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Exploring the Scientific Landscape of Teacher Competence: A Scientometric Analysis

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A B S T R A C T

Teacher competence is essential in today's education, where teachers are expected to not only deliver content but also mentor, assess, and support students' character development. With rapid technological changes, diverse student populations, and evolving learning needs, teachers must continuously adapt their competencies. However, previous research has largely focused on local or conceptual discussions, lacking a comprehensive global perspective. This study aims to map the scientific landscape of teacher competence research from 2005 to mid-2025 using a scientometric method based on the PRISMA 2020 framework. A total of 397 peer-reviewed journal articles indexed in Scopus were analyzed using Biblioshiny. The results show a significant increase in publications after 2020, particularly addressing digital competence, inclusive education, and pedagogical knowledge. Germany and the Netherlands are identified as key contributors, while Indonesia exhibits high productivity with limited international collaboration. This study not only highlights thematic trends and influential contributors but also provides practical insights for shaping future teacher development strategies. By uncovering global research patterns, this work contributes to a more adaptive, inclusive, and digitally responsive understanding of teacher competence in an era of educational transformation.

1. Introduction

Teacher competence serves as the foundational element for creating meaningful learning experience across various educational (Siri et al., 2020). The role of a teacher has expanded beyond the traditional function of delivering instructional content to include responsibilities as educators, mentors, assessors, and character builders (Akbar, 2024; Alan & Güven, 2022). In the context of vocational education, for example, initiatives have been undertaken to enhance teacher competence through training and revitalization programs aimed at aligning educational practices with the dynamic need of industry and the labor market (Aindra et al., 2022). However, many teachers encounter barriers in effectively applying their competencies, particularly in pedagogical practice and technology

integration (Latip et al., 2023; Zamora & Zamora, 2022). As the educational landscape becomes increasingly complex, so do the expectations placed on teachers. They are now expected not only to be competent within local context but also to possess global awareness manifested through cross cultural emphaty, self reflective capacity, and sensitivity to student diversity (Skantz-Åberg et al., 2022; Zamora & Zamora, 2022).

The relationship between teacher competence and student learning outcomes is not necessarily linear. Teachers' knowledge and skills yield optimal results only when mediated by high quality intructional practices (Blömeke et al., 2022). Teachers who demonstrate self-confidence, reflective ability, and strong instructional skills are more likely to significantly impact student achievement (López-Martín et al., 2023). Nonetheless, efforts to improve teacher competence are often hindered by poorly designed training programs that lack systematic evaluation (Alan & Güven, 2022). The emerging concept of Teacher Curriculum Competence (TCC) offers a new perspective by framing teachers as active curriculum agents rather than mere implementers. They are expected to interpret and adapt curriculum content to reflect the local contexts of their students (Tran & O'Connor, 2024), while also balancing national education policies with real world classroom needs (Zamora & Zamora, 2022). Additionally, the rapid pace of digitalization has introduced new challenges and opportunities for developing teacher competence. Although the concept of Teacher Professional Digital Competence continues to evolve, it often overlaps with digital literacy and remains inconsistently defined (Latip et al., 2023; Skantz-Åberg et al., 2022).

The emergence of new competency dimensions was further accelerated by the COVID-19 pandemic, which forced a sudden transformation toward digital learning. Teachers were compelled to adapt by assuming the role of online learning designers, while simultaneously redefining their professional identities in the digital realm (Stevens, 2025). Despite these shifts, many teachers continue to face difficulties in mastering the pedagogical applications of technology (Latip et al., 2023; Alan & Güven, 2022). In response, professional development efforts increasingly emphasize collaboration, critical reflection, and intercultural competence (Parmigiani et al., 2022; Kerkhoff & Cloud, 2020). However, existing research tends to focus on conceptual frameworks or localized case studies, thereby failing to offer a comprehensive understanding of the global structure and dynamics of scientific knowledge on teacher competence (Aindra et al., 2022; López-Martín et al., 2023). With the right analytical approach, it is possible to explore thematic trends, scholarly collaborations, and key contributors in this area of research.

Accordingly, this study does not aim to examine specific variable relationships, but rather to comprehensively map the evolution of the research landscape concerning teacher competence over the past decade. The findings are intended to serve as a reference for scholars, policymakers, and educational institutions in designing more targeted and contextually relevant teacher development strategies.

2. Methodology

This study adopts a scientometric approach to map the global development of research on teacher competence. This approach was selected because it provides a comprehensive overview of trends, collaboration patterns, and frequently studied topics based on bibliographic data from scientific publication (López-Pernas et al., 2022; Mejia et al., 2021). Scientometric methods are also instrumental in identifying the most active authors, institutions, and journal within a given research domain (Haghani, 2023; Y. Liu & He, 2023). Compared to traditional literature reviews, scientometric analysis offers a macro level understanding of how knowledge within a field is structed and evolves over time (Lund, 2022). This method is particularly relevant to educational research, where identifying research directions and prominent contributors is essential for shaping evidence based policy and practice (Jagannara, 2024).

To ensure a systematic and transparent data collection and selection process, the study follows the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) 2020 guideline PRISMA was chosen due to its structured and replicable framework for literature identification and selection, and its growing application in scientometric studies (Börner et al., 2024; López-Pernas et al., 2022). Originally designed for systematic reviews, PRISMA is now widely used in scientometric research because of its sustainability for organizing data search procedures in sequential stages (C. Liu et al., 2020). PRISMA consists oof four core phases, identification, screening, eligibility, and inclusion. The procedure in this study was adapted from the work of Hakam et al. (2023).

In the identification stage, documents were retrieved from the Scopus database using the Boolean search query, (“teacher competence” OR “teacher competency”) AND (“education” OR “school”). This resulted in 2,650 documents. Scopus was selected due to its comprehensive coverage and compatibility with analysis tools such as Rstudio and VOSviewer (Y. Liu & He, 2023). The screening phase involved removing duplicates, editorials, letters to the editor, and brief notes. The refined final search string used in Scopus. The eligibility phase consisted of examining the remaining articles to verify their relevance. Only those that substantively addressed teacher competence were included. Articles that merely mentioned the term without meaningful discussion were excluded (Mejia et al., 2021; C. Liu et al., 2020). In the inclusion phase, a total of 397 articles met all criteria and were retained for quantitative analysis. This number aligns with recommendation from previous scientometric studies, which suggest that 200-300 documents are sufficient for meaningful insights (Haghani, 2023; López-Pernas et al., 2022).

The exported dataset from Scopus in CSV format was processed using Biblioshiny, a web-based interface for the bibliometrix package in Rstudio. Biblioshiny facilitated analyses of author productivity, journal impact, country output, and bibliometric indices such as the h-index and g-index (Mondal & Mondal, 2022). It was also used to track publication trends, identify influentital article, generate thematic maps, and analyze the evolution of research themes. The overall analytical process adhered to standard scientometric practices, which emphasize transparency,

replicability, and visually supported interpretation for drawing reliable conclusions (Y. Liu & He, 2023; Lund, 2022). Also in figure bellow is the exported dataset from Scopus in RIS format was processed using VOSviewer as can be seen in the figure 1.

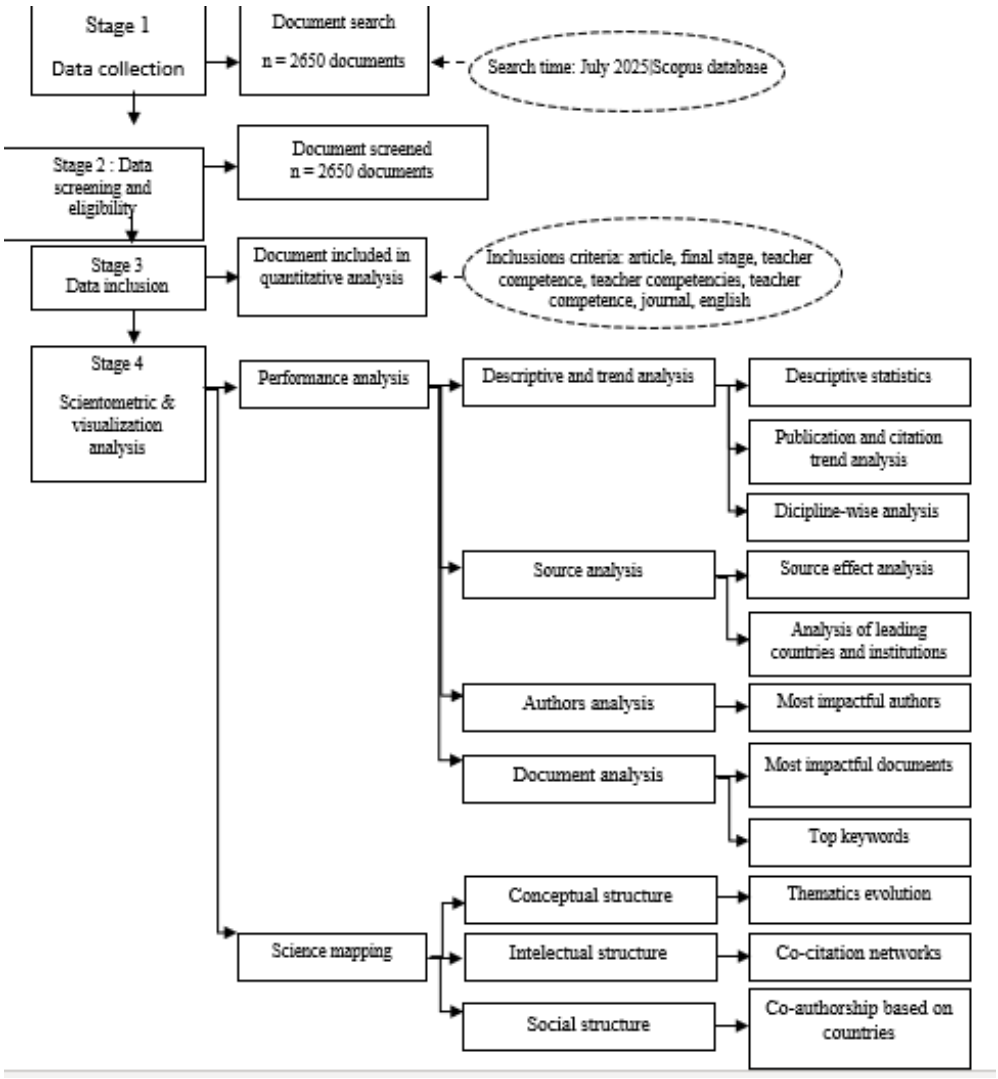

Figure 1. conceptual framework for the scientometric analysis (Hakam et al., 2023)

3. Results and Discussion

Descriptive and Trend Analysis

Descriptive Statistics

A total of 397 scientific articles on teacher competence published between 2005 and mid of 2025 were successfully analyzed, illustrating the evolution of this research field over the past two decades. The results presented in Table 1 show that

the average annual growth rate of publications was 15.55%, indicating sustained scholarly interest in this topic (Giri et al., 2023). This growth trend aligns with global educational issues such as teacher professionalism, digital learning, and curriculum reform. The documents analyzed had an average age of 5.01 years, reflecting that most publications are relatively recent and thus remain relevant to contemporary discussions in education (Amemasor et al., 2025). The average number of citations per document was 16.23, suggesting that the publications are not only numerous but also influential within academic community. In total, the documents referenced over 19,000 sources, and were published across 243 different journals, indicating a robust and diverse literature base.

The dataset involved 1,115 authors, with an average of 3.02 co-authors per article, indicating a strong tendency toward collaborative research. Only 13% of the articles, that 64 documents were single authored. Additionally, 13.85% of the articles resulted from international collaborations, reflecting increasing but still limited cross border engagement in teacher competence research. In terms of conceptual diversity, the dataset contained 1,193 author supplied keywords and 223 plus keywords, demonstrating a wide range of thematic approaches from fundamental pedagogical skills to issues such as digital competence and inclusive education. The data reflect that research on teacher competence has been active, collaborative, and thematically diverse. The growth in publication numbers, strong citation rates, and wide international participation collectively underscore the continued importance of this research domain (Joshi, 2025). Overview of analyzed publication as can be seen in the table 1.

Table 1. Overview of Analyzed Publication

Description	Indicator	Result
Main Infromation	Timespan	2005:2025
	Sources (Journals)	243
	Documents	397
	Annual Growth Rate %	15.55
	Document Average Age	5.01
	Average citation per Doc	16.23
	References	19103
Documents Contents	Keyword Plus (ID)	223
	Author's Keyword (DE)	1193
Authors	Authors	1115
	Authors of single-authored docs	64
Author Collaboration	Single-authored docs	67
	Co-Authors per Doc	3.02
	International co-authorships %	13.85
Documents Types	Article	397

Publication and Citation Trend Analysis

Between 2005 and mid of 2025, the number of publications on teacher competence demonstrated a consistent upward trend. The results presented in Figure 2 show in the eraly phase (2005-2010), the annual number of publications was relatively low, averaging fewer than 10 documents per year, starting with just two articles in 2005. However, by 2010, this number had increased to 10 publications, making the

beginning of a growth phase. The period between 2015 and 2019 represents a transition period, with more stable annual output. In 2015, there were 14 articles, increasing to 22 articles in both 2018 and 2019. This period reflects heightened awareness of the role of teacher competence, coinciding with rising demands for professionalsm and the adoption of new approaches such as technology integration and differential instruction (Zayimoglu Ozturk et al., 2025; Shidiq, 2022). The most significant surge occurred after 2020, corresponding with the global educational disruption caused by the COVID-19 pandemic. The number of publications jumped from 38 in 2020 to 62 in 2024, the highest level recorded in two decades. This spike highlights the urgent need to reexamine the role of teachers in online learning, digital literacy, and adaptability in crisis contexts (Joshi, 2025; Gökdaş et al., 2024). Although only 36 publications were recorded for 2025 as of mid year, this still reflects a sustained high output trend. The findings indicate that teacher competence has become a strategic and timely research focus, particularly in the post-pandemic educational landscape (Zayimoglu Ozturk et al., 2025). Publication trend of teacher as can be seen in the figure 2.

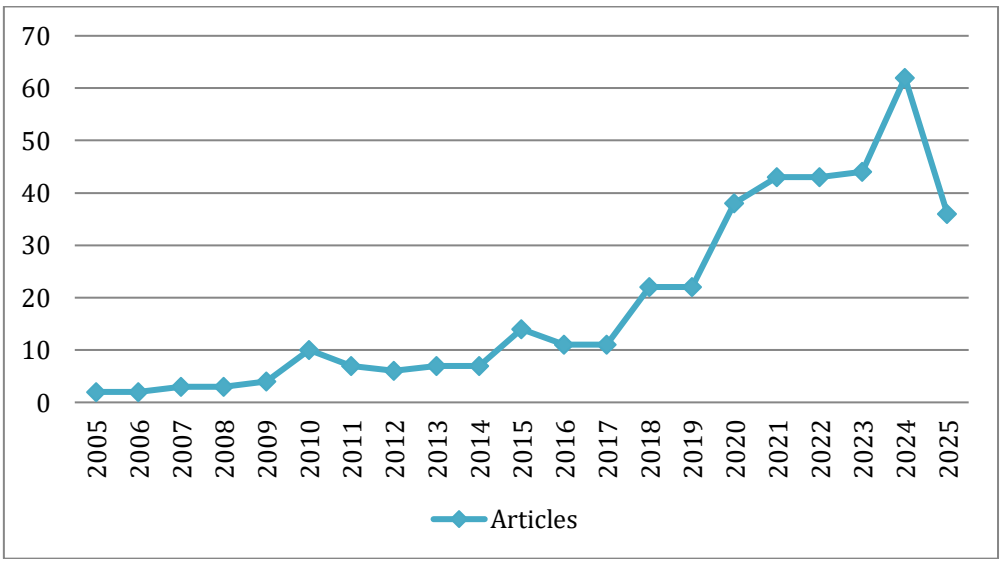

Figure 2. Publications Trend of Teacher Competence Research

Regarding citations trends, the average number of citations per article varied by publication year. Articles published in 2020 achieved the highest citation rate, averaging 5.69 citations per year. This affirms that research produced during the early pandemic had substantial academic and practical value, particularly in relation to digital learning and teacher adaptibility (Butar Butar et al., 2024). In contrast, articles published after 2020, which in 2022, 2024, and mid of 2025 showed a decline in average citations, with 1.48, 0.81, and 0.78 citations per year, respectively. However, these lower numbers are expected due to the recency of the publications and the limited time available for citations to accumulate. The publication and citation trends highlight 2020 as a turning point in both productivity and impact in the field of teacher competence. Annual citation averages by publication year as can be seen in the figure 3.

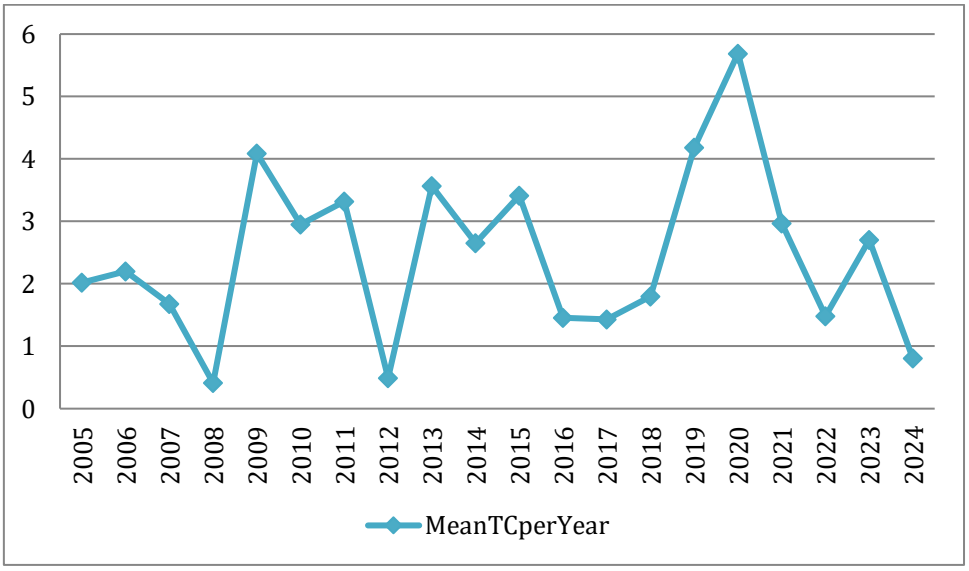

Figure 3. Annual Citation Averages By Publication Year

Discipline-wise Analysis

Research on teacher competence has grown into a multidisciplinary field, extending beyond traditional education into several other academic domains. According to the Figure 3, most publications (2005-mid of 2025) were categorized under the social sciences, with 353 occurences, suggesting that teacher competence is studied not only from a pedagogical perspective but also within broader sociocultural and policy contexts (Smestad & Gillespie, 2020). The humanities accounted for 46 articles, while psychology contributed 37 articles, reflecting a focus on identity, ethics, interpersonal skills, and classroom dynamics. These studies emphasize the affective, relational, and value based dimensions of teacher competence, particularly in character education and instructional climate. The computer science field contributed 29 articles, signaling the growing relvance of educational technology in teacher competence research. This includes topics such as digital teaching skills, technology enhanced pedagogy, and online learning adaptation. Other fields, including management, health, and mathematics, also contributed to the discourse, especially in interdisciplinary research. These studies highlight the role of teachers in specialized contexts, such ad vocational education, health sciences training, and STEM education, underscoring the diverse applications of teacher competence across domains as can be seen in figure 4.

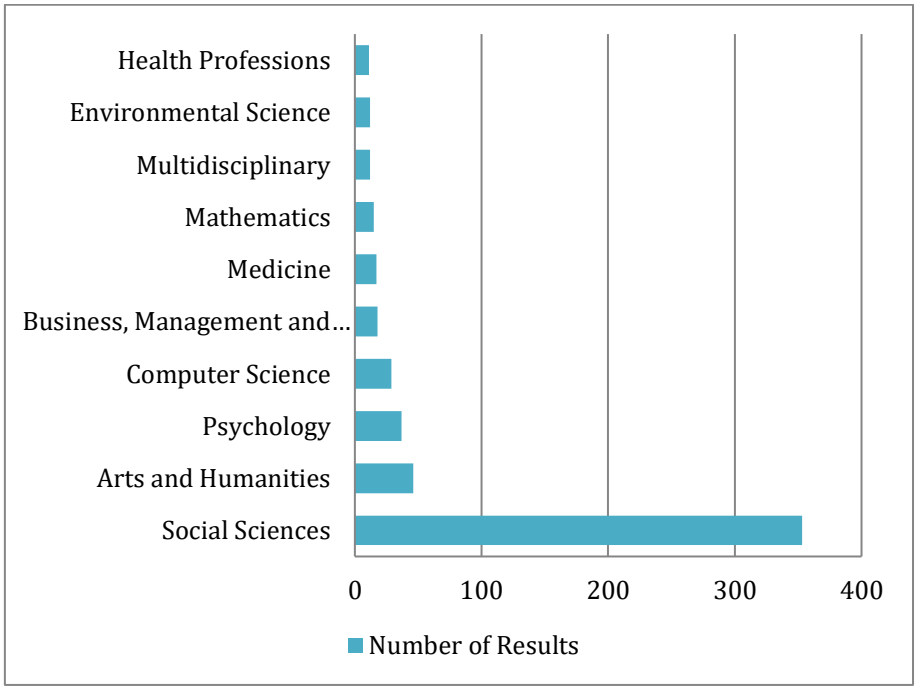

Figure 4. Distribution of Teacher Competence Research by Discipline

Source Analysis

Source Effect Analysis

An analysis of the most prolific journals publishing research on teacher competence reveals a consistent dominance of journals specializing in education and teacher training. As illustrated in Figure 5, Teaching and Teacher Education emerged as the most productive journal, publishing 21 articles on teacher competence. This positions the journal as a leading platform for discussions on teaching practices, professional development, and educationally policy related to the teaching profession. Following closely are the International Journal of Evaluation and Research in Education with 11 articles, and the International Journal of Inclusive Education with 8 articles, underscoring the growing interest in evaluating teacher effectiveness and fostering inclusivity in education. Additional contributions came from journals such as Frontiers in Education, European Journal of Teacher Education with 6 articles, and the International Journal of Learning with 7 articles, which reflect diverse methodological and conceptual approaches from educational innovation to professional preparation. Moreover, journals from broader disciplinary areas, including Sustainability (Switzerland), Frontiers in Psychology, and SAGE Open, indicate that the teacher competence discourse has expanded into areas of sustainability, psychological research, and social science inquiry. The study of teacher competence is not confined to a single disciplinary niche but is widely distributed across journals from various fields, affirming its interdisciplinary nature (Dervenis et al., 2022). Top 10 most productive journals in teacher competence research as can be seen in the figure 5.

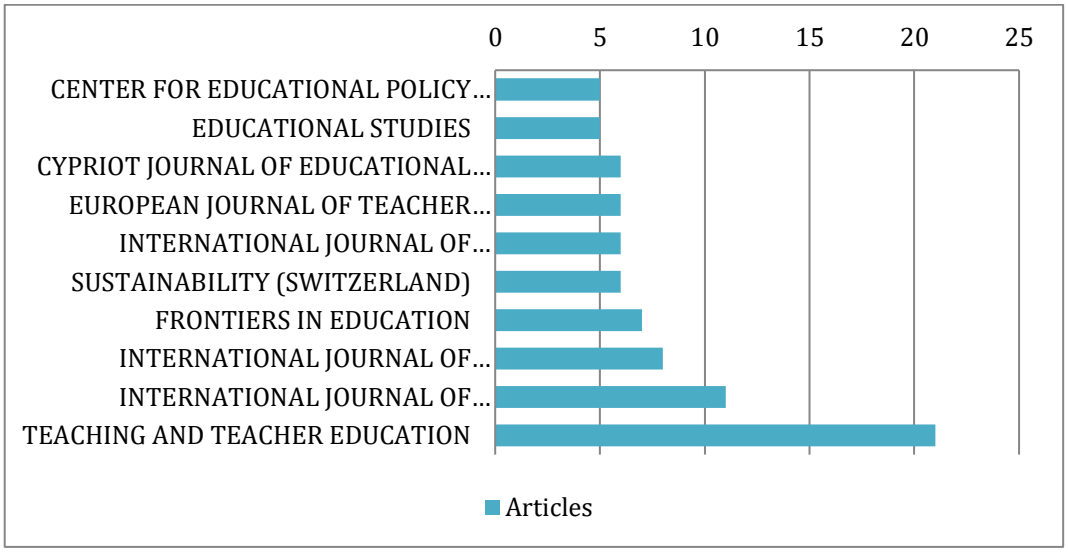

Figure 5. Top 10 Most Productive Journals in Teacher Competence Research

To assess the impact of these journals, five bibliometric indicators were employed, Number of Publications (NP), Total Citations (TC), and three standard indices h-index, g-index, and m-index. As Illustrated in Table 2, Teaching and Teacher Education not only leads in terms of output but also in influence, with the highest total citations of 1,297, h-index of 16, and g-index of 21. Its m-index of 0.76 indicates sustained impact over time, demonstrating consistent publication of high-quality articles since 2005. The European Journal of Teacher Education follows in second place with 974 citations from 6 articles. It holds an h-index and g-index of 6, reflecting evenly distributed influence across its publications. However, its lower m-index of 0.35 suggests that its growth in impact has been more gradual. Journals such as Frontiers in Psychology and the International Journal of Instruction, both relatively young, that first publication year is 2019, have achieved m-indices of 0.57, indicating that their recent articles have rapidly gained academic attention. The inclusion of Sustainability (Switzerland) among the top journals, with 6 articles and 171 citations, signifies that teacher competence is increasingly linked to global issues such as sustainability and interdisciplinary education. Meanwhile, journals like the Center for Educational Policy Studies Journal and Education Sciences, although not yet as influential in citation metrics, show potential for future growth, with steady publication output and moderate m-index values. Journal productivity and impact analysis confirms that research on teacher competence is both concentrated in core educational journals and increasingly diffused into interdisciplinary outlets, suggesting expanding relevance across diverse scholarly domains (Rodríguez-García et al., 2018).

Table 2. Summarizes The Bibliometric Performance of The Top Journals

Source	NP	TC	h-index	g-index	m-index
Teaching and Teacher Education	21	1297	16	21	0.76
European Journal of teacher Education	6	974	6	6	0.35
Teachers and Teaching: Theory and Practice	5	119	5	5	0.25
Educational Studies	5	85	4	5	0.21
Frontiers in Psychology	4	81	4	4	0.57

International Journal of Inclusive Education	8	64	4	8	0.25
International Journal of Instruction	5	64	4	5	0.57
Sustainability (Switzerland)	6	171	4	6	0.31
Center for Educational Policy Studies Journal	5	39	3	5	0.25
Education Sciences	3	42	3	3	0.60

Analysis of Leading Countries and Institutions

Scientific contributions to teacher competence research predominantly originate from countries with well established education systems and progressive teacher development policies (Polat, 2025). As shown in Figure 6, Germany leads with 1,438 total citations and an average of 75.7 citations per article, demonstrating not only high productivity but also exceptional academic quality and influence. This underscores Germany's position as a central hub for educational research in Europe. Following Germany, Spain accumulated 390 citations and an average of 19.5, the Netherlands recorded 382 citations and an average of 34.7, and the United Kingdom contributed 305 citations and and average of 61. These countries exhibit a balanced pattern between output quantity and citation quality, indicating that their research publications are frequently used as authoritative references in teacher competence studies both theoretically and practically. Switzerland, while contributing fewer publications, had the highest citation average of 148 citations per article, indicating that its limited output carries substantial influence and academic depth. In contrast, Indonesia had a total of 236 citations but a much lower average of 4.9 citations per article, reflecting a high level of productivity but limited global impact. This disparity suggests a need for improved research quality and greater international visibility. Other notable contributors include, Australia with 194 total citations and an average of 24.2 citations per article, Finland with 160 total citations and an average of 22.9 citations per article, and Serbia with 142 total citations and an average of 35.5 citations per article. The inclusion of both Nordic and Eastern European countries highlights the geographical breadth of teacher competence research and its global significance as can be seen in the figure 6.

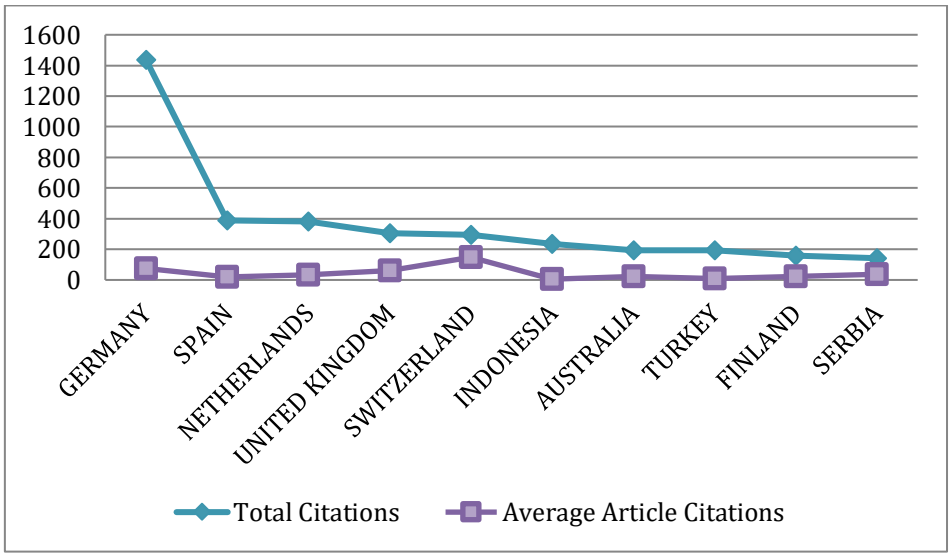

Figure 6. Citation Impact of the Top Contributing Countries

The analysis of corresponding authors' countries provides insights into the geographic origin of institutional leadership in teacher competence research and the extent of international collaboration (Santibáñez et al., 2025). As illustrated in Figure 7, Indonesia leads in terms of corresponding author origin, contributing 48 articles, or approximately 12% of the total dataset. However, only 6 of these articles involved international collaboration (MCP = 6), resulting in a relatively low collaboration rate of 12.5%. This indicates that while Indonesia is highly productive, its integration into global research networks remains limited. Turkey and Spain follow with 22 and 20 articles, respectively. Turkey's contributions were entirely domestic (MCP = 0), whereas Spain demonstrated a modest level of international collaboration at 15%. Germany, although contributing fewer articles (19), demonstrated a much higher international collaboration rate (36.8%), reflecting its active engagement in cross border academic partnerships and reinforcing its status as a collaborative research hub. Other countries such as Malaysia contributing 16 articles, with only 6.25% involving collaboration, China contributing 15 articles, with 13.3% collaboration, also Australia and Sweden, despite contributing fewer articles, had notably higher collaboration rates of 50% and 11.1%, suggesting strong participation in global academic networks. Even Kazakhstan, a relatively new player in international research, contributed 8 articles with a collaboration rate of 12.5%, indicating emerging international engagement. Publication quantity does not necessarily correlate with collaborative quality. Countries with fewer but strategically partnered publications often exhibit greater influence and integration within global research ecosystems (Sadykova et al., 2025). International collaboration based on corresponding author's as can be seen in the figure 7.

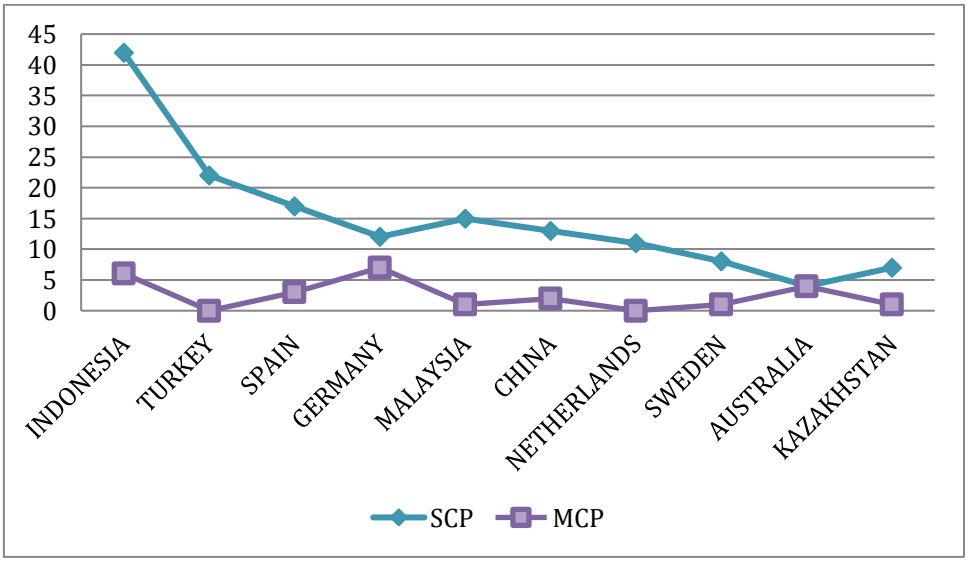

Figure 7. International Collaboration Based On Corresponding Authors' Countries

The analysis of institutional productivity highlights that scientific engagement with teacher competence is widely distributed across institutions in both developed and developing countries (H. Liu et al., 2025). As presented in Figure 8, the Indonesian University of Education was the most productive institution, contributing 30

publications. This demonstrates UPI's strong research focus on teacher competence and its central role in Indonesian educational scholarship. Other highly productive institutions include Universiti Kebangsaan Malaysia contributing 15 articles, State University of Malang and State University of Medan contributing 11 articles each. These Southeast Asian institutions underscore a growing regional emphasis on educational reform and teacher development. The University of Puerto Rico and the University of Ljubljana contributing 10-11 articles, represent Latin American and Central European engagement in this field, contributing to a geographically inclusive research discourse. Further contributors include, Universitas Negeri Yogyakarta, Hacettepe University (Turkey), Korea University, and University of Cologne (Germany). Each with between 9 and 10 articles, indicating that teacher competence research is a shared priority among diverse institutional contexts. The institutional analysis shows that research on teacher competence is not only globally dispersed but also increasingly shaped by institutions in non OECD countries, reflecting a broader and more inclusive scholarly dialogue as can be seen in the in figure 8.

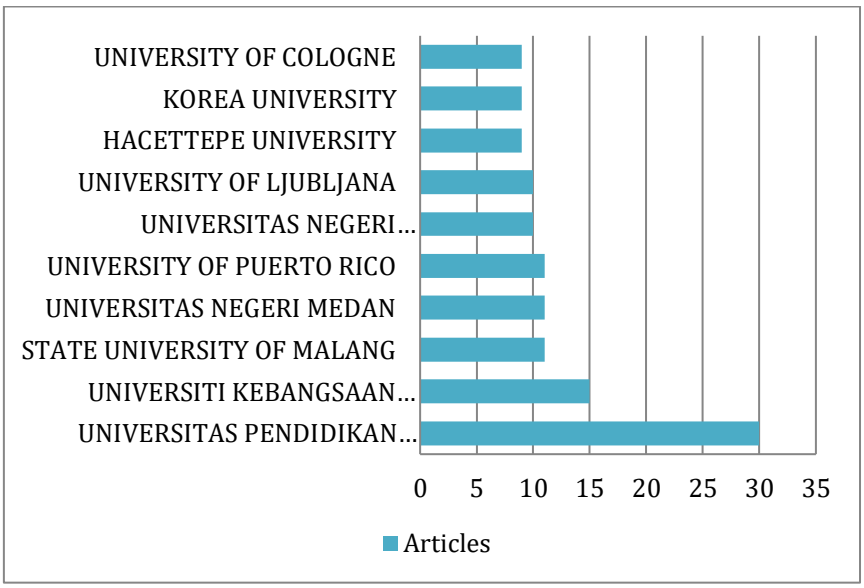

Figure 8. Most Productive Institutions In Teacher Competence Research

Author Analysis

The author analysis identifies the most prolific and influential contributors to the field of teacher competence, based on publication volume and authorship roles (Polat, 2025). The findings indicate that author contributions are geographically diverse and span multiple institutional affiliations, confirming that teacher competence is a global and multidisciplinary research domain. As illustrated in Figure 9, Kaiser G and König J stand out as the most productive authors, each with seven publications. Their consistent output underscores their leadership and sustained commitment to advancing research on teacher competence. Their high fractionalized publication scores 2.09 for Kaiser and 1.84 for König further indicate their prominent roles as lead authors or core contributors within collaborative research teams. Other notable authors include, Blömeke S contribute four articles,

also Gultom S, Hoth J, Kunter M, Kuyini AB, Mangope B, and Ohle-Peters A contribute three articles each. While these authors have published fewer total articles, their fractionalized authorship scores reflect active leadership roles and meaningful scholarly impact within their respective contributions. Importantly, the inclusion of Gultom S, a scholar from a developing country, highlights the growing participation of researchers from Asia and Africa in shaping the global teacher competence discourse. This trend signifies a broadening of perspectives and the incorporation of diverse regional contexts in academic dialogue (Simó et al., 2020). Most productive and influential authors as can be seen in the figure 9.

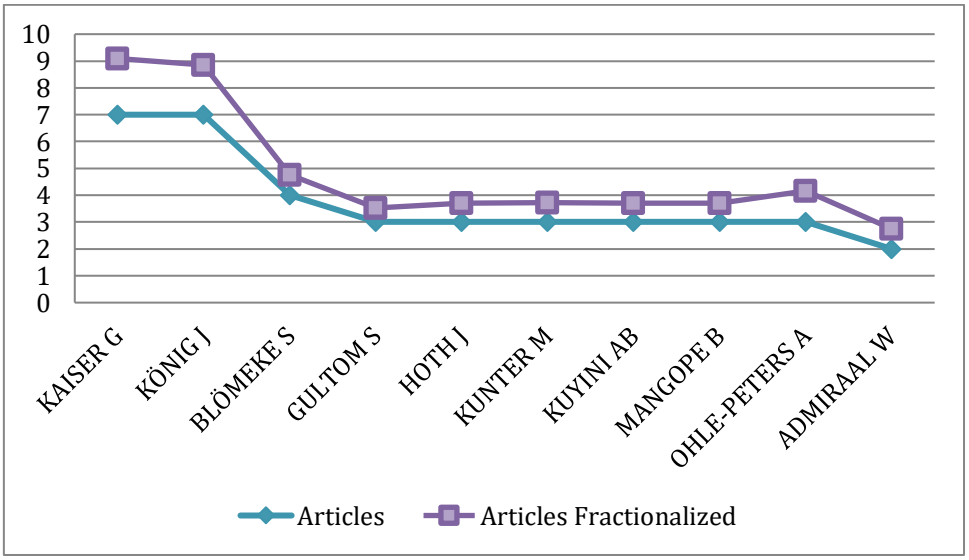

Figure 9. Most Productive And Influential Authors

The temporal analysis of author productivity reveals two distinct trends. First, authors with sustained contributions over the past decade. Second, authors with emerging visibility in the last five years (Santibáñez et al., 2025). As shown in Table 3, Kaiser G. and König J. have consistently contributed scholarly work on teacher competence, particularly within the domains of mathematics education and pedagogical practice. Since 2015, both authors have published regularly in reputable international journals, with several of their articles recording strong annual citation averages. Notably, their 2021 publication, “The Links Between Pedagogical Competence and Mathematics Achievement,” has attracted considerable attention from the academic community and has become a widely cited reference in related studies. Their contributions are not isolated efforts. Blömeke S. has emerged as a key collaborative partner in many of their co-authored works, with a sustained research presence since the mid 2010s. Articles produced by this team have garnered substantial early citations, reflecting their significant conceptual influence and methodological rigor. Kuyini A. B. and Mangope B. began appearing in the literature around 2016, with a primary focus on inclusive education in African and Northern European contexts. Although their publication volume is relatively modest, their citation records have remained consistently strong over the years. This suggests that the issues they address are both regionally relevant and socially resonant.

In the past three to five years, scholars like Ohle-Peters A. and Gultom S. have started gaining visibility within the publication landscape. Their research primarily explores contemporary shifts in education such as the digitalization of learning environments and teacher training in developing nations. While their work is relatively recent and still accumulating citations, the thematic directions they pursue demonstrate a timely response to evolving global educational demands. Kunter M. and Hoth J. have exhibited a sustained interest in research grounded in educational psychology and STEM based pedagogy. Their contributions, published in esteemed journals like Teaching and Teacher Education and ZDM Mathematics Education, affirm their commitment to strengthening teacher competence through empirically grounded and methodologically robust approaches. temporal productivity trends of leading authors as can be seen in the table 3.

Table 3. Temporal Productivity Trends of Leading Authors

Author	Active Period	Research Focus and Themes	Key Collaborations	Impact Notes
Kaiser G	2015-2023	Mathematics education, pedagogy, and student error analysis	König J., Blömeke S	Consistently productive in high impact journals. The 2021 article co-authored with König received over 14 citations per year, reflecting significant influence.
König J.	2015-2021	Pedagogical competence and its relation to student achievement in mathematics	Kaiser G., Blömeke S.	Played a central role in collaborative publications. The 2021 paper with Kaiser and Blömeke ranks among the most cited in the field.
Blömeke S.	2015-2020	Teacher competence, video based assessment, and professional skills	Kaiser G., König J.	Authored a 2015 article that received 163 citations (TCpY ≈ 14.8), making it one of the most impactful contributions over the past decade.
Kuyini AB	2016-2022	Inclusive education in Africa and Northern Europe	Mangope B.	Though less prolific, his work maintains steady citation levels. Research themes are geographically specific but academically relevant across contexts.
Mangope B.	2016-2022	Inclusive learning strategies and socio educational contexts	Kuyini AB	Focuses on localized educational issues, gaining consistent academic attention through regional and thematic specificity.
Ohle-Peters A.	2021-2023	Student misconceptions, teacher interpretation,	Mostly independent	An emerging contributor in recent years. Although citation

Table 3. Temporal Productivity Trends of Leading Authors

Author	Active Period	Research Focus and Themes	Key Collaborations	Impact Notes
		and digital competence		impact is still limited, the themes addressed are timely and conceptually relevant.
Gultom S.	2020-2023	Teacher training and professional development in developing countries	No major collaborations noted	Represents a newer voice in the discourse, engaging with current issues around digital transformation in teacher education. Citation patterns are still evolving.
Kunter M.	2015-2020	Educational psychology, teaching quality, and competence measurement	Hoth J., STEM education teams	Publications appear in reputable journals, contributing robust empirical perspectives to the study of teacher competence.
Hoth J.	2015-2020	STEM education, classroom management, and learning outcome assessment	Kunter M.	Emphasizes empirical and pedagogical integration. His work in journals like ZDM Mathematics Education highlights the scientific framing of teacher research.

Document Analysis

Most Impactful Documents

The impact of scientific contributions in teacher competence research is not solely determined by publication volume, but also by the degree of scholarly influence, as reflected through citation metrics (Ji et al., 2025). This section identifies the most frequently cited articles published between 2005 and mid of 2025. According to Table 4, the most influential article is authored by König J (2020), titled "Adapting to Online Teaching During COVID-19 School Closure: Teacher Education and Teacher Competence Effects". Published in the European Journal of Teacher Education, this article has received 791 citations, with an impressive average of 132 citations per year. Its extraordinary impact reflects the article's strategic relevance in addressing urgent global educational challenges during the early pandemic period, especially concerning ICT integration and technological-pedagogical knowledge (TPACK). Other high-impact articles include Brookhart (2011), which discusses assessment for learning as an essential dimension of teacher professional competence, receiving 256 citations, and remaining a seminal reference in formative assessment research. Fauth et al. (2019) and Kaiser et al. (2015), each with over 150 citations, both focusing on evaluative approaches to teacher competence, including video based assessment and pedagogical knowledge measurement. In addition, two articles by Pantić N (2010, 2015) on teacher agency

and professional identity demonstrate a sustained research interest in the sociopolitical dimensions of competence. Their publication in journals such as Sustainability and IRRODL signifies the expanding relationship between teacher competence and sustainable development as well as open and digital learning environments. Overall, these top cited documents underscore the dual trajectory of teacher competence research are grounded in theoretical frameworks and responsive to contemporary educational disruptions such as COVID-19 and digitalization (Velandia Rodriguez et al., 2022). High impact publications based on total citations as can be seen in the table 4.

Table 4. High Impact Publications Based On Total Citations

Author	Title	Year	Total Citation	Author Keyword
König J 10.1080/02619768.2020.1809650	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among	2020	791	COVID-19; ICT; teacher competence; teacher education; technological pedagogical knowledge
Brookhart S.M. 10.1111/j.1745-3992.2010.00195.x	Educational Assessment Knowledge and Skills for Teachers	2011	256	Classroom assessment; Educational assessment; Teacher competency
Fauth B.; Decristan J.; Decker A.-T.; Büttner G.; Hardy I.; Klieme E.; Kunter M. 10.1016/j.tate.2019.102882	The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching	2019	253	Elementary school; Science education; Teacher competence; Teaching quality
Pantić N.; Florian L. 10.3402/edui.v6.27311	Developing teachers as agents of inclusion and social justice	2015	200	educational change; inclusive pedagogy; teacher agency; teacher competence; teacher education
Vogt F.; Rogalla M. 10.1016/j.tate.2009.04.002	Developing Adaptive Teaching Competency through coaching	2009	172	Adaptive teaching; Coaching; Differentiation; Professional development; Teacher competencies; Teacher education

Table 4. High Impact Publications Based On Total Citations

Author	Title	Year	Total Citation	Author Keyword
Kaiser G.; Busse A.; Hoth J.; König J.; Blömeke S. 10.1007/s10763-015-9616-7	About the Complexities of Video-Based Assessments: Theoretical and Methodological Approaches to Overcoming Shortcomings of Research on Teachers' Competence	2015	163	Decision-making; Mathematics teacher education; Noticing; Perception skills; Performance assessment; Teacher competence; Teacher knowledge; Video-based assessment
Pantić N.; Wubbels T. 10.1016/j.tate.2009.10.005	Teacher competencies as a basis for teacher education - Views of Serbian teachers and teacher educators	2010	134	Beliefs; Educational change; National standards; Teacher attitudes; Teacher characteristics; Teacher competence; Teacher education; Teacher knowledge; Values
Bertschy F.; Künzli C.; Lehmann M. 10.3390/su5125067	Teachers' competencies for the implementation of educational offers in the field of education for sustainable development	2013	124	Csct-model; Ece-model; Education for Sustainable Development; Teacher competencies
Nousiainen T.; Kangas M.; Rikala J.; Vesisenaho M. 10.1016/j.tate.2018.04.012	Teacher competencies in game-based pedagogy	2018	120	Basic education; Case study; Educational technology; Game-based pedagogy; Primary school; Teacher competence

Top Keywords

The analysis of frequently occurring keywords provides insight into the dominant conceptual patterns in the field of teacher competence (Polat, 2025). As shown in Figure 10, the term "teacher competence" appears 134 times, making it the most frequently used keyword, and affirming its centrality to the research theme. Variations of the term such as "teacher competencies" occurs 117 times and "teacher competency" occurs 51 times. As well as plural or possessive forms like "teacher competences," "teachers' competence," and "teachers' competencies", indicate an evolving discourse that reflects both terminological flexibility and semantic richness. This variation suggests that many studies are not limited to a general discussion of competence but instead explore specific dimensions, such as pedagogical competence, professional competence, and social competence. Additionally, the term "teacher education" occurs 36 times, emphasizing the importance of pre service and in service training as key contexts for developing teacher competence. This confirms the role of institutional education in shaping core teaching capacities. Other prominent keywords include "inclusive education" occurs 20 times, reflecting a focus on teachers' ability to support classroom diversity, particularly students with special needs. Furthermore, "professional development" occurs 17 times, which highlights the increasing recognition that teacher competence is a lifelong developmental process, involving continuous training and reflection. Also "education" occurs 16 times and "teacher training" occurs 14 times further emphasize the systemic context in which competence is nurtured and sustained. Collectively, the keyword data confirm that research on teacher competence is increasingly framed within multi dimensional constructs, encompassing not only instructional ability but also technological adaptability, inclusive practice, and professional growth. These terms also reflect an expanding awareness of the complex and dynamic nature of teaching in contemporary education systems (Smestad & Gillespie, 2020). Most frequently used keywords in teacher competence researchas can be seen in the figure 9.

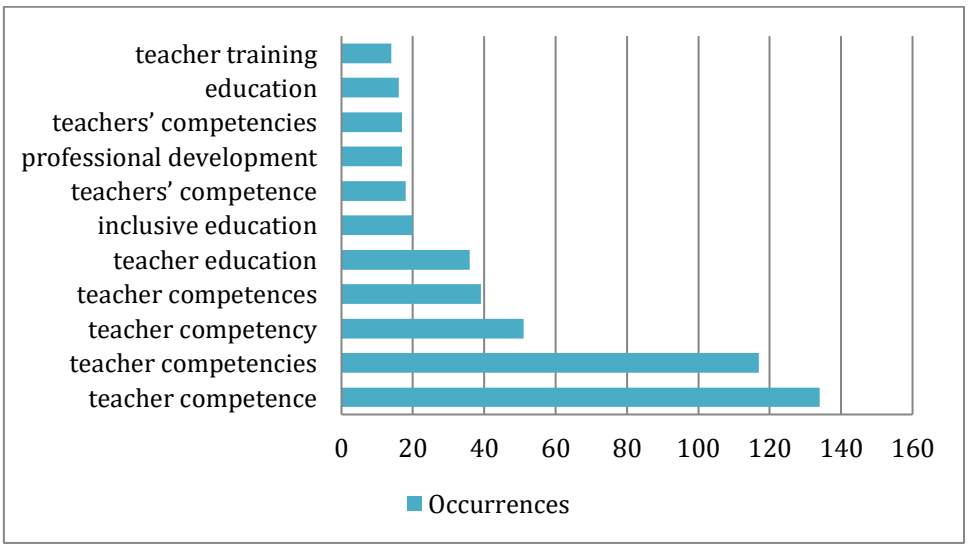

Figure 10. Most Frequently Used Keywords In Teacher Competence Research

Conceptual Structure

The conceptual structure analysis provides insight into how the themes in teacher competence research have evolved over time. By mapping thematic clusters across distinct time periods, the study highlights shifts in research priorities, conceptual depth, and emerging concerns (Li et al., 2025). As presented in Table 5, the development of teacher competence research between 2005 and mid of 2025 can be categorized into four chronological clusters, each characterized by distinct dominant themes. First, Foundation Phase (2005-2012), research predominantly focused on the fundamentals of teacher competence, including teacher preparation, knowledge acquisition, and professional characteristics. These studies typically aligned with national standards and policy driven frameworks, aiming to define what constitutes a "competent" teacher. The themes were mostly classified as basic and motor themes, reflecting the early establishment of competence frameworks and training model development, especially in response to global educational reform agendas.

Second, Professionalism and Reflective Practice Phase (2013–2017), the concept of teacher competence began to intersect with teacher professionalism, emphasizing reflective teaching, teacher quality, and ongoing development. Research during this period addressed practical applications, such as the development of professional identity, instructional improvement, and the cultivation of teacher beliefs and values. Additionally, themes related to inclusive education and technological-pedagogical knowledge began to emerge, marking the start of an integrative approach that incorporated both pedagogical and sociocultural dimensions of competence.

Third, Pedagogical Knowledge and Instructional Quality Phase (2018–2021), this period saw a deepening of conceptual analysis, with growing emphasis on pedagogical content knowledge (PCK), teaching effectiveness, and student learning outcomes. Research explored how competence influences instructional quality, especially among pre service teachers, and how it connects to curricular adaptation. New themes such as self efficacy, professional identity, and reflective teaching began to dominate, indicating a shift toward more affective, cognitive, and metacognitive aspects of competence. These were categorized as motor themes (high centrality and density) and niche themes (high specialization), showing both relevance and conceptual refinement.

Fourth, Digital Transformation and Resilience Phase (2022–mid of 2025), the most recent phase is marked by a rapid conceptual transformation in response to the COVID-19 pandemic and the acceleration of digital learning. Dominant themes such as TPACK (Technological Pedagogical Content Knowledge), online learning, digital competence, teacher resilience, and post pandemic pedagogy reflect the urgency of equipping teachers with the capacity to adapt to uncertain educational contexts. This phase demonstrates that teacher competence is no longer solely about classroom instruction or subject mastery, it now encompasses the ability to operate within digital ecosystems, design virtual learning experiences, and maintain pedagogical integrity during educational disruptions. As such, digital competence

has become both a strategic priority and a foundational requirement in contemporary teacher education.

The conceptual evolution from normative to adaptive frameworks, from policy centered standards to digital responsiveness, illustrates that teacher competence is a fluid and evolving construct (Rudkevych et al., 2020). Thematic shifts also reflect the dynamic interaction between theoretical development, educational policy, and global crises, affirming that competence is contextual, multifaceted, and deeply tied to societal and technological change (Domínguez-González et al., 2025). Evolution of Core Themes in Teacher Competence Research as can be seen in the table 5.

Table 5. Evolution of Core Themes in Teacher Competence Research

Period	Cluster Label	Dominant Keywords
2005-2012	Teacher Competence	Teacher competence, teacher knowledge, teacher characteristics, educational change
2013-2017	Teacher Professionalism	Profesional competence, teacher quality, teacher development, reflective practice
2018-2021	Pedagogical Knowledge	Pedagogical content knowledge, teaching quality, pre-service teachers, curriculum
2022- mid of 2025	Digital Competence	TPACK, online learning, digital competence, teacher training, educational technology

Intellectual Structure

The intellectual structure of teacher competence research is explored through co-citation network analysis, which reveals how foundational knowledge in the field has been shaped by influential authors and interconnected citation patterns (Nain et al., 2025). This analysis enables the identification of core contributors, conceptual clusters, and the theoretical scaffolding of the research domain. As illustrated in Figure 11, the co-citation network visualization reveals a clearly defined intellectual landscape in which several key scholars occupy central positions. Among them, König J. and Blömeke S. stand out prominently, as evidenced by the large size of their nodes and their central placement within the most densely connected cluster. This indicates their foundational role in shaping the field of teacher competence and the high frequency with which their works are cited together. Their proximity and integration within the green cluster suggest a shared theoretical orientation or methodological framework. Kaiser G. also emerges as a significant contributor, occupying a strategically central position with substantial node size, further reinforcing his influence in connecting various thematic areas within the field. In contrast, authors such as Glutsch N., Jentsch A., and Gehrer K. are visible but with smaller nodes, implying a more moderate yet still relevant presence in the citation landscape. The overall network structure is characterized by a dominant core

surrounded by smaller, less connected clusters, reflecting a coherent scholarly community anchored by a few influential figures. These visual patterns point to the pivotal role of König, Blömeke, and Kaiser in constructing the epistemological and methodological foundations of teacher competence research.The co-citation network analysis underscores the importance of a small but influential set of scholars whose works have significantly structured how teacher competence is conceptualized, debated, and developed. These intellectual anchors provide continuity, credibility, and direction in a field that is increasingly interdisciplinary and context sensitive (Chano et al., 2025; Chen et al., 2023). Co-citation network of influential author's as can be seen in the figure 11.

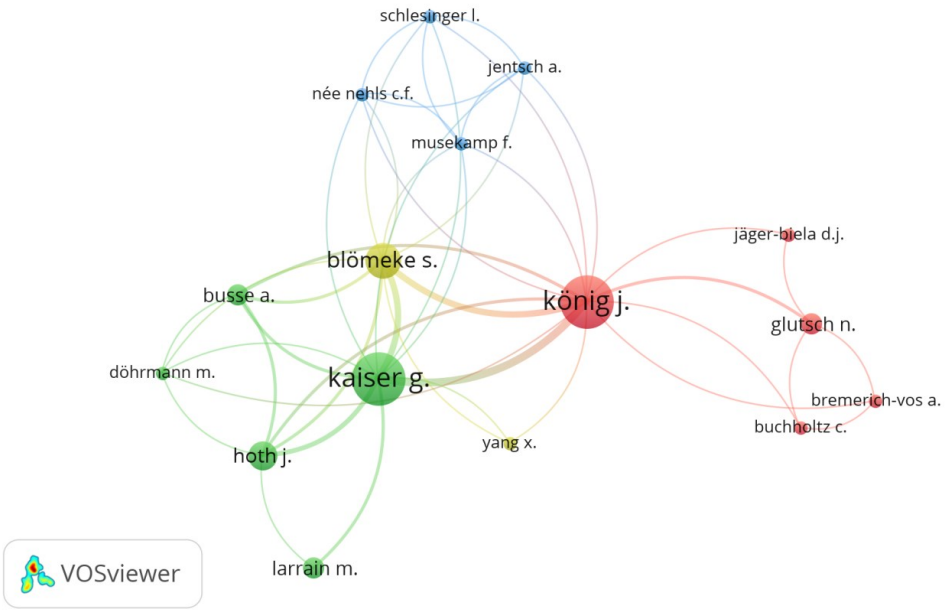

Figure 11. Co-Citation Network Of Influential Authors

Social Structure

The social structure of teacher competence research is examined through a collaboration network analysis, which reveals how authors are connected through co-authorship and how these connections shape the global distribution of knowledge production (Noben et al., 2022). This analysis highlights key research clusters, the centrality of individual scholars, and the extent of international collaboration. As visualized in Figure 12, the network visualization of international collaboration, reveals a structured map of inter country research interactions. The size of each node corresponds to the number of collaborative ties, with Germany and Australia emerging as the most central countries in this network. Their prominence suggests a high degree of engagement in international research partnerships. For instance, Germany maintains particularly strong ties with Norway, while Australia exhibits dense connections with Botswana, Ghana, India, and New Zealand, indicating a collaborative orientation toward both regional and global partners. The colors in the visualization reflect distinct clusters, which represent communities of countries with frequent and reciprocal collaborations. The blue cluster, anchored by Australia, includes countries primarily from Oceania and

parts of Sub Saharan Africa, suggesting Australia's pivotal role in fostering South–South scientific cooperation. The yellow cluster, centered on Germany, represents a dense network of Central and Northern European countries, including Portugal, Switzerland, and Egypt, highlighting regional scientific integration within Europe. China, situated in the purple cluster, plays a bridging role in the network, connecting with countries such as Thailand, the United Kingdom, and the United States, and indicating its strategic positioning in cross-continental research collaboration. Another important regional cluster is formed around Indonesia, which is closely connected to Malaysia, Thailand, and Uzbekistan. This grouping reflects patterns of geographically driven collaboration within Southeast and South Asia. Meanwhile, countries such as Slovenia, Croatia, and Sweden form a cohesive network within the green cluster, representing a strong axis of collaboration across Eastern and Northern Europe. On the periphery of the network, countries like Uzbekistan, Myanmar, and Jordan appear with limited links, indicating lower levels of engagement or more isolated collaborative activity as can be seen in the figure 12.

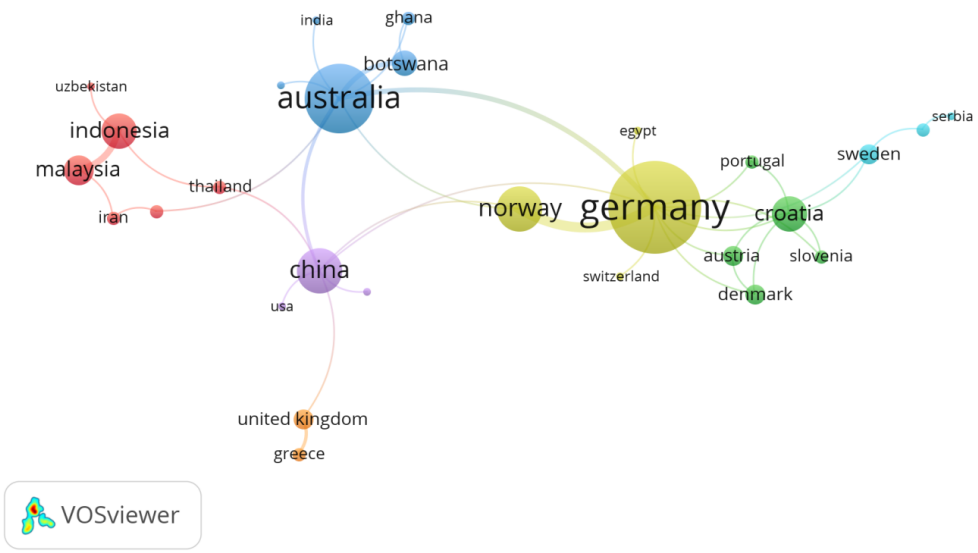

Figure 12. Collaboration Network Among Teacher Competence Researchers

The structure of this network suggests that while geographical proximity remains a dominant factor in shaping collaborative patterns, certain countries most notably Germany, Australia, and China play a critical role as hubs that connect otherwise distinct regional clusters. Their central positions enable them to act as conduits for knowledge exchange across different parts of the world, reinforcing their influence in shaping global research dynamics. To foster a more inclusive and globally integrated research landscape, there is a need to promote cross regional collaboration, support equitable partnerships, and amplify the voices of scholars from developing countries in global teacher competence discourse (Kolleck et al., 2021).

4. Conclusion

This study maps the development of teacher competency research from 2005 to mid-2025 based on 397 articles. A significant increase was found after 2020, with a shift in focus to pedagogy, inclusion, and digital competencies. Germany, Spain, and the Netherlands were the most influential, while Indonesia was productive but less collaborative globally. This study is useful for researchers, policymakers, and educational institutions, though it is limited to English-language articles in Scopus. Further studies are recommended to incorporate qualitative approaches to yield a deeper and more contextual understanding.

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