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## A BIBLIOMETRIC REVIEW OF GLOBAL RESEARCH TRENDS IN PEDAGOGY AND COMPETENCE BASED ON SCOPUS DATA

**Abstract.** The purpose of this work is to systematically analyze the main directions, thematic structure, and scientific field of global scientific research on pedagogy and competence, based on Scopus data. The study includes 3,876 scientific documents published between 2006 and 2024 containing the keywords “pedagogy” and “competence”. Using the Bibliometrix and Biblioshiny tools, the thematic structure of publications, frequency indicators, co-occurrence networks, strategic maps, and conceptual keyword clusters were analyzed. According to the results, the research field was grouped into three main areas: medical education, which studies clinical and professional competence; pedagogical areas, which include higher education, teaching methods, and professional development; research on digital learning, e-learning, and information technology-based competence research. Cluster and thematic analyses showed that pedagogical competence is interdisciplinary, that is, it develops through the interconnections among the fields of education, medicine, psychology, and digital technologies. The study systematizes global research directions in the field of pedagogy and competence and assesses the relevance of future issues, such as digital competence, intercultural competence, and the effectiveness of competency-based curricula.

**Keywords:** pedagogy; competence; pedagogical competence; bibliometric analysis; Scopus; Bibliometrix.

### Introduction

The competency-based approach has become one of the dominant paradigms in contemporary educational research and practice. The growing complexity of professional activities, rapid technological development, globalization, and the transformation of labor markets have shifted educational priorities from the acquisition of knowledge to the development of competencies that enable individuals to effectively respond to changing social and professional demands. Consequently, concepts such as competence, competency, pedagogical competence, professional competence, and digital competence have become central to educational discourse.

Although these concepts are frequently used in educational research, their definitions often vary across scientific traditions and disciplinary contexts. Competence is generally understood as an integrated capacity to successfully perform tasks and solve problems in a particular context through the effective application of knowledge, skills, attitudes, and values. In contrast, competency refers to specific measurable attributes, skills, or behaviors that contribute to overall competence. Within educational research, pedagogical competence refers to the knowledge, skills, and dispositions required for effective teaching and learning processes. Professional competence encompasses broader professional knowledge, ethical values, self-regulation, and reflective capacities necessary for successful professional performance. Digital competence has emerged as a distinct construct

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describing the confident, critical, and responsible use of digital technologies for learning, teaching, communication, and professional development.

The increasing significance of digital technologies has substantially transformed the understanding of competence in education. International frameworks developed by UNESCO and the European Commission emphasize digital competence as a key component of lifelong learning and educational quality. The COVID-19 pandemic further accelerated this transformation, highlighting the importance of teachers' digital readiness and stimulating unprecedented growth in research related to online learning, educational technologies, and artificial intelligence.

With the rapid development of science and the proliferation of research by different countries and scientific schools, understanding the structure of scientific knowledge in this area, identifying key areas and systematizing global research trends has become an important needs. In recent years, bibliometric methods have been widely used in the evaluation of research in education, they allow for the quantitative analysis of the volume, thematic evolution of scientific publications, research areas and the structure of the scientific community.

In the 21st century, the relationship between pedagogy and competence has become a major focus of educational research. Modern research explains the strengthening of this relationship primarily through the widespread adoption of digital technologies in the educational process. In particular, digitalization requires teachers and students to master not only subject knowledge but also a new type of digital competence. In response to this trend, the European Union and UNESCO have proposed competency frameworks aimed at the systematic development of teachers' digital skills [1]. This, in turn, indicates that the content of pedagogical competence has expanded over time and shifted from a traditional understanding to a more complex structure that includes digital components.

Research shows that digital technologies have fundamentally changed the forms and content of education, and the development of teachers' digital competence has become an important condition for improving the quality of education. Especially during the COVID-19 pandemic, the massive transition to distance learning has clearly highlighted differences in teachers' digital preparation, increasing the relevance of research in this area [2]. Analysis of the concept of pedagogical competence shows that it is not limited to mastering teaching methods but, on the contrary, is understood as a unity of abilities to effectively organize the teaching process, to master the content qualitatively, and to develop students' skills. In research, the content of this competence is often associated with 21<sup>st</sup>-century skills, namely collaboration, innovative thinking, and problem-solving, which are identified as priority areas [3]. However, although a number of works indicate the priority of these skills, how they are actually implemented in pedagogical practice and their interrelationships are not sufficiently revealed. This suggests that a deeper analysis of the structure of pedagogical competence is needed.

In addition, in the scientific literature, pedagogical competence is often considered a component of professional competence. Professional competence is described as a complex system that includes a teacher's subject knowledge, the ability to apply it in teaching, professional principles, motivation, and self-regulation skills [4]. Research shows that each of these components affects the quality of education to varying degrees: for example, subject-pedagogical knowledge and motivation increase teaching effectiveness, while self-regulation skills ensure a teacher's professional stability. However, the mechanisms of interaction among these components and their complex impact on educational outcomes are insufficiently systematized. Although studies analyzing teacher education programs in Indonesia consider pedagogical and professional competencies as key components, their integration is often described at a declarative level [5].

Research on digital competence shows that this concept has acquired strategic importance in the education system. The European Union defines it as one of the eight core competencies necessary for lifelong learning. Available research is often limited to describing the level of digital skills or the ways in which they are developed, and does not pay sufficient attention to a

comprehensive analysis of their relationship to pedagogical and professional competencies. In general, the literature review shows that research on digital competence is concentrated in five main areas: levels of competence, factors influencing it, teacher training, digital skills of learners, and their relationship with learning outcomes. Although these areas show that research is structured, they are often considered in isolation, and an integrative analysis is not conducted sufficiently. As a result, the interrelationships among pedagogical, professional, and digital competences, and their complex roles in the education system, are not fully revealed.

Thus, although the available research demonstrates the importance of competency-based approaches, there is a lack of research that considers pedagogical, professional, and digital competences as a single system and comprehensively analyzes their interaction and impact on learning outcomes.

Although these concepts are frequently used in educational research, their definitions vary considerably across disciplines and scientific traditions. In this study, competence is understood as an integrated capacity to perform effectively in a specific context, whereas competency refers to individual knowledge, skills, attitudes, and personal attributes contributing to that capacity. Pedagogical competence relates to the effective organization of teaching and learning processes, professional competence encompasses broader professional capacities, and digital competence refers to the confident and critical use of digital technologies for educational and professional purposes.

According to scholars, in the 1960s and 1970s, a competency-based approach began to take shape in Western pedagogy and, in the late 1980s, in Soviet science, but the concepts of “competence” and “competency” were not consistently defined. These terms are used with different meanings and are considered alongside concepts such as “professionalism”, “qualification”, and “pedagogical culture”, competence includes a system of knowledge, skills, abilities, and personal characteristics that provide the acquisition of methods of action, setting, and achieving goals as a result of education. In general, competence is understood as a set of potentials that characterize an individual's ability to solve various tasks and the complex set of qualities necessary to carry out professional activities. The UNESCO report (1996), the Bologna Declaration (1999) and other European agreements influenced the structure and assessment system of higher education and became the basis for rethinking educational outcomes through the concept of “competence”. As a result of this process, the ultimate goal outcomes of education began to be rethought through the concept of “competence”. As a result, it became clear that knowledge and skills alone are not enough for student training, and that additional competencies need to be developed. In other studies, the concept of “competence” is considered one of the main qualities of an individual and is described as a factor that enables high-quality, effective work performance. According to authors, competence includes a complex of motivation, personality traits, and situational aspirations, along with knowledge, skills, and abilities that contribute to the effective solution of specific tasks in a particular organizational setting. And the concept of “competence” is understood as a set of established competencies that determine a specialist's general level of professionalism or readiness in a given field of activity. This means not only the presence of knowledge and experience, but also the ability to effectively use them in necessary situations. From this point of view, competence is considered a potential opportunity that has not yet been fully realized, has not been reflected in practice.

The ability of students to apply the skills they have acquired during their studies in situations outside the learning environment is considered one of the most relevant areas of educational theory and practice. In recent years, the widespread use of competency-based approaches in the global education system has further heightened the importance of this issue. In this regard, the concept of “competence” has been a central focus of scientific research in pedagogy for more than half a century. Although many empirical studies have been conducted in this area and significant scientific results and practical recommendations have been presented, the number of review studies that

comprehensively summarize and systematize these findings remains insufficient. This situation poses a significant challenge, given the complexity and multifaceted nature of the competency issue. The diversity of theoretical approaches, research methodologies, and application contexts complicates the systematization of accumulated knowledge and hinders the identification of leading scientific directions and unexplored issues. Notably, there is a lack of systematic bibliometric analysis of studies on this topic in the scientific space of education. In this regard, conducting a bibliometric review of competence and pedagogy is of particular scientific and practical importance.

The Scopus database is of particular importance in this regard, as it encompasses internationally recognized publications and reflects a wide range of global scientific research. The bibliometric analysis carried out on the keywords “Pedagogy” and “Competence” would make it possible to determine how the concept of competence in pedagogy has developed, which areas prevail and the general structure of the scientific field. Unlike previous bibliometric studies that focused separately on teacher competence, digital competence, or specific educational sectors, the present study investigates pedagogy and competence as an integrated interdisciplinary research field. By analysing 3,876 Scopus-indexed publications, the study maps the intellectual structure, thematic evolution, and emerging trends of competence research across educational contexts. Unlike previous bibliometric studies that focused separately on teacher competence, digital competence, or specific educational sectors, the present study investigates pedagogy and competence as an integrated interdisciplinary research field. By analysing 3,876 Scopus-indexed publications, the study maps the intellectual structure, thematic evolution, and emerging trends of competence research across educational contexts. The purpose of this bibliometric review is to systematically analyze the main directions, thematic structure and scientific field of world scientific research on the topics of pedagogy and competence based on Scopus data. The aim of this paper is to systematically analyze the main directions, thematic structure, and scientific field of global scientific research on pedagogy and competence, based on Scopus data.

### **Research methods and materials**

The data were retrieved from the Scopus database in January 2025 using the following search query: TITLE-ABS-KEY ("pedagogy" AND "competence") AND PUBYEAR > 2005 AND PUBYEAR < 2025

The search was restricted to documents published between 2006 and 2024. Publications from The initial search retrieved 4,536 records. Data were exported in BibTeX format and imported into Bibliometrix (version 5.0). Duplicate records were identified and removed using the duplicate matching functions available in Bibliometrix. Metadata inconsistencies involving author names, affiliations, keywords, and source titles were standardized. Publications lacking essential bibliographic information were excluded. Additionally, records not directly related to pedagogy and competence were manually screened and removed.

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### **Results and discussion**

According to the data covering the period from 2006 to 2024, a total of 3876 scientific documents with the keywords “pedagogy” and “competence” were identified. These publications have been published in 1476 different sources. The annual growth rate of the research industry is 15.21%, and the average age of documents is 6.28 years. The average citation rate per document is 14.77. 9515 author keywords and 4953 keywords plus (variable) are registered in the collected data.

The total number of authors is 9675, of which 1072 have published unique (single-authored) works. In total, 1158 individual author's documents are registered. Each document has an average of 2.8 authors. The share of international co – authorship is 14.45%. The structure of document types is diverse. The majority of publications are scientific articles (2732). In addition, 88 books, 417 book chapters and 363 conference materials were registered. As part of the study, 222 review Articles, 10 editorial materials, 10 brief reviews and 33 documents of other categories were identified.

Annual scientific performance indicators show stable growth dynamics from 2006 to 2024. In 2006, only 39 articles were published, and in subsequent years this figure gradually increased. Since 2016, there has been a significant breakthrough, reaching 223 articles in 2018 and 340 in 2019. In 2020-2022, growth continued, stabilizing at 359-402 annually. In 2023-2024, the indicator reached its highest level, with 455 and 499 articles registered, respectively. These data show that the field of research has developed rapidly over the past decade. This growth can be associated with the global expansion of competency-based education reforms, increasing emphasis on learning outcomes, and the growing importance of digital skills in contemporary education systems. The acceleration observed after 2018 coincides with intensified international discussions on digital competence and educational transformation.

The results of the simulation of the field life cycle show that the number of publications increased smoothly at the initial stage, then accelerated rapidly. The high correspondence of annual publications to the logistics curve determines the systematic growth of scientific production in this direction. According to the model's forecast, the maximum limit for publications falls on 2030, with annual productivity set to reach about 657 jobs this year. After this point, there is a slowdown in the pace of publication and it goes on a downward trajectory. The cumulative growth curve shows a continuous increase in the number of publications in the research field over the years. Although growth is slow in the early stages, there is an intense acceleration in subsequent years, and the total volume of accumulated publications approaches the upper limit of the logistics curve. The carrying capacity of the model ( $K \approx 14736$ ) represents the maximum total number of publications expected in the industry. The gradual flattening of the cumulative curve over time means that the period of natural saturation characteristic of scientific production is approaching. In general, the logistics model is highly consistent with the data ( $R^2 = 0.973$ ), indicating that the publication dynamics are consistent with the forecast curve. The combination of annual and cumulative publications clearly shows that the industry has developed a trend of continuous growth, followed by stabilization.

The publication with the most publications in this dataset is Nurse Education Today (47 articles) (Table 1). Then, the journal Sustainability (Switzerland) is highlighted with 39 articles. 27 articles have been published in each of the journals BMC Medical Education and Nurse Education in Practice. In addition, the journals Lecture Notes in Networks and Systems (23), Perspektivy Nauki i Obrazovania (21), Academic Medicine (19) and Journal of Nursing Education (19) stand out for their activity and registered 18 materials in the journals Frontiers in Education and Vysshee Obrazovanie v Rossii. These indicators show that industry publications are concentrated in certain scientific journals.

An analysis of the authors' scientific performance over time shows that the publication and citation activity of leading scientists in the field is heterogeneous. The visualized data on the time scale suggest that some authors are distinguished by long-term, consistently high scientific activity, while others have begun publishing intensively in recent years. The “Na Na” symbol visible on the graph does not indicate the actual author; this is a technical error that occurs if the author's name is incorrectly recognized during data processing. That is, the author's information across several different written or Invalid formats is combined into a single non-common value and displayed in the visualization as “Na Na”. Among the active authors, Chen S, Arias-Estero JL, Kääriäinen M, and Liu Y have stood out in recent years for increased publication volumes and high citation counts. Chen S's work has shown steady growth since 2019 and is recognized for research focused on pedagogical competence, educational effectiveness, and systematic reviews. Arias-Estero JL's

publications include sports pedagogy, digital pedagogy, and methodologies that affect students' learning outcomes. Kääriäinen M was particularly active in 2019-2022, conducting research on the professional competence of health and social educators. Liu Y. stands out for his work in the field of online learning, the tpack model and nursing education. In addition, authors such as Wang Y., Mikkonen K., Morales-Belando M.T. and Olmos-Migueláñez S. have also contributed to the development of the industry, but their publications are episodic and have a relatively low citation density. In general, the increase in the activity of authors in recent years proves the growth of scientific interest on the topic of pedagogy and competence, and the publications of leading authors play an important role in the formation of the main scientific discourse of the research direction.

**Table 1 - Top-25 Most relevant sources**

|    | Sources                                                           | Articles |
|----|-------------------------------------------------------------------|----------|
| 1  | NURSE EDUCATION TODAY                                             | 47       |
| 2  | SUSTAINABILITY (SWITZERLAND)                                      | 39       |
| 3  | BMC MEDICAL EDUCATION                                             | 27       |
| 4  | NURSE EDUCATION IN PRACTICE                                       | 27       |
| 5  | LECTURE NOTES IN NETWORKS AND SYSTEMS                             | 23       |
| 6  | PERSPEKTIVY NAUKI I OBRAZOVANIA                                   | 21       |
| 7  | ACADEMIC MEDICINE                                                 | 19       |
| 8  | JOURNAL OF NURSING EDUCATION                                      | 19       |
| 9  | FRONTIERS IN EDUCATION                                            | 18       |
| 10 | VYSSHEE OBRAZOVANIE V ROSSII                                      | 18       |
| 11 | ASEE ANNUAL CONFERENCE AND EXPOSITION, CONFERENCE PROCEEDINGS     | 17       |
| 12 | EDUCATION SCIENCES                                                | 17       |
| 13 | RETOS                                                             | 16       |
| 14 | MEDICAL TEACHER                                                   | 15       |
| 15 | PHYSICAL EDUCATION AND SPORT PEDAGOGY                             | 15       |
| 16 | FRONTIERS IN PSYCHOLOGY                                           | 14       |
| 17 | NURSING EDUCATION PERSPECTIVES                                    | 14       |
| 18 | ACM INTERNATIONAL CONFERENCE PROCEEDING SERIES                    | 13       |
| 19 | CEUR WORKSHOP PROCEEDINGS                                         | 13       |
| 20 | INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH | 13       |
| 21 | INTERNATIONAL JOURNAL OF NURSING EDUCATION SCHOLARSHIP            | 13       |
| 22 | JOURNAL OF DENTAL EDUCATION                                       | 13       |
| 23 | JOURNAL OF TEACHING IN PHYSICAL EDUCATION                         | 13       |
| 24 | PROFESORADO                                                       | 13       |
| 25 | COGENT EDUCATION                                                  | 12       |

*Note:* Generated by the author through Bibliometrix software

The organization that made the most publications in this data is Monash University (40 articles). Griffith University is distinguished by 33 publications, and Kazan Federal University by 30. At each of the major universities, including Pennsylvania State University, Universitat de València, the University of California, and the University of Toronto, 29 articles were registered. Also among the organizations with the highest activity are Universidad de Sevilla (26) and

Universidad de Granada (25). The structure of the Faculty of Education completes the list with 23 articles. These universities, which show high results, show that the field of research is widely distributed geographically and institutionally.

According to the results, the United States has the most publications, clearly in the lead with 519 documents (Figure 1). Then, Great Britain (186), Spain (168), and Australia (162) showed high levels of scientific activity. China, Canada, Germany, and Northern European countries (Finland, Sweden, Norway) also contributed significantly. Although domestic authors predominate in many countries, the proportion of international collaborative articles is also high, especially in the UK, China, Canada, and Ireland.

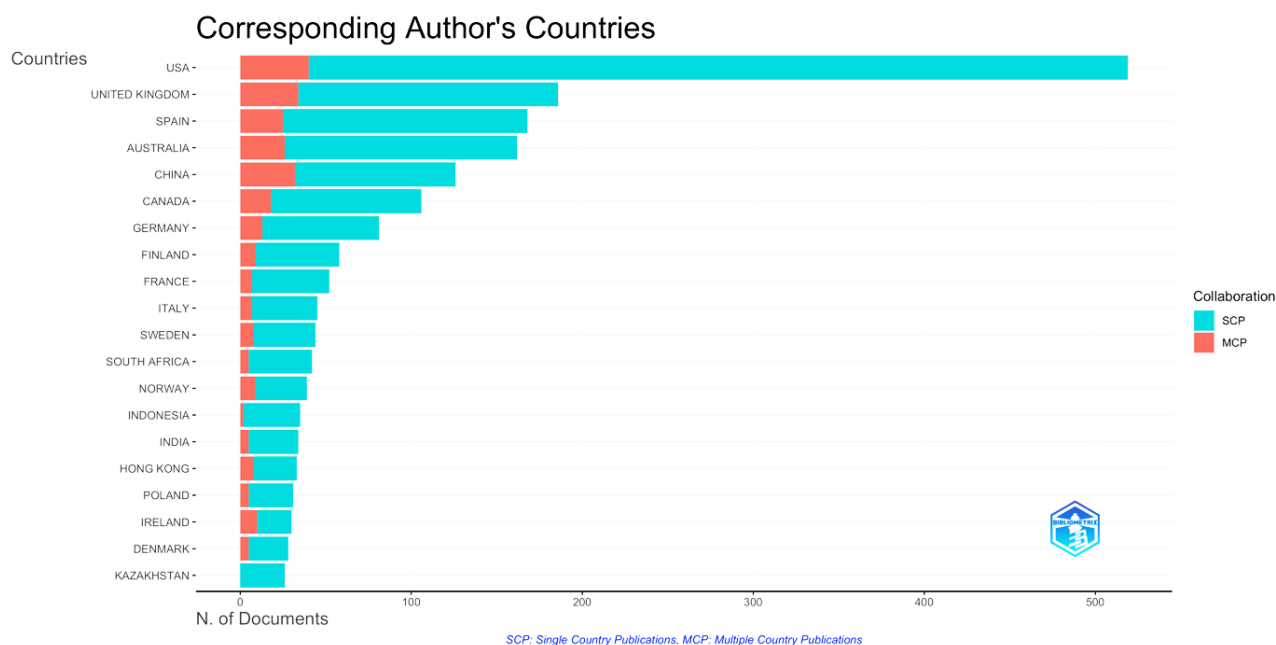


**Figure 1 - Corresponding author's countries**

Source: Generated by the author through Bibliometrix software

Although Kazakhstan is at the bottom of the list with 26 publications, all works are written only by domestic authors (MCP = 0). This suggests that Kazakhstani researchers are less involved in international joint research projects. In general, the dynamics of publications between countries prove that research on the topic of pedagogy and competence has spread across a wide geography.

The top-20 most cited articles cover a wide range of theoretical and applied areas in the field of research (Table 2). The highest total number of quotes is for Hazari et al., Sugand et al., and Lozano et al., each of which is recognized as a fundamental study in its field. Topics such as sustainable development, STEM, professional and language competence, physical education pedagogy, nursing education, digital and online learning occupy a leading position. According to the annual Citation Index, Chiu (2024) differs significantly because it covers the most relevant direction at the present stage – generative AI and the topic of higher education transformation. The general list shows the formation of highly influential works in the fields of pedagogy, language teaching, professional development, sustainable development, education, and educational technologies.

The most frequent terms in the frequency analysis indicate that the field of study focuses on the human factor and educational processes. The priority of basic concepts such as human, education, students, teaching, learning, and pedagogy suggests that research in the field is largely concerned with pedagogical experience, the learning process, and student development. At the same time, the high frequency of the terms clinical competence, professional competence, and

competence indicates that competence is the central research topic. The large number of concepts, such as nursing, medical education, nursing education, and nursing students, indicates that a significant portion of the research falls within medical and nursing education. The terms curriculum, higher education, and pedagogy define the content of training and the role of higher education institutions.

**Table 2 - Top-20 most globally cited documents**

| Paper                                        | DOI                                                                                                             | Total Citations | TC per Year | Normalized TC |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|-------------|---------------|
| (Hazari et al., 2010) [7]                    | <a href="https://doi.org/10.1002/tea.20363">https://doi.org/10.1002/tea.20363</a>                               | 835             | 52,19       | 15,48         |
| (Sugand, Abrahams, & Khurana, 2010) [8]      | <a href="https://doi.org/10.1002/ase.139">https://doi.org/10.1002/ase.139</a>                                   | 742             | 46,38       | 13,75         |
| (Lozano et al., 2017) [9]                    | <a href="https://doi.org/10.3390/su9101889">https://doi.org/10.3390/su9101889</a>                               | 576             | 64,00       | 23,84         |
| (Whitehead, 2010) [10]                       | <a href="https://doi.org/10.4324/9780203881903">https://doi.org/10.4324/9780203881903</a>                       | 533             | 33,31       | 9,88          |
| (Rainey et al., 2018) [11]                   | <a href="https://doi.org/10.1186/s40594-018-0115-6">https://doi.org/10.1186/s40594-018-0115-6</a>               | 503             | 62,88       | 23,54         |
| (Kramsch, 2014) [12]                         | <a href="https://doi.org/10.1111/j.1540-4781.2014.12057.x">https://doi.org/10.1111/j.1540-4781.2014.12057.x</a> | 436             | 36,33       | 16,46         |
| (Lee & Tsai, 2010) [13]                      | <a href="https://doi.org/10.1007/s11251-008-9075-4">https://doi.org/10.1007/s11251-008-9075-4</a>               | 421             | 26,31       | 7,80          |
| (Kioupi & Voulvoulis, 2019) [14]             | <a href="https://doi.org/10.3390/su11216104">https://doi.org/10.3390/su11216104</a>                             | 414             | 59,14       | 24,22         |
| (Abrams & Moio, 2009) [15]                   | <a href="https://doi.org/10.5175/JSWE.2009.200700109">https://doi.org/10.5175/JSWE.2009.200700109</a>           | 391             | 23,00       | 13,02         |
| (Risager, 2007) [16]                         | <a href="https://doi.org/10.2307/jj.27710858">https://doi.org/10.2307/jj.27710858</a>                           | 343             | 18,05       | 7,24          |
| (Tynjälä, 2013) [17]                         | <a href="https://doi.org/10.1007/s12186-012-9091-z">https://doi.org/10.1007/s12186-012-9091-z</a>               | 339             | 26,08       | 17,34         |
| (Foronda et al., 2020) [18]                  | <a href="https://doi.org/10.1097/SIH.0000000000000411">https://doi.org/10.1097/SIH.0000000000000411</a>         | 325             | 54,17       | 20,12         |
| (Wald, 2015) [19]                            | <a href="https://doi.org/10.1097/ACM.00000000000000731">https://doi.org/10.1097/ACM.00000000000000731</a>       | 317             | 28,82       | 16,23         |
| (Beni, Fletcher, & Ní Chróinín, 2017) [20]   | <a href="https://doi.org/10.1080/00336297.2016.1224192">https://doi.org/10.1080/00336297.2016.1224192</a>       | 292             | 32,44       | 12,08         |
| (May, 2013) [21]                             | <a href="https://doi.org/10.4324/9780203113493">https://doi.org/10.4324/9780203113493</a>                       | 272             | 20,92       | 13,91         |
| (Chiu, 2024) [22]                            | <a href="https://doi.org/10.1016/j.caeai.2023.100197">https://doi.org/10.1016/j.caeai.2023.100197</a>           | 267             | 133,50      | 85,57         |
| (Van den Berghe et al., 2014) [23]           | <a href="https://doi.org/10.1080/17408989.2012.732563">https://doi.org/10.1080/17408989.2012.732563</a>         | 255             | 21,25       | 9,63          |
| (Celce-Murcia, 2007) [24]                    | <a href="https://doi.org/10.1007/978-1-4020-5639-0_3">https://doi.org/10.1007/978-1-4020-5639-0_3</a>           | 251             | 13,21       | 5,30          |
| (Harvey & Jarrett, 2014) [25]                | <a href="https://doi.org/10.1080/17408989.2012.754005">https://doi.org/10.1080/17408989.2012.754005</a>         | 245             | 20,42       | 9,25          |
| (Segalàs, Ferrer-Balas, & Mulder, 2010) [26] | <a href="https://doi.org/10.1016/j.jclepro.2009.09.012">https://doi.org/10.1016/j.jclepro.2009.09.012</a>       | 241             | 15,06       | 4,47          |

*Note:* Generated by the author through Bibliometrix software

A brief description of the thematic trends from 2008 to 2024 according to the following graph: at the initial stage (2008-2012), such topics as assessment and health, program evaluation

and questioning predominated; at the intermediate stage (2012-2018), educational programs, methodologies and training models intensified, and attention was paid to educational interventions and continuing professional training; in recent years (2018-2024), along with the growth of general pedagogical topics such as “education”, “learning”, “students”, new, rapidly developing areas such as mental health, distance learning, electronic education and artificial intelligence (AI), which arose under the influence of COVID-19, are clearly visible.

The emergence of artificial intelligence, online learning, and mental health as trend topics reflects broader transformations in education following the COVID-19 pandemic. The rapid transition to remote learning increased demand for digital competence among teachers and students and stimulated research on technology-enhanced learning environments. Furthermore, the growing presence of artificial intelligence among recent research topics indicates a new stage in competence research, where digital, data, and AI-related skills are becoming increasingly important components of educational practice and professional development.

The network of interconnections of these words divides the main thematic areas in the field of research into several large clusters. The red cluster covers the field of medical and clinical education and shows that the concepts of “education”, “human”, “clinical competence”, “medical education” often coexist. The green cluster is associated with general pedagogical terms such as “learning”, “article”, “pedagogics”, and elements of cultural context. The blue cluster is the most extensive, in which higher education and training technologies such as “students”, “pedagogy”, “higher education”, “e-learning”, and “professional development” are intertwined. The purple cluster combines concepts specific to nursing education (“nursing”, “nursing student”, “simulation”). At the same time, some terms such as “intercultural competence” remain isolated from the network, suggesting that this direction is not yet fully formed or studied independently of other topics. In general, the network structure shows that the areas of medical, general pedagogical, and technological education are closely interconnected.

This strategic map shows the place and level of development of research topics within the industry. In the lower right part, such concepts as “education”, “people”, and “clinical competence” are highly centralized, that is, basic topics that are basic for the industry, but are not yet fully developed. “Human”, “article”, and “learning” in the upper right are all central and well-developed leading (motor) topics, the main driving force of the research field. In the upper-left part, “nursing”, “nursing education”, and “nursing student” are niche topics that are well-developed in their own right but are less related to the industry. “Pedagogy”, “students”, and “teaching” in the lower-left part are among the topics that are either ascending or weakening, both centrally and at a low level of development. The map shows that general education, the human factor, and clinical competence are the main areas, while nursing education is a separate, specialized field.

This factor map (MCA) illustrates the relationships among key concepts in the field of research (Figure 2). The first criterion (87.68%) determines the difference in directions in the field of general education: on the left – medical and nursing education (“medical student”, “medical education”, “nursing”), and on the right – concepts related to general pedagogical and higher education (“e-learning”, “higher education”, “pedagogy”). The second dimension (6.47%) mainly reflects the differentiation between medical and nursing specialties.

In the central area on the map, such general educational terms as “education”, “teaching”, “students”, and “curriculum” are concentrated, which means that they are the main, unifying topic in the industry. The right panel indicates the areas of technological and innovative training (“e-learning”, “competence”, “professional development”), while the topics of nursing education in the upper left appear as a separate cluster. Overall, the map shows that research is grouped into three major areas: medical/nursing education, general pedagogical concepts, and topics related to higher education and digital learning.

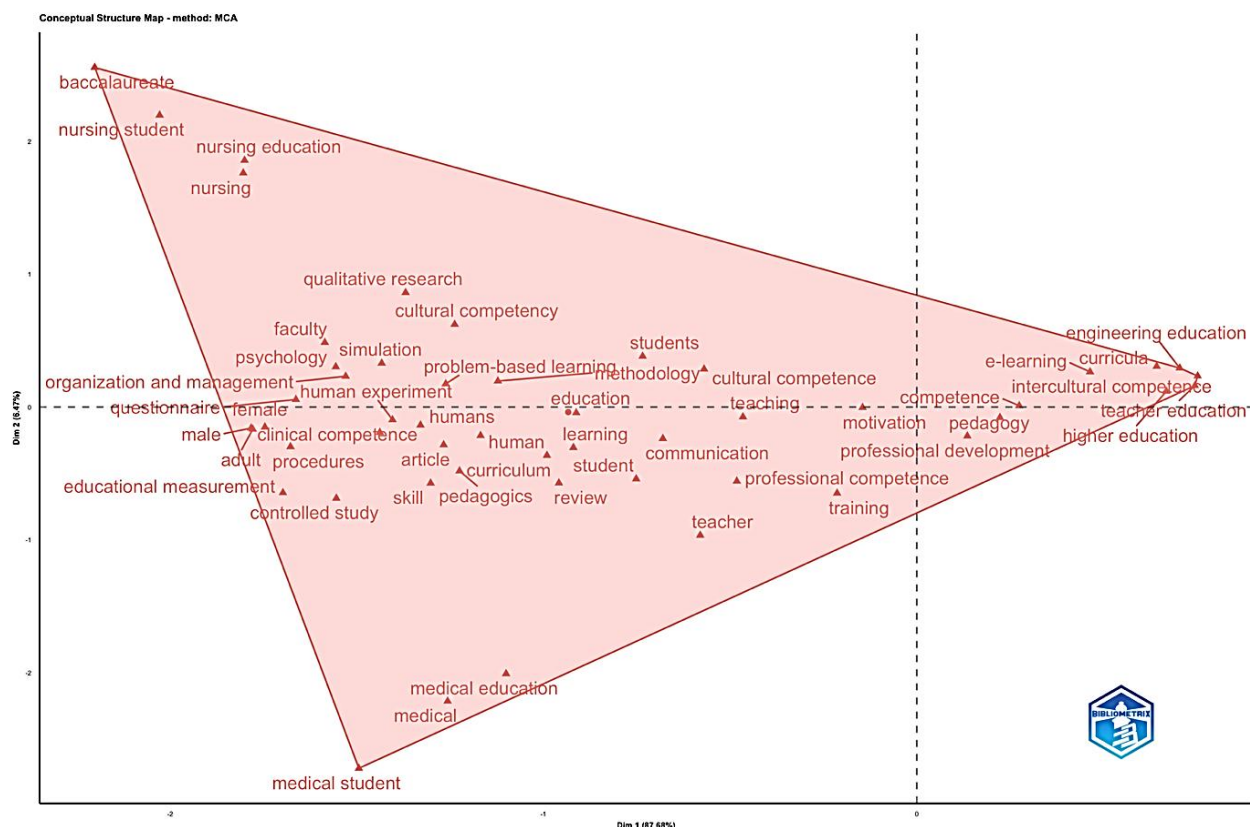


**Figure 2 – Factorial analysis – conceptual structure map – method: MCA**

Source: Generated by the author through Bibliometrix software

The map of scientific cooperation among countries reflects the clear geography of international partnerships in pedagogy and competence. The most active hub is the United States, which has close ties with Europe, Asia, and Australia. The countries of Western Europe (Great Britain, Germany, France, Italy) cooperate extensively, both with one another and with the United States. Australia maintains permanent scientific partnerships with the United States and Europe. The ties between China and Japan with the United States and Europe are also quite visible. In contrast, many developing countries are less well represented on the map, which may be due to a low number of publications in Scopus and a low level of international co-authorship. The map shows that, in general, the center of scientific cooperation is concentrated in North America and Western Europe.

The relatively low representation of Kazakhstan suggests the need for stronger participation in international research networks. Although Kazakhstan has demonstrated growing interest in competence-related studies, the absence of internationally co-authored publications in the dataset indicates limited integration into global scientific collaboration. Strengthening international partnerships may increase research visibility, citation impact, and contribution to the global discourse on pedagogy and competence.

The results obtained confirm, at a concrete empirical level, the multifaceted nature of the concept of competence described in the literature and its different interpretations across scientific traditions. As shown in the literature review, the lack of a consistent definition of the concepts of “competence” and “competency” [28], [29] also leads to the fragmented development of research areas. This trend was also reflected in the results of the bibliometric analysis: the division of topics into several independent clusters (medical education, general pedagogy, digital learning) indicates that the issue of competence is considered not on a single theoretical basis, but in different contexts. In recent years, the rapid development of areas such as digital learning, distance learning, and artificial intelligence suggests that the process of rethinking educational outcomes through

“competence,” as noted by Zimnyaya [30], has entered a new phase. In particular, amid the COVID-19 pandemic, digital competence has gained prominence, becoming one of the main research areas alongside pedagogical and professional competences. Analysis of cluster structures shows that, although pedagogical, professional, and digital competences are interconnected, they are often studied separately. For example, in the field of medical and clinical education, the concept of “clinical competence” is leading, while in general pedagogical research, concepts such as “learning,” “students,” and “pedagogy” dominate. This situation demonstrates that, despite the complex nature of competence, as shown by Efimova et al. [31], its components remain fragmented in scientific research. In addition, the isolation of concepts such as “intercultural competence” from the network suggests that some areas are insufficiently integrated or studied independently. The results of the factor analysis showed that the research was grouped into three main areas - medical/nursing education, general pedagogy, and higher education and digital learning. This classification demonstrates that although the concept of competence is universal, its specific content varies with the context of application. In addition, the unifying role of concepts such as “education”, “teaching”, and “students”, located at the center of the map, indicates that the theoretical basis of competence research remains grounded in general pedagogical categories.

Thus, the results obtained, which confirm the main conclusions expressed in the literature, highlight an important issue: although the concept of competence has been widely studied, the relationship among its various types (pedagogical, professional, digital) has not been sufficiently systematized. The sectoral and thematic division of research indicates the need for integrative, comprehensive analyses in this direction. Therefore, future research should aim to consider competence not as a set of separate components but as a holistic, interconnected structure within the education system.

The dominance of medical and nursing education observed in this study may be explained by the long-standing tradition of competency-based assessment in healthcare professions. Clinical competence is closely linked to professional accountability and quality assurance, making it a particularly active area of competence research.

The rapid growth of digital competence research reflects the broader digital transformation of education. The COVID-19 pandemic accelerated this trend by exposing differences in teachers' technological readiness and highlighting the importance of digital literacy for effective teaching and learning.

The emergence of artificial intelligence as a new research theme suggests that future competence frameworks may increasingly include AI literacy, data literacy, and technology-supported decision-making skills.

## Conclusion

This bibliometric review, based on Scopus data, clearly demonstrated the broad and multifaceted structure of global research on pedagogy and competence. An analysis of 3,876 publications covering the period from 2006 to 2024 showed that the concept of competence in pedagogical science has consistently attracted scholarly attention and has become increasingly prominent each year. The results showed that the main thematic areas related to competence are concentrated in three broad groups: medical education focused on clinical and professional competence; higher education and teaching methodologies; and the development of competences based on digital technologies and e-learning. Keyword networks and thematic maps showed that research on pedagogical competence is interdisciplinary, with close relationships among education, medicine, psychology, and information technology. The geographical analysis showed that the United States, the United Kingdom, Spain, Australia, and China are the main research centers, while the limited number of studies from Kazakhstan underscores the need to strengthen international cooperation in this area.

Overall, the rapid development of global research on pedagogy and competence contributes to the expansion of theoretical concepts in this area, the formation of new learning models, and the

modernization of educational processes. Digital competence assessment, the long-term measurement of the effectiveness of competency-based curricula, and the development of intercultural competences are proposed as promising areas for future research. The use of bibliometric methods made it possible to systematize the structure of the research field quantitatively and opened the way to a deeper understanding of how the concept of competence has developed in pedagogical science at the global level.

**Theoretical contribution:** This study contributes to the literature by integrating pedagogical, professional, clinical, and digital competence research within a single bibliometric framework.

**Practical contribution:** The findings may support policymakers, teacher educators, and educational institutions in identifying emerging competence-related priorities and designing evidence-based educational strategies.

Future studies should explore the integration of competence frameworks, artificial intelligence literacy, intercultural competence, and the long-term effectiveness of competency-based curricula.

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### **Педагогика және құзыреттілік бойынша жаһандық зерттеу үрдістерінің Scopus деректеріне негізделген библиометриялық шолуы**

**Аңдатпа.** Бұл жұмыстың мақсаты - «педагогика» және «құзыреттілік» түйін сөздерін қамтитын Scopus деректері негізінде әлемдік ғылыми зерттеулердің негізгі бағдарларын, тақырыптық құрылымын және ғылыми бағыттарын жүйелі талдау. Зерттеуге 2006-2024 жылдар аралығында «педагогика» және «құзыреттілік» түйін сөздері қамтылған 3876 ғылыми құжат кірді. Bibliometrix және Biblioshiny құралдары арқылы жарияланымдардың тақырыптық құрылымы, жиілік көрсеткіштері, co-occurrence networks талдауы, стратегиялық карталар және кілт сөздердің тұжырымдамалық кластерлері талданды. Нәтижелер бойынша зерттеу саласы үш негізгі бағытқа топтастырылды: клиникалық және кәсіби құзыреттілікті зерттейтін медициналық білім; жоғары білім, оқыту әдістемесі және біліктілікті арттыруды қамтитын педагогикалық бағыттар; цифрлық оқыту, электронды оқыту және ақпараттық технологияларға негізделген құзыреттілікті зерттеу. Кластерлік-тақырыптық талдау көрсеткендей, педагогикалық құзыреттіліктің пәнаралық байланысы бар, яғни ол білім беру, медицина, психология және цифрлық технологиялар салаларының өзара байланысымен дамиды. Зерттеу педагогика және құзыреттілік саласындағы жаһандық ғылыми бағыттарды жүйелейді және болашақта цифрлық құзыреттілік, мәдениетаралық құзыреттілік және құзыреттілікке негізделген оқу бағдарламаларының тиімділігі сияқты мәселелердің өзектілігін анықтайды.

**Кілт сөздер:** педагогика, құзыреттілік, педагогикалық құзыреттілік, библиометриялық талдау, Scopus, Bibliometrix.

### **Библиометрический обзор глобальных тенденций исследований в области педагогики и компетентности на основе данных Scopus**

**Аннотация.** Целью настоящего исследования является систематический анализ основных направлений, тематической структуры и исследовательского поля мировых научных исследований в области педагогики и компетентности на основе данных Scopus. Материал исследования составили 3876 научных документов, опубликованных в период с 2006 по 2024 годы, отобранных по ключевым словам «педагогика» и «компетентность». С помощью инструментов Bibliometrix и Biblioshiny были проанализированы тематическая структура публикаций, частотность употребления ключевых слов, сети их совместной встречаемости, стратегические карты и концептуальные кластеры ключевых слов. По результатам библиометрического анализа были выделены три основных тематических

направления: медицинское образование, в рамках которого исследуются клинические и профессиональные компетенции; педагогические исследования, охватывающие высшее образование, методику преподавания и профессиональное развитие педагогов; цифровое и электронное обучение, а также исследования компетенций, связанных с использованием информационных технологий. Кластерный и тематический анализы показали, что исследования педагогической компетентности носят междисциплинарный характер, поскольку данная проблематика развивается на пересечении педагогики, медицины, психологии и исследований цифровых технологий. Результаты исследования позволяют систематизировать глобальные направления научных исследований в области педагогики и компетентности и определяет перспективность таких направлений, как изучение цифровой и межкультурной компетентности и эффективность компетентностно-ориентированных образовательных программ.

**Ключевые слова:** педагогика, компетентность, педагогическая компетентность, библиометрический анализ, Scopus, Bibliometrix.

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