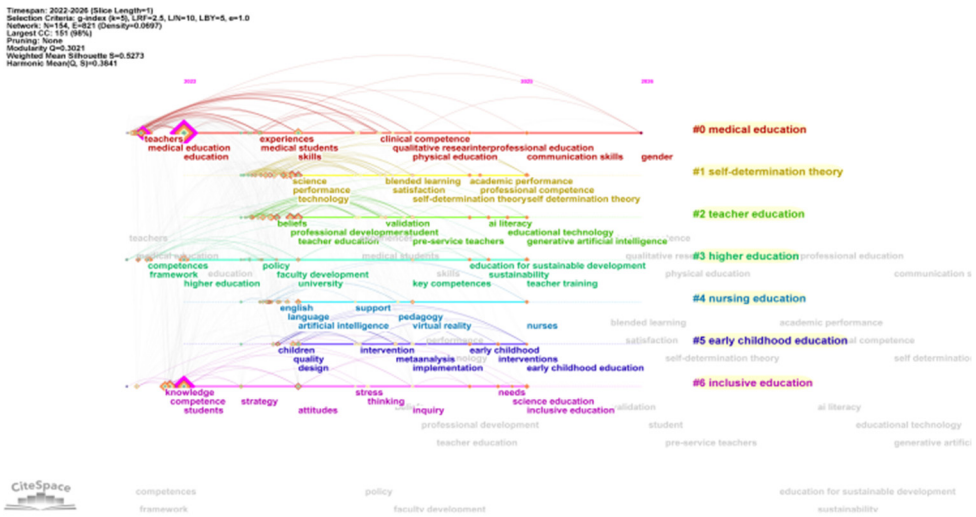

Figure 4. Keyword timeline visualization of teacher competence research in education

The burst of identity suggests increasing interest in teachers' professional identity and role development. This trend may reflect growing attention to how teachers perceive and adapt their professional roles in changing educational environments [14].

The emergence of curriculum as a burst keyword indicates that curriculum-related competence remains an important topic within teacher competence research. Researchers have increasingly examined the relationship between curriculum design, instructional practice, and teacher competence [3][16].

The burst keyword online reflects increasing attention to online and technology-supported teaching environments. This trend is consistent with the growing integration of digital technologies into educational practice and highlights the importance of teachers' abilities to effectively support learning in digital settings.

The appearance of academic achievement suggests that researchers are increasingly concerned with the relationship between teacher competence and student learning outcomes. This trend reflects a growing interest in understanding how teachers' knowledge, skills, and professional capabilities contribute to educational effectiveness [16].

Top 8 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2022 - 2026
care	2022	4.85	2022	2023	
identity	2022	4.07	2022	2023	
curriculum	2022	3.85	2022	2023	
online	2023	3.8	2023	2024	
health care	2023	3.45	2023	2024	
perspectives	2023	3.28	2023	2024	
academic achievement	2023	2.41	2023	2024	
outcm	2022	1.97	2022	2023	

Figure 5. Keyword burst detection of teacher competence research in education

Finally, the emergence of health care indicates that teacher competence research has expanded into professional and disciplinary contexts beyond traditional school education. This finding is consistent with the prominence of medical education and nursing education identified in the clustering analysis.

Overall, the burst detection results suggest that teacher competence research is undergoing continuous development and diversification. Recent attention has focused not only on instructional knowledge and skills, but also on professional identity, student support, curriculum development, online teaching, and learning outcomes. These trends indicate an increasing emphasis on contextual, relational, and technology-related dimensions of teacher competence.

4. Conclusion

This study used CiteSpace and bibliometric methods to examine international research on teacher competence within the education field, drawing on publications indexed in the Web of Science Core Collection from 2022 to early 2026. Through publication trend analysis, country and institutional distribution, keyword co-occurrence, clustering, timeline visualization, and burst detection, the study mapped major hotspots, knowledge structures, and developmental trends in this domain.

The findings show that teacher competence research has grown rapidly in recent years. The field has gradually shifted from traditional pedagogical skills toward a more comprehensive, interdisciplinary scope. Digital competence, artificial intelligence literacy, professional development, and technology-integrated pedagogy have emerged as dominant themes. This shift may be related to broader changes in global educational systems driven by digitalization, educational modernization, and intelligent learning environments.

Teacher competence research has also become more contextualized and practice-oriented. Different educational settings, such as higher education, medical education, and inclusive education, require distinct competence structures. Current work increasingly emphasizes adaptability, interdisciplinary integration, and contextual responsiveness.

Teachers' psychological and emotional dimensions have received growing scholarly attention. Themes such as self-efficacy, professional identity, occupational well-being, and psychological resilience suggest that teacher competence is no longer viewed merely as instructional skills. It is now understood as a multidimensional framework integrating cognition, emotion, motivation, and technological

adaptability.

Digital transformation and AI-assisted technologies are reshaping teacher professional roles. Teachers are increasingly expected to function as learning facilitators, instructional designers, technology integrators, and data-informed practitioners, not only as knowledge transmitters. Future teacher education programs may need to place greater emphasis on digital literacy, AI literacy, and adaptive professional development. Despite the valuable findings of this study, several limitations should also be acknowledged. First, the dataset was limited to publications indexed in the Web of Science Core Collection and English-language literature, which may have excluded relevant studies published in other databases or languages. Second, because the data for 2026 were collected before the end of the year, the annual publication statistics for 2026 remain incomplete. In addition, bibliometric analysis mainly focuses on quantitative patterns and may not fully capture the deeper theoretical implications of individual studies. Besides, this study focused specifically on publications within the field of education, which may have excluded relevant studies on teacher competence conducted in other interdisciplinary fields such as psychology, management, healthcare, or information technology. Therefore, the findings of this study mainly reflect the developmental characteristics of teacher competence research within educational contexts.

Future research may further explore several important directions. More studies are needed to investigate the long-term impact of AI-assisted educational technologies on teacher competence and educational ecosystems. In addition, greater attention should be paid to intercultural competence, inclusive pedagogy, and teacher mental health in increasingly diverse and digitalized learning environments. Future scholars are also encouraged to develop more localized, dynamic, and practice-oriented teacher competence evaluation frameworks in order to better support educational reform and teacher professional development.

In conclusion, teacher competence research has gradually evolved into a highly interdisciplinary and globally connected field characterized by digitalization, contextualization, and technological integration. Against the background of rapid educational transformation and artificial intelligence development, teacher competence research will continue to play an increasingly important role in shaping future educational systems and teacher professional development worldwide.

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