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Filiz Zayimoglu Ozturk
Ordu University, Turkiye

Michael Kopish
Ohio University, USA

Talip Ozturk
Ordu University, Turkiye

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The Ongoing Trend in Teacher Competence: A Bibliometric Analysis of Scopus

Filiz Zayimoglu Ozturk, Michael Kopish, Talip Ozturk

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Abstract

This study employs a bibliometric analysis to present the shifting trends in research on teacher competence through an interdisciplinary approach, solely based on scientific contributions shared in the Scopus database. Searches are conducted in the database using search criteria such as "teacher competence" or "teacher competencies" in the titles, abstracts, and keywords of publications, including scientific articles, review papers, conference materials, and books. VOSviewer software and bibliometric analysis tools integrated into the Scopus database are used to evaluate and analyze the information found. According to some of the results of text mining conducted on the search criteria, The US contributed the most publications on teacher competency. Also, academic interest in teacher competency has increased constantly in the last twenty years. Most publications on the subject are in the social sciences field and in the form of articles. Results obtained with science mapping, one of the bibliometric analysis techniques, have been discussed from a neoliberal perspective, focusing on the last twenty-two years. Overall, the results of this study provide a quick overview of the output in the field over the years and a guide for the future direction of teacher competency research.

Introduction

Much has been said about what constitutes a quality teacher (Bourgonje & Tromp, 2011). Some argue that student learning is the most important determinant, and that quality teachers are best equipped to assist their students in learning (Darling-Hammond, 1997). However, research shows that quality teacher characteristics vary depending on the context, and that defining "the good teacher" definitively may be pedagogically undesirable (Korthagen, 2004). And that brings the teacher standards or teacher competence issues to the desktop. Teacher competence is one way to look at teacher quality because it provides a framework for discussing the essential qualities that teachers are expected to possess (Korthagen, 2004). Many teacher education reforms are currently being implemented around the world with the goal of making teacher education more functional for the development of competencies that teachers require in practice (Pantiç & Wubbels, 2010). Teacher competency standards are increasingly being developed, both in teacher education and in the classroom. This makes it significant to examine the studies on teacher competencies and determine their status in the historical development process.

Conceptual Framework

From the literature, a long list of different competences can be assembled (Bourgonje & Tromp, 2011), e.g. knowledge competence, civic competence, emotional competence, cultural competence, gender competence. Competence concerns someone's ability to use knowledge and skills with a degree of independence and autonomy instead of simply knowing (Wuttke & Seifried, 2017), and it is defined as a combination of knowledge, abilities, and attitudes, and it is regarded as a prerequisite for success in various fields (Mulder, 2012). Teacher competence encompasses both hidden and visible knowledge, cognition, practical skills, and dispositions, and it reflects the basic competencies of diverse common classroom situations (Blömeke et al., 2015). While teacher competence represents a complex trait holistically, teaching competency emphasizes the components of competence from an analytical standpoint (Sudirman, 2017; Ye et al., 2021).

Extensive research has been conducted in the field of teaching to gain a comprehensive understanding of what it means to be a competent teacher (Karacaoğlu, 2008; Kararmaz and Arslan, 2014; Kobalia and Garakanidze, 2010; Lawrence and Veena, 2012; Pantić and Wubbels, 2010; Taşar, 2012). Such research aims to improve teacher education in the long run. The proficient performance of teachers is believed to involve multiple aspects, including knowledge, skills, beliefs, values, motivation, and metacognition (Schoenfeld, 2010). Köning et al. (2014) reported that the knowledge acquired during teacher education influences teachers' perception of classroom situations and ability to quickly recognize students' errors.

It is needless to emphasize that teacher standards and teacher competencies are both important elements in defining the expectations and requirements for educators (Alan & Güven, 2022). However, they differ in their scope and focus (Sembiring et al., 2018). Teacher standards refer to a set of guidelines or criteria that outline the overall expectations and professional behaviors that teachers should adhere to. These standards often cover areas such as knowledge of subject matter, instructional strategies, assessment practices, classroom management, and professional ethics (Nessipbayeva, 2012).

The need to learn more about the skills, teachers need to possess to stay up with the demands of a society that is rapidly changing has grown in recent years (European Commission, 2013). In order to provide a full and systematic understanding of the abilities required for effective teaching, many teacher skill frameworks have emerged. One of the most popular frameworks for teacher skills is the TALIS (Teaching and Learning International Survey) framework from the OECD (OECD, 2019). These three categories—cognitive, social, and emotional—are used to classify teacher competencies.

The cognitive domain includes subject matter expertise, instructional proficiency, and understanding of assessment and evaluation. The social domain includes interpersonal skills, collaboration and teamwork abilities, and communication skills. The emotional domain includes self-efficacy, resiliency, and emotional intelligence. Another framework that has attracted attention in recent years is the UNESCO framework for teacher competencies (UNESCO, 2018). This framework identifies five domains of teacher competencies: professional knowledge, pedagogical knowledge and skills, interpersonal and intercultural competence, values, attitudes, and

ethics, and professional development. The framework emphasizes the importance of a holistic and integrated approach to teacher competencies that considers not only the cognitive and technical aspects of teaching but also the socio-emotional and ethical dimensions.

Hattie's (2009) influential work on visible learning has helped shape the discussion on teacher quality, contending that effective teaching requires various competencies, such as subject matter knowledge, pedagogical content knowledge, and classroom management skills. Similarly, Imig et al. (2016) emphasize the importance of developing "high-quality teacher education" that stresses content knowledge and pedagogical skills.

However, the examination of teacher competence is not without controversy, especially in the context of neoliberal education policies (Bullough, 2016). Neoliberalism is an ideology that emerged in the 1980s and has had a significant impact on various aspects of society, including education (Karlsen, 2010). Neoliberal policies frequently prioritize market-driven approaches to education, emphasizing measurable outcomes and standardization over the growth of teacher expertise and contextual knowledge (Peters & Green, 2021). One area where the influence of neoliberalism can be observed is in teacher competency and the management of teacher education. Therefore, there has been a shift towards standardized teacher education, with an emphasis on evaluation and control.

The best way to judge and assess a teacher's ability is also still being discussed. Work by Clandinin and Connelly (1996) on instructors' professional knowledge landscapes emphasizes the significance of including teachers' personal tales and experiences in assessments of competency rather than depending exclusively on standardized measures. In addition to conversations regarding the definition and evaluation of teacher competence, research has investigated alternative approaches to teacher education and professional development. The assessment of the evolving policy and knowledge environment of teacher education by Mayer & Reid (2016) calls for a more professionalized approach that considers the complexity and diversity of teaching contexts.

A more nuanced knowledge of teacher competency can be developed through the integration and synthesis of research from multiple viewpoints, which will result in more advantageous approaches to teacher education and better student outcomes. It's incredible how easy it has become to gather enormous amounts of bibliometric data thanks to the development of scientific databases like Scopus and Web of Science, and how bibliometric analysis tools like Gephi, Leximancer, and VOSviewer make it possible to look at such data in a highly useful way. Moreover, bibliometric analysis has become much more popular among academics. In fact, a variety of areas of educational research, such as teacher education and other forms of teacher skills, have used the bibliometric technique (Cretu & Morandau, 2020; Huang et al., 2020; Shidiqa et al., 2022; Wang & Jia, 2023). Yet, there hasn't been any bibliometric research in teacher education that examines the temporal variation of discourses in teacher competences or focuses on teacher competencies through keywords. Taking this into account, the current study will do a bibliometric analysis of the literature on evolving patterns in teacher competency and competencies. As well as highlighting important topics and challenges that have evolved in the field, this study especially aims to find patterns, trends, and gaps in the literature on this subject.

Purpose and Significance of the Research

Examining the development, change, and present condition of research on teacher competency in the worldwide literature is the aim of this study. By using bibliometric methodologies to find new concepts, themes, or subjects, this study also intends to suggest further lines of inquiry in this area. The following questions are addressed by study to achieve this goal:

1. What are the most current developments and major trends in teacher competencies?
2. What ideas are prevalent in teacher competencies?
3. How have these ideas or terms changed over time?

In order to understand the features of publishing trends and classify possible research gaps, bibliometric analysis is becoming more and more common in the research evaluation process. It has become a useful method for measuring the elements that influence research quality in recent couple of years (Abdullah, 2022). By doing so, this research is expected to contribute to the ongoing discourse on teacher competence and become a reference for future researchers in conducting and determining new research.

Methods

Kurtz (2018) said that bibliometric studies is a serious business. These studies have become increasingly important in the academic landscape as they provide valuable insights into the structure, trends, and impact of scholarly literature. These studies offer objective and quantifiable measures of research productivity, influence, and collaboration.

We conducted a search for publications using the Scopus database, which was selected due to its interdisciplinary focus (Mongeon & Paul-Hus, 2016). We utilized the search terms “teacher competence” or “teacher competency,” or “teacher competencies” to retrieve all available publications published through the end of 2022. “Document title”, “abstract”, “title” and “keyword” were chosen as search criteria in Scopus. During the publication selection stage, we excluded studies that had not yet been published in their final versions. Adhering to the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) framework guidelines for systematic literature reviews (Page et al., 2021), we conducted a comprehensive search for all relevant publications in multiple stages to identify literature on teacher competence. Figure 1 illustrates the PRISMA process implemented in the study.

The technique for bibliometric analysis has performance analysis and science mapping categories. Co-word analysis, which is one of the five analysis units, is included in science mapping. The words in a co-word analysis are often derived from “author keywords”, and in their absence, notable words can also be extracted from “article titles,” “abstracts,” and “full texts” for the analysis. The co-word analysis assumes that words that frequently appear together have a thematic relationship with one another (Donthu et al., 2021).

For the study’s research goal, we analyzed the contributions of the countries, the type of subject area and documents, and trends in teacher competencies over time. Furthermore, we narrowed our focus to the keywords

"teacher competence" and "teacher competencies" from the initial pool of 1801 publications. Subsequently, we used the Vosviewer software to analyze, critically assess, and summarize all relevant research related to teacher competence and competencies, resulting in 228 items.

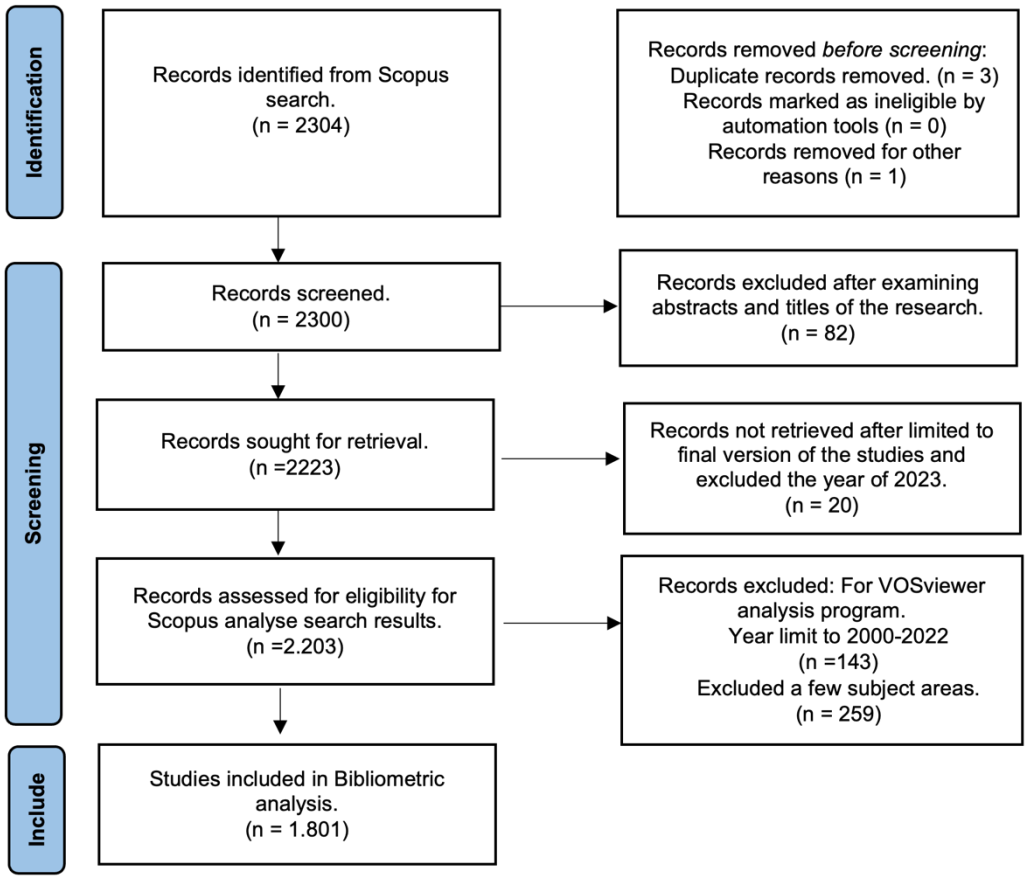

Figure 1. PRISMA flow Diagram in the Identification and Screening of Sources (Page et al., 2021).

The information gathered based on the criteria and limits was exported from the Scopus database in the (.cvs) format for processing in VOSviewer software, a computer tool utilized for constructing and visualizing bibliometric networks. These networks include various entities, such as journals, researchers, or individual publications, and are established based on citation, bibliographic coupling, co-citation, or co-author relationships (Van Eck & Waltman, 2018). Moreover, the software incorporates text mining functionality that can be employed for constructing and visualizing co-occurrence networks of significant terms extracted from a scientific literature corpus. The VOSviewer generates maps based on network data and this may be utilized to generate networks of scientific publications, scientific journals, researchers, research organizations, countries, keywords, or conditions. These networks' constituents may be connected by co-authorship, co-occurrence, citation, bibliographic coupling, or co-citation links. To construct data from the Web of Science, Scopus, Dimensions, PubMed, RIS, or Crossref JSON files may be utilized. In addition, the software is a viewing and exploration map, and it presents three views of a map: network visualization, overlay visualization, and density visualization (Van Eck & Waltman, 2018). We selected "keywords" as the fundamental unit for conducting bibliometric analysis on the topic of teacher competence and its trends over time. Then we generated network, overlay, and focused overlay visualization maps based on keywords and co-occurrence units to analyze and present our results.

Results and Discussion

The results of this research focus on three main areas. First: a bibliometric analysis of the scientific contributions detected in the Scopus database. Second: a bibliometric analysis of the scientific contributions detected. Third: a discussion of the research trends in the theme of teacher competence using keyword maps over time.

Results of the Bibliometric Analyses of the Scopus Database

The detected publications of the Open Access type are divided into the following categories, within the Scopus database. Table 1 shows the categories, definitions, and list of scientific contributions, only Open Access type.

Table 1. Open Access Types Available in Scopus.

Open Access types available in Scopus		
Categories	Definition	Number of scientific contributions
All Open Access	Documents that enable unrestricted, free, and immediate access to research outputs, including scholarly articles, books, datasets, and other forms of academic and scientific information	835
Gold open	Documents that are in journals that only publish open access.	415
Hybrid Gold	Documents that are in journals that provide authors the choice of publishing open access.	94
Bronze	The published version of the record or manuscript is accepted for publication. The publisher has chosen to provide temporary or permanent free access.	232
Green	Published versions or manuscripts accepted for publication, available at the repository.	354

When the distribution of Open Access types in Scopus is examined, it is seen that the number of documents of the "all open Access" type is the highest, while the number of documents of the hybrid gold type is the least. The open access types in Scopus appear to be the most repetitive of all open access types.

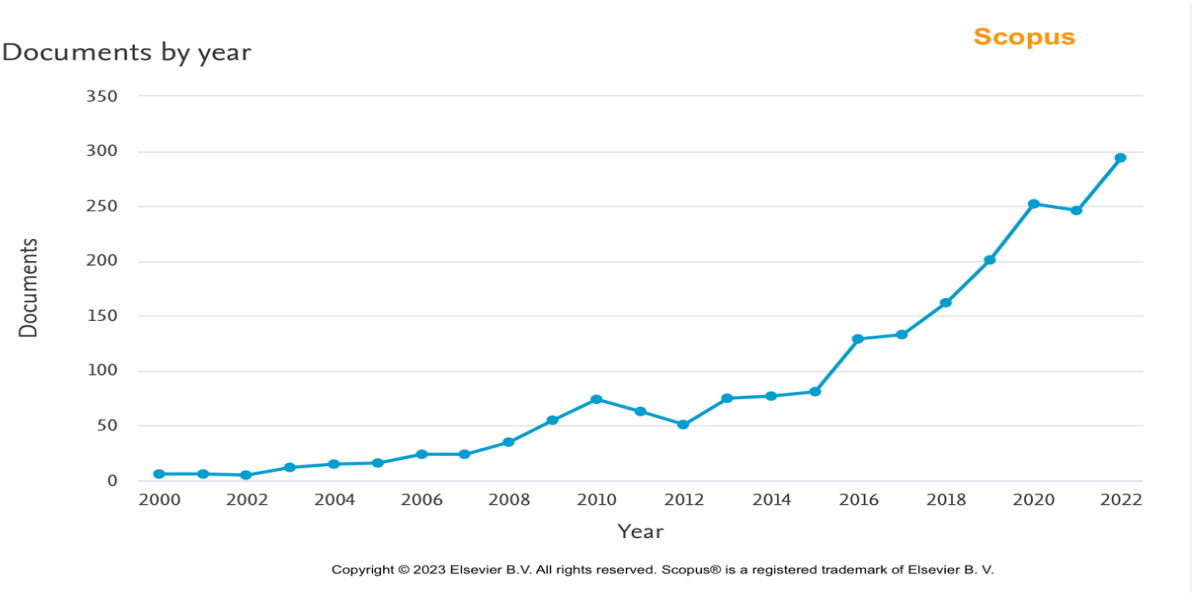

Figure 2. Documents by Year

According to the scientific data in the Scopus database, the first study on teacher competencies was conducted in 1950, and at least one research paper was published in this field every year until the 2000s. Between 2000 and 2008, there was a remarkable increase in the number of scientific contributions published on the theme of teacher competencies in the international scientific community in the Scopus database, from 6 to 35. When the Figure 2 is examined, although there is a tendency to remain stable or decline in some years, an upward trend in general, especially towards recent times, is noteworthy. There has been an increase in the number of scientific contributions published on this theme since 2012.

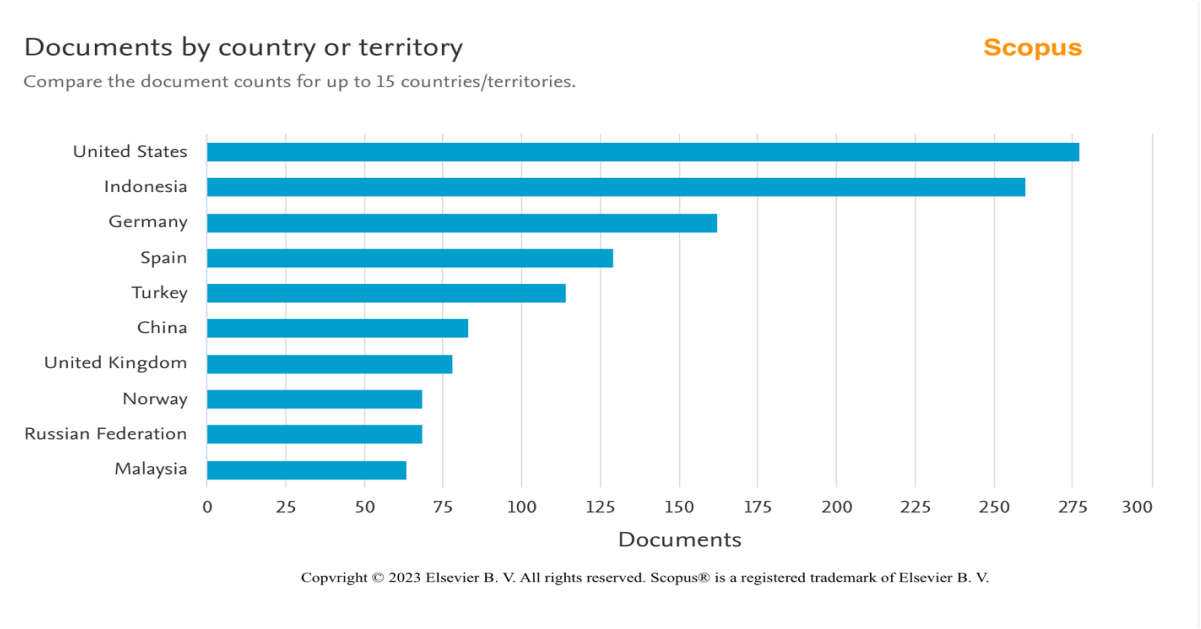

Figure 3. Documents By Country or Territory

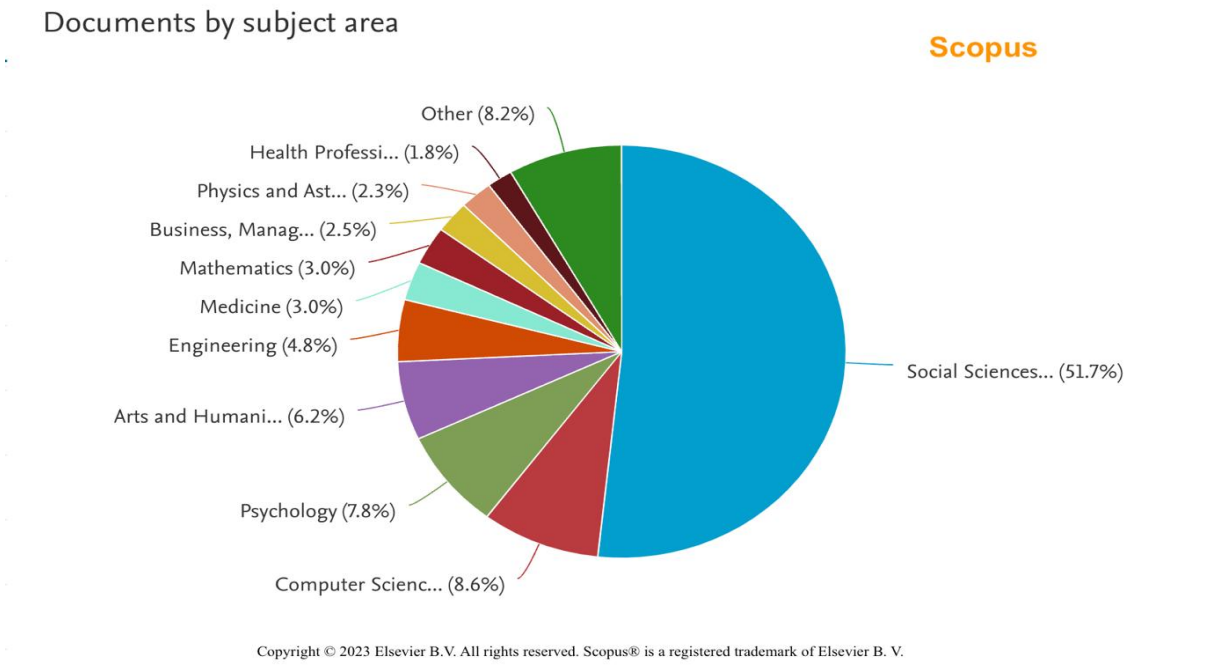

Figure 4. Documents By Subject Area

The first five countries to show the highest results in this regard with their contributions to the database in question are the United States, Indonesia, Germany, Spain, and Turkey. It is noteworthy that the United States is the country that contributes the most to this field in terms of publication in other studies that make systematic or bibliometric analyses of teacher competencies (Cretu & Morandau, 2020; Iturralde & Bravo, 2022; Shidiqa et al., 2022). We especially find the increase in the number of scientific publications Indonesia has published on the theme of teacher competencies noteworthy. As shown in Figure 3, the fact that developing countries are among the top ten countries that publish the most in this field, alongside developed countries, proves that countries care about their teachers being equipped with competencies. Figure 4 shows the distribution of published documents by subject areas with percentage values. The identified scientific contributions are divided into the following subject areas:

Table 2. Subject Area Numbers

Subject Areas	**f**
Social Sciences	1764
Computer Science	292
Psychology	266
Arts and Humanities	210
Engineering	165
Medicine	103
Mathematics	102
Business, Management and Accounting	85
Physics and Astronomy	80
Health Professions	63
Environmental Science	55
Decision sciences	38
Energy	30
Nursing	27
Economics and Finance	25
Earth and planetary sciences	17
Neuroscience	17
Agricultural and Biological Sciences	16
Materials Science	14
Multidisciplinary	13
Biochemistry, Genetics and Molecular Biology	11
Chemistry	9
Pharmacology	4
Chemical Engineering	3
Dentistry	2
Total	**3411**

Although the theme of "teacher competence" is perceived as a part of educational sciences in the field of social sciences, the fact that it has been handled in 25 different fields in the context of subject areas shows the importance of the subject and that it is an interdisciplinary theme.

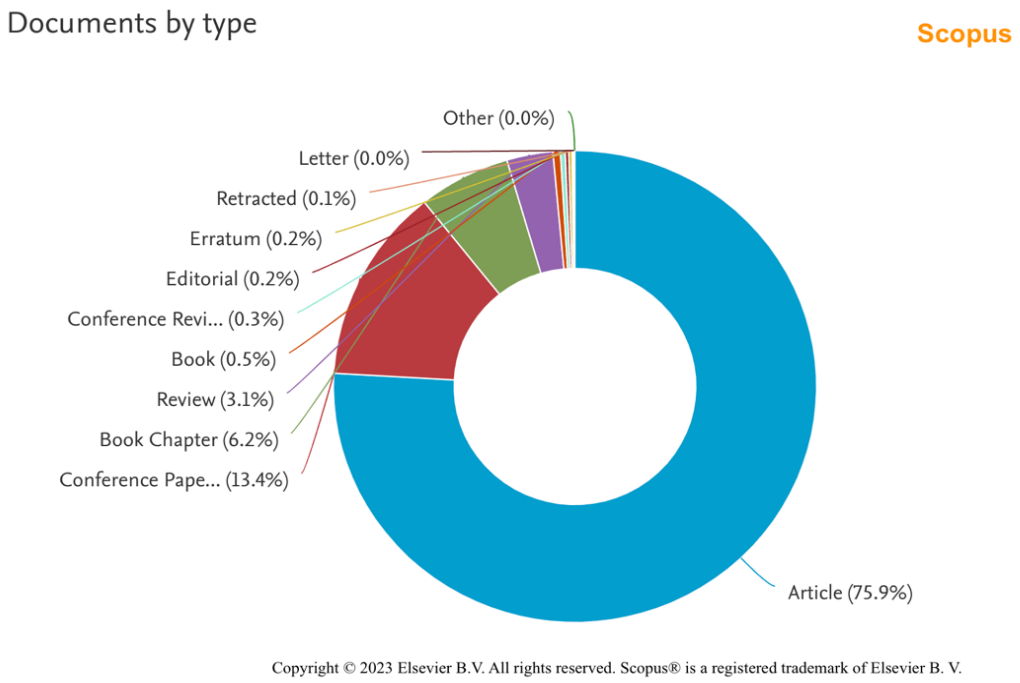

Figure 5. Documents By Type

Figure 5 shows, in percentage values, the distribution of the types of documents detected. Of the 2,203 documents found in the Scopus database, 1672 are articles, 295 are conference papers, 136 are book chapters, 68 are reviews, 11 are books, 7 are conference reviews, 5 are editorial type, 5 are erratum, 2 are retractions, 1 is a letter, and 1 is a note. According to this bibliometric study, the Scopus database contains a little amount of research output beyond just journal articles; so, %75 of the documents are in article forms.

Results of the Bibliometric Analyses Using VOSviewer Software

This study aimed to investigate the textual data present in the keywords of 1,801 articles pertaining to "teacher competence or teacher competencies" published in the Social Sciences field and indexed in the Scopus database. The analysis focused on the co-occurrence of keywords to identify and extract the most relevant conceptual information. The study identified 228 concepts that were repeated at least five times from a total of 4,715 words used in the keywords of the 1,801 documents. The findings were analyzed from two different dimensions, which were the frequency and co-occurrence of the identified keywords. The results of the analysis regarding the keywords are shown in Table 2.

According to Table 2, the most used keywords are "teacher education", "teacher competence" and "teacher

competences". It is a reasonable result that these concepts, which are the focus of the studies, are repeated most frequently. The other concepts that emerge draw a panorama in terms of understanding which concepts the subject focuses on.

Table 2. Statistical results of the most used selected keywords about teacher competence.

Keywords	Indicators				
	Cluster***	Links**	Total link Strength**	Occurrences*	Average publication year
Teacher Competence	1	93	170	133	2017
Teacher Education	1	113	242	136	2016
Teacher Competences	1	99	192	131	2016
Professional Development	1	93	168	66	2018
21st Century Skills	1	6	7	5	2020
Teacher Training	2	101	205	68	2016
Competence	2	73	132	46	2016
Curriculum	2	71	144	30	2013
Learning	2	75	131	27	2018
Education for Sustainable Development	2	30	39	9	2020
Teaching	3	151	563	112	2015
e-Learning	3	66	149	41	2017
Technology Integration	3	26	43	18	2016
Covid-19	3	41	49	17	2021
Digital Technology	3	21	26	5	2020
Education	4	131	413	75	2015
Teacher	4	99	263	58	2017
Professional Competence	4	81	176	32	2014
Standard	4	28	62	7	2007
Certification	4	14	20	5	2002
Motivation	5	51	66	24	2016
Teacher Characteristic	5	15	22	9	2010
Teaching Experience	5	21	29	8	2018
Teacher Professionalism	5	7	10	6	2017
Teacher Quality	5	12	14	5	2015
Assessment	6	45	59	28	2016
Perception	6	46	57	10	2014
Teaching Practice	6	13	14	7	2017
Quality Assurance	6	24	25	6	2015
Challenges	6	12	12	5	2019

* The size of the circles in Figure 6 fluctuates according to the frequency of the terms identified in Table 2's keywords. Table 2 also shows the top five terms from each of the six clusters, ranked by frequency data.
**The frequency with which terms are linked is referred to as their link frequency. The network (line) structure in the map is created by this data.
***Clusters arise as the frequency of terms used with each other rises. This information is used to generate the cluster information, which is displayed by colors on the map and expressed numerically in the table.

Clusters Resulting from the VOSviewer Network Mapping with the Keyword of Teacher Competence

The analysis of the frequency of these keywords and their co-occurrence takes place in Figure 6 as a network map, which visually displays the 228 concepts with the highest relationality. Visualizing bibliographic data in VOSviewer can provide valuable insights and enhance understanding of research landscapes, collaboration networks, and trends (Husaeni & Nandiyanto, 2021). The number of clusters obtained from the VOSviewer software science mapping with the keyword "teacher competence" is 6. Each of these clusters has a different number of items, different item types, and different cluster colors. Each item in the cluster formed a circle, and each circle had a different size. The size of the circle is determined by its frequency of occurrence (Mulyawati & Ramadhan, 2021). The larger the circle, the more often the keyword is used; the smaller the circle, the less frequently the term is used.

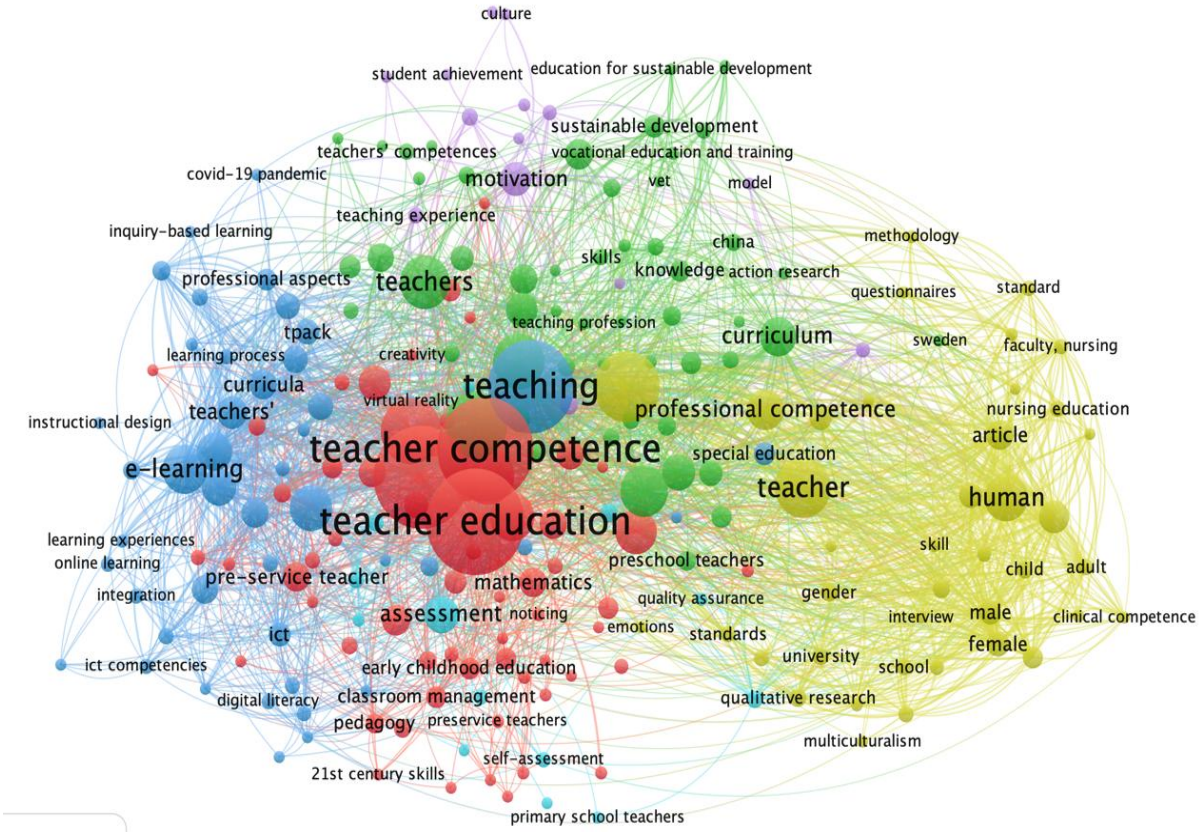

Figure 6. Network Visualization of Teacher Competence Keyword

The six clusters obtained from the results of the VOSviewer mapping with the keyword "teacher competence" are as follows:

Red Cluster: Cluster 1 has 63 items which are 21st century skills, active learning, beliefs, blended learning, classroom management, comparative study, confirmatory factor analysis, content knowledge, creativity, distance learning, diversity, early childhood education, early childhood teacher, educational change, English is a foreign language, factor analysis, general pedagogical knowledge, inclusion, inclusive education, information and communication technology, initial teacher education, initial teacher training, instructional quality, language

teaching, lesson planning, lesson study, mathematics, mathematics education, mathematics teacher education, multicultural education, noticing, pedagogical content knowledge, pedagogy, pre-service teacher, pre-service teacher education, preschool teachers, professional development, professional knowledge, professional vision, self-efficacy, self-regulated learning, student teachers, surveys, teacher beliefs, teacher competence, teacher competences, teacher competencies, teacher competency, teacher education, teacher knowledge, teacher noticing, teacher preparation, teacher professional development, teacher self-efficacy, teachers' competence, teaching competencies, technological pedagogical content knowledge, validity, video, and video-based assessment. It is noteworthy that the concepts of "teaching competence" and "teacher education" are repeated more frequently in the red cluster than in others. The red cluster may be regarded as the foundational cluster of analysis. This cluster includes the concepts that are most prevalent and have the highest correlation. It can be said that the cluster encompasses the competencies consisting of skills, knowledge, dispositions, and attitudes that teachers must possess, which constitute the content of the teacher competence concept.

Green Cluster: Cluster 2 has 53 items of action research, China, competence, competences, competencies, competency, curriculum, education for sustainable development, education policy, educational development, educational process, elementary school, evaluation, higher education, implementation, knowledge, learning, lifelong learning, music education, pedagogical competence, performance, physical education, preschool, preschool teachers, preservice teacher education, primary education, primary school, quality, science education, secondary education, skills, sustainability, sustainable development, Sweden, teacher development, teacher effectiveness, teacher evaluation, teacher training, teachers, teachers' competence, teachers' competency, teachers' competences, teachers' competencies, the teaching profession, teaching quality, teaching skills, training, university sector, vet, vocational education, vocational education, and training. The green cluster centers on the theme of teacher training and encompasses studies on school types, education, and pedagogical competencies.

Blue Cluster: Cluster 3 has 45 items which are action research, adult education, collaboration, collaborative learning, communication skills, competence development, computer-aided instruction, covid-19, covid-19 pandemic, curricula, curriculum development, decision making, digital literacy, digital technologies, distance education, e-learning, educating computing, educational technology, engineering education, ICT (information and communication technologies), ICT competencies, information and communication technologies, information technology, inquiry-based learning, instructional design, integration, learning experiences, learning process, learning system, online learning, online teaching, participation, personnel training, professional aspects, science, special education, stem education, students, teachers, teachers' competencies, teaching, teaching and learning, technology, technology integration, and virtual reality. The blue cluster emphasizes technology skills and digital literacy. Notably, the red cluster is closely associated with the blue cluster, and the most frequently used and highly related words within both clusters relate to emerging research topics such as blended learning.

Yellow Cluster: Cluster 4 has 40 items which are adult, article, certification, child, clinical competence, education, emotions, faculty, faculty nursing, female, Finland, gender, human, human experiment, humans, interview, leadership, male, methodology, multiculturalism, Norway, nursing education, organization and management, professional competence, psychology, qualitative research, questionnaire, questionnaires, school, school teacher,

school teachers, schools, skill, special education needs, standard, standards, student, surveys and questionnaires, teacher, and university. In the yellow cluster, "education and teacher" concepts are observed to act as a bridge that links other clusters, and this dynamic engenders a preponderance of scientific research types and concepts pertaining to research methods within this cluster.

Purple Cluster: Cluster 5 has 14 items which are culture, high school, Indonesia, mathematics teacher, model, motivation, professional competencies, student achievement, teacher characteristics, teacher credibility, teacher learning, teacher professionalism, teacher quality, and teaching experience. The purple cluster exhibits a transitional character that connects the green and blue clusters, and it encompasses common concepts utilized in research on technology integration and teaching competencies.

Turquoise Cluster: Cluster 6 has 13 items which are assessment, challenges, content analysis, digital competence, feedback, perception, primary school teachers, quality assurance, reflection, self-assessment, teachers' competencies, teaching competence, and teaching practice.
The turquoise cluster, which encompasses concepts from various disciplines, may be characterized as an interdisciplinary cluster and is associated with the theme of "assessment."

Upon examination of the research clusters in light of teachers' competencies (Selvi, 2010), it becomes evident that the red cluster encompasses studies that span across all competency domains, including field, research, curriculum, lifelong learning, social-cultural, emotional, communication and ICT competencies. The green cluster, on the other hand, comprises studies that are primarily focused on the field, curriculum, and environmental competencies. Similarly, the blue cluster predominantly consists of studies that investigate ICT competencies, while the yellow cluster is characterized by studies that explore research competencies. Furthermore, the purple cluster is largely composed of studies that delve into lifelong learning and emotional competencies, whereas the turquoise cluster is primarily concerned with curriculum and communication competencies.

Clusters Resulting from the VOSviewer Overlay Mapping with the Keyword of Teacher Competence

Using VOSviewer, we created a keywords map using the contributions' indexing keywords. This map of keywords visualizes the main themes related to research on teacher competence. The time frame covered by the keywords map runs from 2000 to 2020. The color codes reveal the difference in time. The dimension of the circles indicates the co-occurrence of the keyword, and the lines establish the interconnection of the keywords. This keyword map shows the evolution of research on the theme of Teacher Competence over time. In the analysis of time trends, the progression, and thematic areas created by the topics that stand out periodically are shown on a map. The publication dates of the texts containing the concepts were used to determine the prominent thematic areas. In this way, temporal longitude analysis becomes possible.

Figure 7 shows the keyword clusters overlay mapping over time. In this type of visualization, we can see the year that research is often done on the keywords we are looking for. In Figure 7, we can see that the keyword "teacher competence" was widely researched from 2015 - 2020.

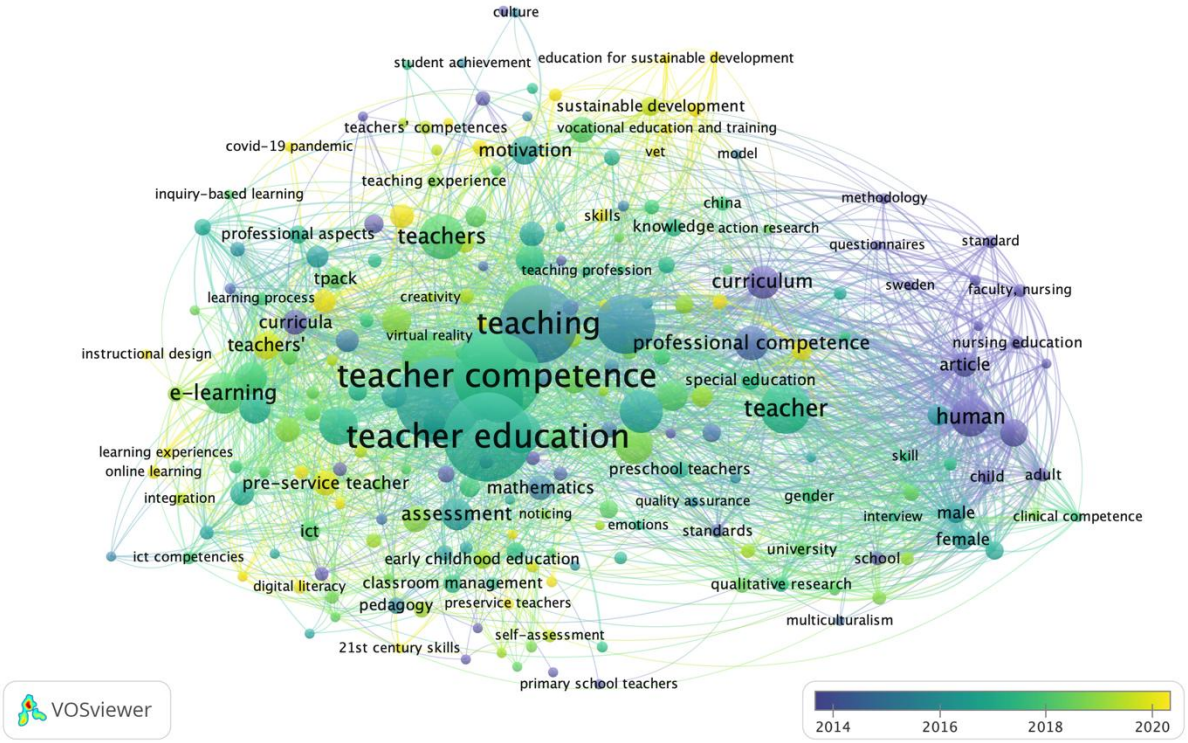

Figure 7. Overlay Visualization of Teacher Competence Keywords

Discussion of the Shifting Trends in Teacher Competence Over Time Through the Keyword Maps

In this section, we focus on detailed visuals to discuss deeply how identified concepts or terminologies shifted over time. At this stage, we focused on the year criterion as the unit of analysis and performed our analysis as a visual for every five years between 2000 and 2022 (in this way, 2000-2005, 2006-2010, 2011-2015, 2016-2020, 2021-2022). Information about the colors in the images is in the legend section of each map. We also chose to present the following maps from the past to the present in order to allow readers to travel in time regarding the change in teacher competence. This section provides a perspective on the keywords most commonly used by researchers on the path from neoliberalism to Industry 4.0.

When we embark on a historical journey regarding teacher competencies over the past twenty years, we encounter neoliberalism, the new phase of capitalism, as we enter the 21st century. Neoliberalism is defined as a system dominated by libertarian, individualistic, democratic, and free-market conditions, with a more passive state, and though it appears to be primarily economic, it affects every aspect of life, including education (Bullogh, 2018; Peters & Green, 2021) and daily life (Keles & Aslan, 2022).

Education plays a significant role in the cultivation of the neoliberal individual that the economic rationale envisages and in the reproduction of the system. Beltekin and Özdemir (2020) discuss the effectiveness of the *human capital theory* in determining the objectives of education, whereas Lazear (2000) argues that the economic rationale guides social policies from who should receive education to the content of education. In this system,

where humans are seen as capital as an investment and production tool, neoliberal policies prioritize market-oriented approaches to education by emphasizing measurable outcomes and standardization instead of developing teacher expertise and contextual knowledge (Peters & Green, 2021). This has resulted in practices such as "standards, certification, accreditation, performance standards, and standardized tests" (Bullogh, 2018) in teacher education. For example, the National Council for the Accreditation of Teacher Education (NCATE, 2001) conducted a study and field-tested a set of standards and assessments for professional development schools in the United States between 1995 and 2001, and the standards were officially launched in 2001.

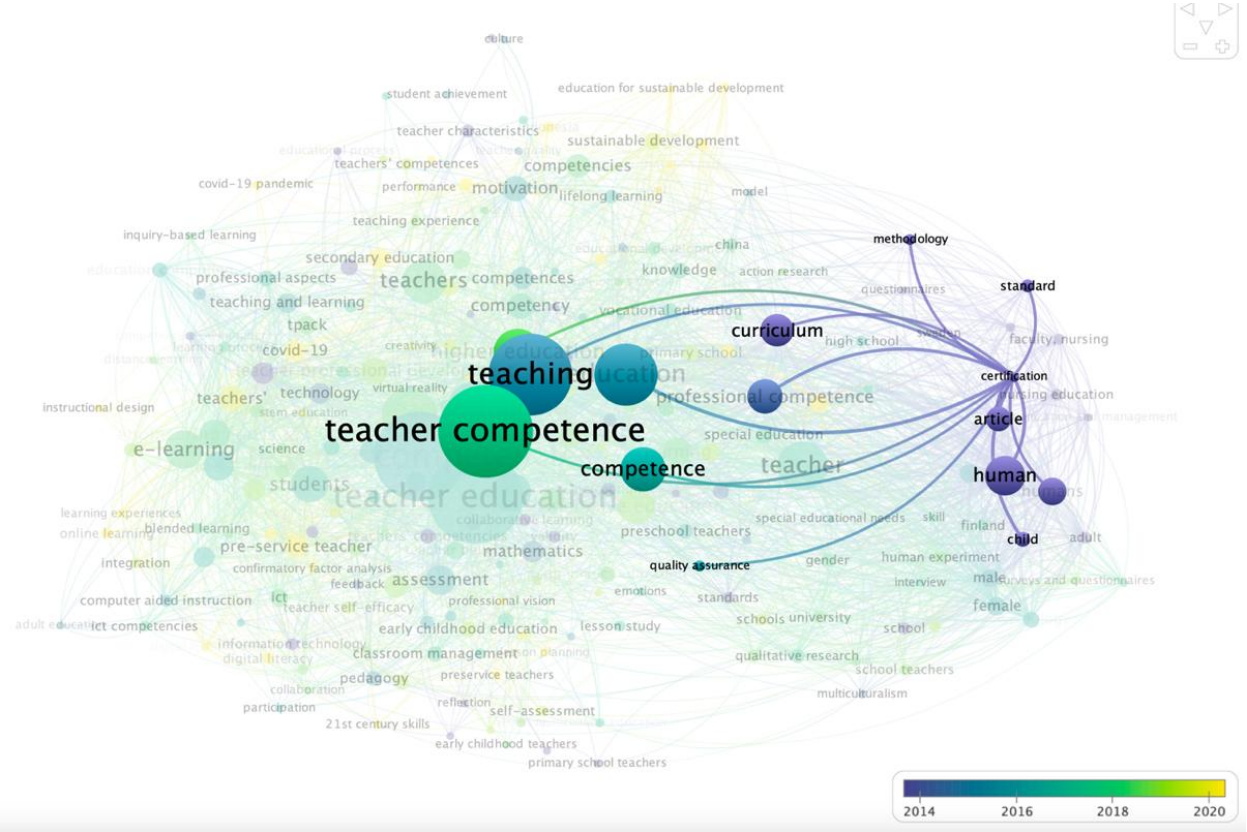

Figure 8. The Map of the Keyword "Certification" (2002)

Figure 8 clearly shows how the notion of "certification" has shaped the reflection of teacher competence as a quality assurance mechanism in the neoliberal system. The desire to achieve measurable and evaluable results in education has led to the evaluation of teacher competencies based on the achievements of students. Thus, in the mid-2000s, the importance of international exams such as PISA and TIMSS increased, and as countries reviewed their education systems, they also evaluated the competencies of teachers based on the results of these standardized tests (Valcke, 2013). This standardization has evolved into performance-based evaluation systems developed by independent external evaluators to assess teachers' competencies based on specific subject areas in the transition to the teaching profession (such as edTPA). Especially during these years, research on teacher competencies has focused on nursing education and engineering education, as seen in Figure 9's network map, where the keyword "standard" is central. Accreditation in nursing education serves as an example in this context. The Accreditation Council for Graduate Medical Education seeks to include educational and selection views into its accreditation process for medical schools in the United States by demanding assessments of many characteristics of clinical competence (Bölmeke et al., 2015).

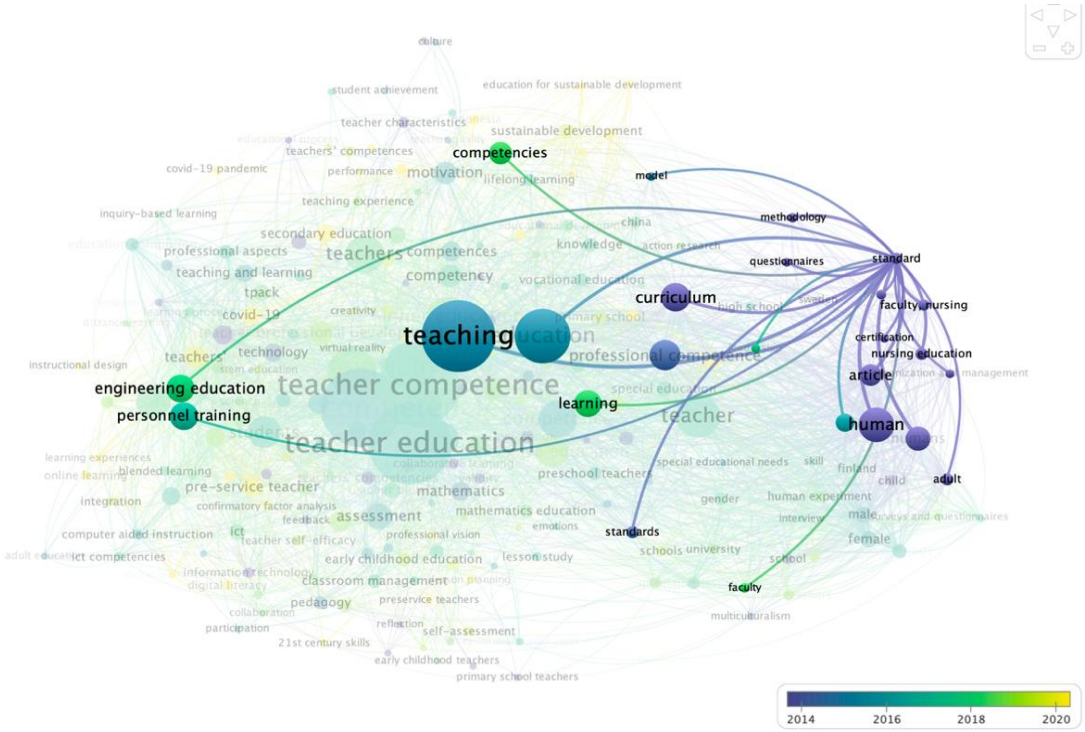

Figure 9. The Map of the Keyword "Standard" (2007)

As the first decade of the 2000's ended, the importance of knowledge and skills in the field of teacher competencies came to the fore through the concept of "curriculum" in Figure 10. Many countries have implemented reformist practices in their teaching programs through both international and domestic funding (OECD, 2011). Teachers' skills and knowledge are critical components that can be incorporated into the curriculum by enhancing their value, skills, and knowledge.

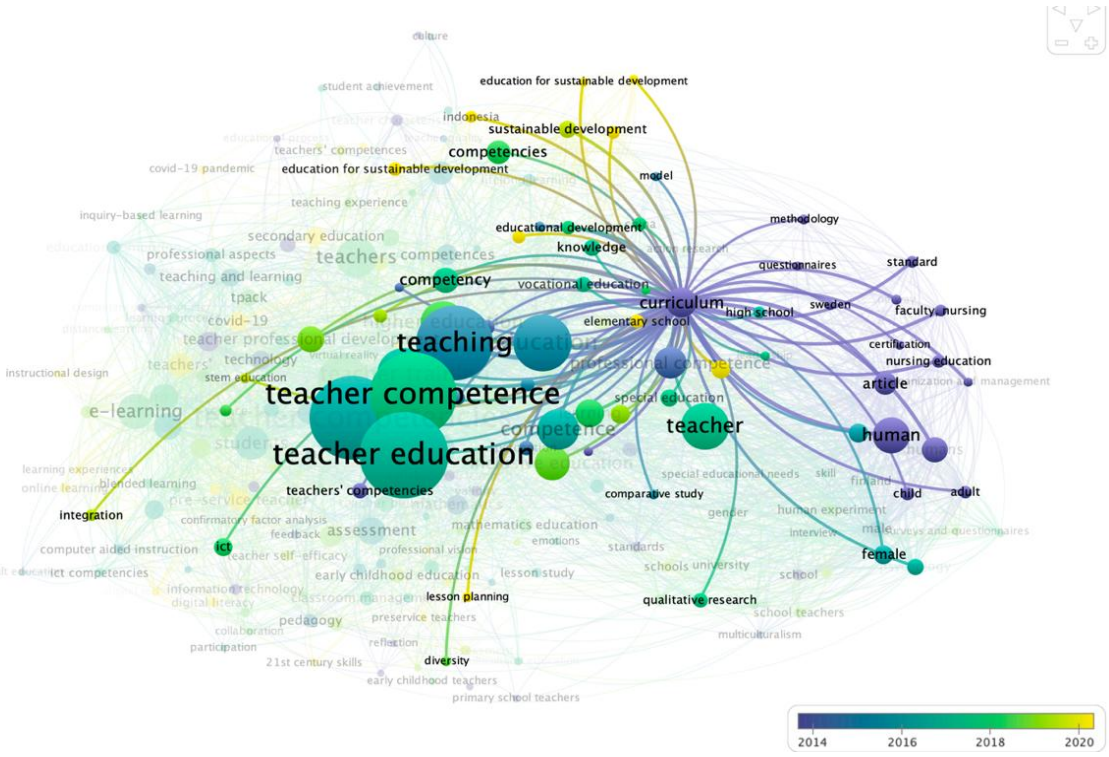

Figure 10. The Map of the Keyword "Curriculum" (2013)

It is important for teachers to have a say in adopting and implementing teaching programs. However, it has been revealed by Keles & Aslan (2022) that, schools or teachers are not given a say in determining lessons, creating lesson content, or selecting textbooks. The fact that teachers do not have a say in changing curricula but are responsible for teaching them has caused curriculum-related teacher competencies to be the subject of research in the context of "theoretical and practical knowledge" in the following years. Based on the publications during these years, as seen in Figure 11, it is understood that "teacher competence and teacher education" are addressed together, and if competence is desired, the way to achieve it is through education. Here, how the pre-service teachers are educated and whether they are equipped to meet the qualifications in their undergraduate education come to the fore.

Therefore, in modern teacher education, there is a growing emphasis on developing relational skills, which encompass both theoretical and practical knowledge, to enhance the identity and competence of educators in educational institutions, including in their training and preparation (Bocala, 2015; Knight et al., 2015). Wiksten (2018) identified an important issue in teacher education as the criteria and standards used to prepare teachers, particularly in terms of how they make decisions during the teaching process and foster higher-order thinking skills. One approach to addressing these concerns is also to integrate theoretical courses at the university level with practical teaching experiences in schools, thereby improving the quality of teaching and promoting professional development through thoughtful, reflective, inquiry-based, and knowledge-based approaches to education that aim to provide equitable opportunities for all students (Knight et al., 2015).

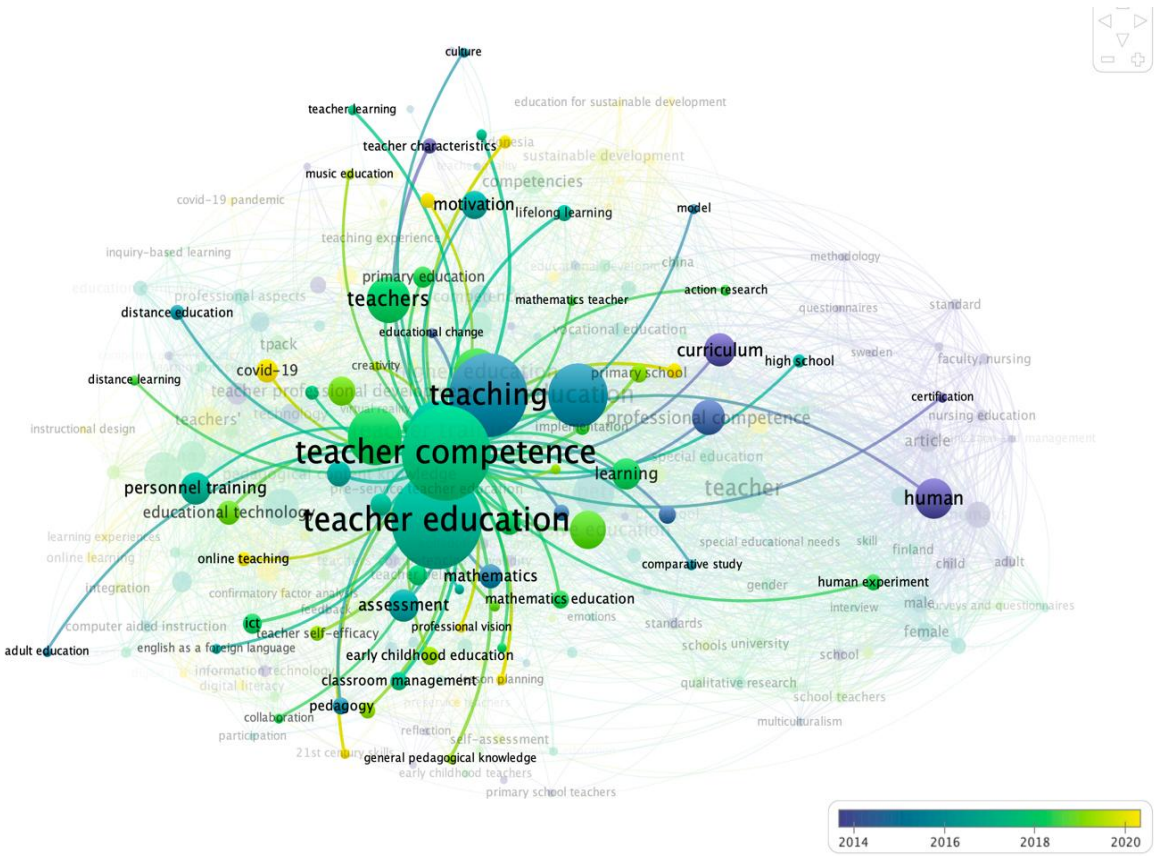

Figure 11. The Map of the Keyword "Teacher Competence" (2017).

Moreover, teacher education should emphasize the quality of instruction and how teachers collaborate in delivering instruction. Teachers' abilities and expertise can be reflected in their problem-solving skills, including pedagogical intervention, performance evaluation, feedback, and classroom activity reflection (Medeiros, Ramalho, & Falcão, 2018). Developing values, skills, and knowledge aligned with 21st-century teaching professional criteria requires improving teachers' innovation, reflection, mutual respect, personal connection, and collaboration.

One of the 21st century skills, "technology skills and digital literacy," leads us to the perspective of teacher competencies, especially with the keyword "Covid-19." The related keywords presented in Figure 12, such as "e-learning technology integration, online teaching, information, and communication technology," clearly demonstrate the digital transformation in teacher competencies. Especially during the Covid-19 pandemic, the "distance learning" that the whole world had to experience has led to an increase in studies on teachers' digital competencies. One of the indicators of teachers who master digital competence is the mastery of ICT and digital literacy in the era of Industry 4.0 (Cebi & Reisoglu, 2022). One of the competencies of teachers in the digital era is to master information literacy and process and search for digital-based data for learning purposes.

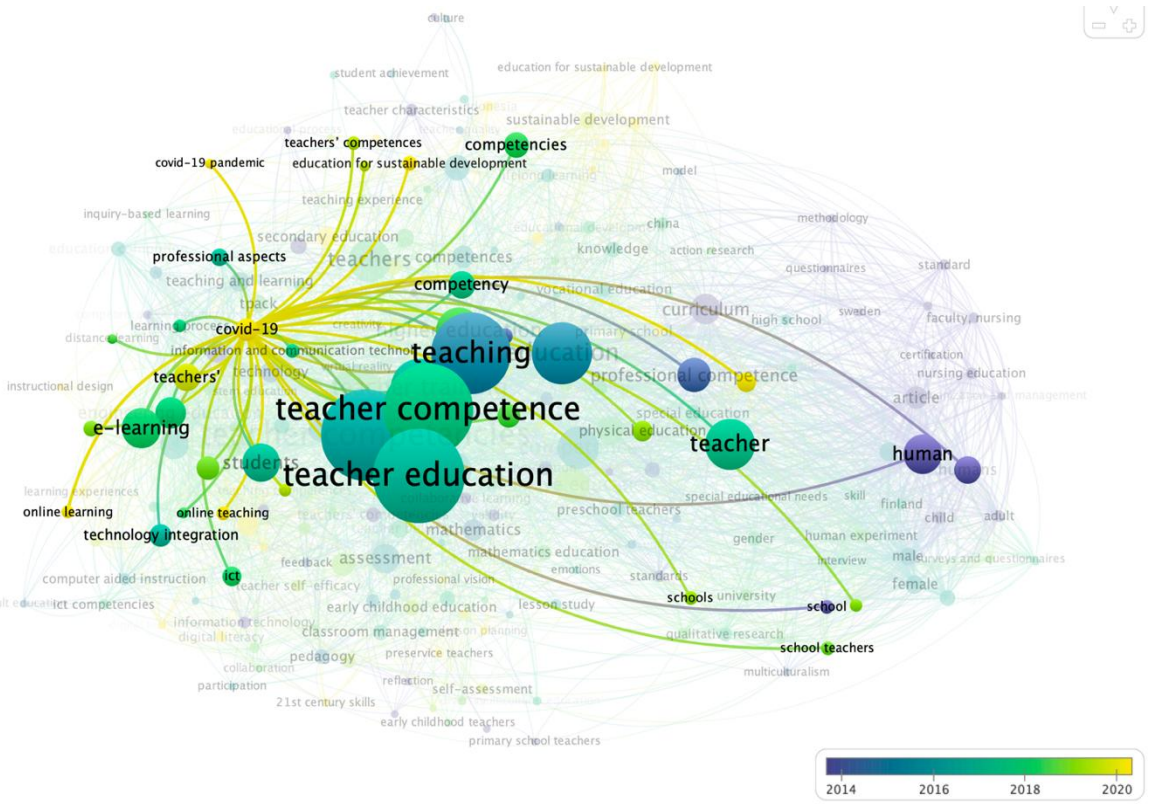

Figure 12. The Map of the Keyword "Covid-19" (2021).

Conclusion

In conclusion, our examination of teacher competencies within the studied timeframe reveals their enduring relevance and a consistent increase in researchers' interest in the subject from the past to the present. Additionally,

our investigation highlights the global significance of studies related to teacher competencies, with most publications originating from the United States. Furthermore, it is evident that publications on teacher competencies are predominantly concentrated in the social science domain and primarily consist of research articles.

Analysis shows that the number of open access type documents is the highest. In order for a study to be open Access, authors publish their scientific publications in journals for a fee, often called the article processing fee. This pre-publication fee is for everyone's free access to the relevant publications. This fee is usually paid by the author, the institution to which the author is affiliated, or the funder. The golden road publishing model is based on payment and subscription for access to scientific information, which raises a cost problem. The distinction here really comes down to how much writers can support the wage cost of their work. The topic of which types of articles are published by researchers in which countries can also be examined in another study.

Network visualization mapping has illustrated that the clusters of keywords presented in this study are closely aligned with the domains of teacher competencies (Selvi, 2010). Notably, our research findings indicate that researchers have been most active in publishing on topics related to teacher competencies between 2015 and 2020. The focus maps presented in this research vividly depict how the evolution of teacher competence has transformed from neoliberalism to the present-day Industry 4.0. Specifically, we traced the emergence of key terms such as 'certification' in 2002, 'standards' in 2007, 'curriculum' in 2013, 'teacher competencies' in 2017, and the prominence of 'Covid-19' in 2021, reflecting the pandemic's profound impact on education.

It is clear that the number of academic publications continues to increase in many areas. The results of the analysis conducted within the scope of our study reveal that studies on teacher competencies have increased since 2012. The distribution of the number of publications by country shows that this field is not regionally concentrated in certain continents, and that the subject of teacher competencies is studied in countries on different continents. It has been concluded that the subject of teacher competencies has been studied mostly by social scientists. In terms of document type, it is seen that the most publications are in the article type. The fact that articles are the most common type of scientific publication supports this situation.

Consequently, the adaptability of teacher competencies to the changing landscape across all fields globally is intrinsic to their organic nature. The industrial revolution 4.0 is characterized by the presence of new technologies that emphasize the digital economy, artificial intelligence, and big data. The increasing importance of measurable and assessable aspects, driven by neoliberalism, required standardization. However, the Covid-19 pandemic has emphasized the need for digitalization, technology integration, and competencies such as blended learning. These shifts underscore the necessity for educators, who are the central agents of education systems aimed at nurturing individuals in line with the demands of the era, to update themselves according to the requirements and conditions of the times. The bibliometric analysis of research on teacher competencies presented in this study contributes to the theoretical understanding of the subject and offers valuable insights to researchers in the field of teacher competencies.

Research Limitations and Recommendations

The study has some limitations, mainly regarding the collection of sample data. The sample used in this study was obtained from the Scopus database, which may have resulted in relevant data being left out. To improve the study significantly, researchers should collect sample data from multiple independent databases and use more relevant keywords in their search queries. Timeframe selection has a crucial effect on the construction of the literature base. To improve future research, it may be beneficial to expand the filtering criteria to include publications that are not listed in Scopus.

This study assumes that authors were careful in naming their papers, but the limited number of words in a title may not fully capture the essence of an article. Therefore, imprecise wording or misleading headlines can compromise the results of bibliometric analysis (Donthu et al., 2021). To address this issue, future research should focus on developing more advanced and rigorous algorithms. Despite these limitations, the study aims to provide insight to researchers, especially scholars, about the research landscape and future research areas in teacher competence. The study identifies top articles, prolific authors, and research hotspots in the field of teacher competence, as well as emerging topics that need to relate to competencies. Overall, the results of this study offer a quick overview of the output in the field over the years and a guide for the future direction of teacher competence research.

Declaration of Generative AI in Scientific Writing

The authors used Chat GPT during the writing process to solicit ideas for how to cut the word count of this paper. The writers examined and edited the text after utilizing this tool/service as necessary, and they assume full responsibility for the publication's content.

Conflicts of interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Author Information

Filiz Zayimoglu Ozturk

https://orcid.org/0000-0002-9917-5841

Ordu University

Turkiye

Contact e-mail: *filizzayimogluozturk@odu.edu.tr*

Michael Kopish

https://orcid.org/0000-0001-5889-2548

Ohio University

USA

Talip Ozturk

https://orcid.org/0000-0003-3543-0468

Ordu University

Turkiye