



## Mapping Global Trends in the Evaluation of Elementary School Teacher Training Programs: A Bibliometric Analysis

*Review a scientific article*

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### Abstract

*Evaluating elementary school teacher training programs is essential for improving global education quality amid evolving 21st-century learning paradigms, technological integration, and increasing professionalization demands. This study employs a bibliometric approach to map global research trends, intellectual structures, and future directions in evaluating elementary teacher training programs. Using the Scopus database, 545 publication records retrieved on October 16, 2025, were analyzed through VOSviewer and Biblioshiny (R) to identify publication trends, citation patterns, authors, institutions, journals, and thematic clusters. Results indicate a sharp rise in publications since 2015, dominated by education and sustainability journals, with Spain as the most productive country. Six major research clusters were identified, highlighting teacher professionalization, curriculum innovation, and governance. Future themes include AI-based evaluations, sustainability literacy, and adaptive frameworks for hybrid and inclusive learning, offering empirical insights for evidence-based policy and teacher training strategies.*

**Keywords:** *Bibliometric review; educational sustainability; elementary education; professional development; teacher training evaluation*

Improving the quality of basic education largely depends on the competence and professionalism of teachers, who serve as the primary agents in the learning process. To achieve this objective, various training programs for elementary school teachers have been developed to enhance

their pedagogical, professional, social, and personal competencies (Ngoc, 2024; Rasmitadila et al., 2024). These programs cover diverse aspects, including the application of innovative learning models, the integration of digital technology in classrooms, and the strengthening of

assessment skills. However, the success of a training program should not be measured solely by its implementation but also by its tangible impact on improving teacher competence and student learning outcomes (Ruiz et al., 2022; Usman & Anwar, 2021). Ngoc (2024), emphasized that although many teachers perform well in training programs, weaknesses persist in areas such as contextual analysis, information processing, and consideration of students' perspectives. Therefore, evaluating training programs is essential to assess their effectiveness, efficiency, relevance, and sustainability within the dynamic context of education.

The evaluation of elementary school teacher training programs plays a strategic role in ensuring that professional development initiatives align with field needs. Cockerill et al. (2019) highlighted that evaluation activities, including assessments of implementation accuracy and scalability, are crucial for maintaining this alignment. Through systematic evaluation, it becomes possible to determine the relevance of training content to the curriculum, assess how training influences classroom teaching practices, and identify the factors contributing to program success or failure (Ngoc, 2024; Tomokawa et al., 2020). Practical evaluation should be both summative, to assess outcomes, and formative, to provide continuous feedback for improvement (Turysbayeva et al., 2023). Moreover, evaluation results can guide the design of more adaptive and effective training strategies that respond to curriculum changes, technological advancements, and the demands of 21st-century competencies (Soares et al., 2022). Thus, evaluation serves not only as a measurement instrument but also as a reflective tool that promotes ongoing improvement in the quality of primary education.

A number of studies have highlighted the challenges in evaluating teacher training programs, particularly those focused on improving teaching practices in elementary schools. Studies indicate that evaluation processes often face methodological limitations, lack evidence-based approaches, and are constrained by the absence of integrated frameworks to measure the actual impact of training on teachers' classroom performance (Popova et al., 2022). Furthermore, many evaluation

models focus primarily on short-term outcomes, such as participant satisfaction, while overlooking long-term impacts on pedagogical competence and student learning outcomes (Verseveld et al., 2021). These shortcomings lead to a fragmented understanding of program effectiveness, obscuring the actual contribution of training to educational quality. Contextual factors such as school culture, leadership support, and policy coherence have also been shown to affect the success and sustainability of teacher training initiatives significantly. Additionally, the diversity of program objectives, implementation strategies, and evaluation tools across countries results in considerable variation in research findings (Usman & Anwar, 2021). While this diversity enriches the field of teacher professional development, it also contributes to theoretical fragmentation (Stavridis & Papadopoulou, 2022), making it challenging to obtain a comprehensive understanding of global trends and theoretical advancements in teacher training evaluation.

In this regard, bibliometric analysis offers a relevant and systematic approach to mapping the intellectual landscape and the evolution of research in this area. Through bibliometric methods, it is possible to identify dominant research themes, influential authors and institutions, and academic collaboration networks that shape the development of teacher training evaluation studies (Hangul et al., 2022). Moreover, this approach helps reveal emerging topics and uncover unexplored knowledge gaps, guiding future research agendas.

Research on the evaluation of teacher education and training programs has shown significant global progress. For instance, Judijanto et al. (2024) mapped research trends in educational program evaluation using the Google Scholar database and VOSviewer, revealing a rise in publications since the early 2000s that primarily focused on educational programs, quality management, and leadership. Similarly, Arwildayanto et al. (2024) analyzed in-service teacher training studies indexed in Scopus using VOSviewer, highlighting themes related to e-learning and continuing professional development, with most publications originating from the United States and Europe. Meanwhile, Insan et al. (2025) used the Scopus database

and the Biblioshiny R tool to examine trends in teacher performance assessment, demonstrating steady growth in global publications and increasing international collaboration.

These studies collectively indicate considerable progress in research on teacher training and evaluation. However, they do not specifically address the evaluation of elementary school teacher training programs as a distinct area of inquiry. Prior studies have tended to focus either on general teacher training evaluation (Arwildayanto et al., 2024; Judijanto et al., 2024) or on teacher performance assessment (Insan et al., 2025). In addition, most analyses relied on a single bibliometric tool—such as VOSviewer or Biblioshiny—without integrating multiple methods to produce a more comprehensive overview of thematic linkages and scientific collaboration networks within the field.

The novelty of this study lies in its specific focus on mapping global trends in the evaluation of elementary school teacher training programs, as indexed in the Scopus database up to 2025. Using a Scopus-based bibliometric approach and analytical tools including VOSviewer and Biblioshiny (R), this research seeks to identify publication trends, patterns of scientific collaboration among authors and institutions, and the evolution of key research themes in this domain. The findings are expected to make an original contribution to strengthening the knowledge base on evidence-based teacher training development. Furthermore, the study provides a reference for researchers exploring this topic and offers valuable insights for educational policymakers in designing strategies to improve learning quality at

the elementary school level. Accordingly, this study addresses the following research questions:

- What are the global publication trends and patterns in research on the evaluation of elementary school teacher training programs?
- What dominant themes have emerged in studies on the evaluation of elementary school teacher training programs?
- What potential themes and future directions can be identified for research on the evaluation of elementary school teacher training programs?

## Method

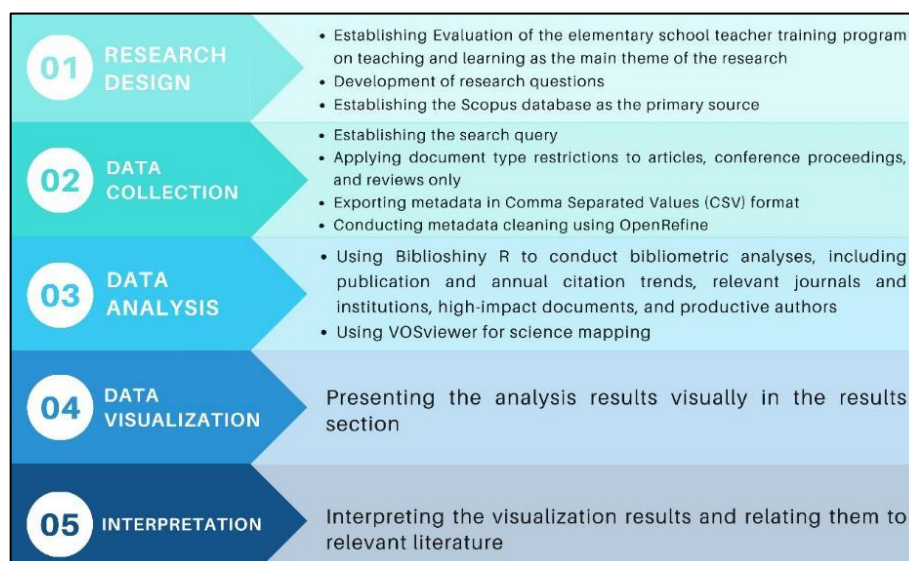
### *Type of Research*

This study employs a bibliometric analysis to examine datasets on the evaluation of elementary school teacher training programs. Research data were obtained from the Scopus database on October 16, 2025. Scopus was selected due to its comprehensive metadata coverage, ease of access, and reliability as a trusted source of indexed scientific publications. Moreover, Scopus is one of the leading international journal databases widely used by researchers and provides a diverse range of scholarly literature across disciplines.

### *Data Collection*

The research process in this study comprised several stages: research design, data collection, data analysis, data visualization, and data interpretation, as illustrated in Figure 1 (Salido et al., 2024; Zupic & Cater, 2015).

**Figure 1.**  
*Science Mapping Workflow*



In the research design stage, the study theme—evaluation of elementary school teacher training programs—was defined, and the corresponding research questions were formulated. The Scopus database was designated as the primary data source. During the data collection stage, the following search query was applied: “(“teacher training” OR “teacher professional development” OR “teacher education program” OR “in-service teacher training” OR “teacher preparation”) AND (“primary school” OR “elementary education” OR “elementary school” OR “primary education”) AND evaluation”. This query was carefully constructed to capture all relevant representations of the research domain and ensure the inclusion of pertinent literature. The initial metadata search was limited to publications from 2016 to 2025, yielding 590 documents. The dataset was then refined to include only articles, conference proceedings, and reviews, resulting in a final dataset of 545 documents. The metadata were exported in Comma-Separated Values (CSV) format for further analysis.

#### **Data Analysis**

The data analysis phase commenced after data collection. This study utilized Biblioshiny (R) and VOSviewer, both selected for their user-friendly interfaces

and open-access availability (Nasrum et al., 2025; Salido et al., 2025). The bibliometric analysis conducted with Biblioshiny (R) was descriptive, covering annual publication and citation trends, leading journals and institutions, influential documents, and prolific authors (Gandasari et al., 2024; Passas, 2024). Further analysis focused on keyword mapping using VOSviewer, applying a minimum co-occurrence threshold of five to generate network and overlay visualizations. A thesaurus file was used to standardize keyword terms and eliminate duplicates. Irrelevant or non-contextual keywords were also excluded to ensure that the resulting cluster mapping accurately reflected the research domain.

Data visualization was performed concurrently with the analysis phase, transforming analytical results into visual representations. These visualizations constitute the main findings of the study and serve as the foundation for interpretation and discussion. Data interpretation was guided by the research questions, focusing on publication trends and landscapes, dominant and emerging themes, and potential directions for future research. To enhance validity and minimize bias, the interpretations were independently reviewed and validated by two additional researchers.

Results

*Global Trends and Publication Landscape in Elementary School Teacher Training Evaluation Research*

**Figure 2.**

*Annual Scientific Production in Elementary School Teacher Training Evaluation Research*

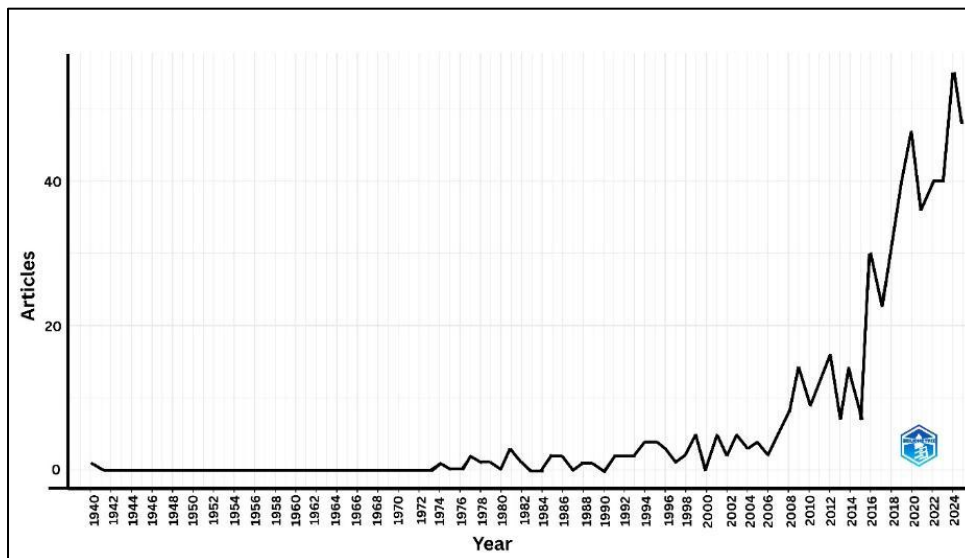


Figure 2 presents global publication trends related to the evaluation of elementary school teacher training programs from 1940 to 2025. Overall, the number of publications has increased substantially over the past two decades following a long period of limited research activity. Between 1940 and the early 2000s, fewer than five articles were published annually. However, beginning around 2015, a sharp rise occurred, reflecting

growing scholarly interest in this field. The peak of publication activity was observed between 2023 and 2024, with nearly 50 articles published per year. This trend highlights the significant expansion of research on the evaluation of elementary school teacher training, particularly over the past decade. Figure 3 illustrates the average annual citation trends of these publications.

**Figure 3.**

*Average Citations per Year in Elementary School Teacher Training Evaluation*

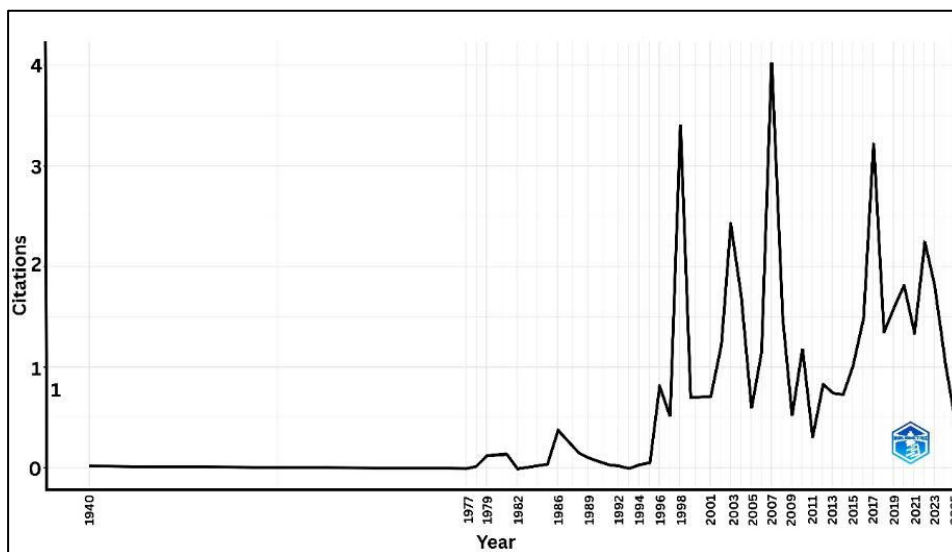
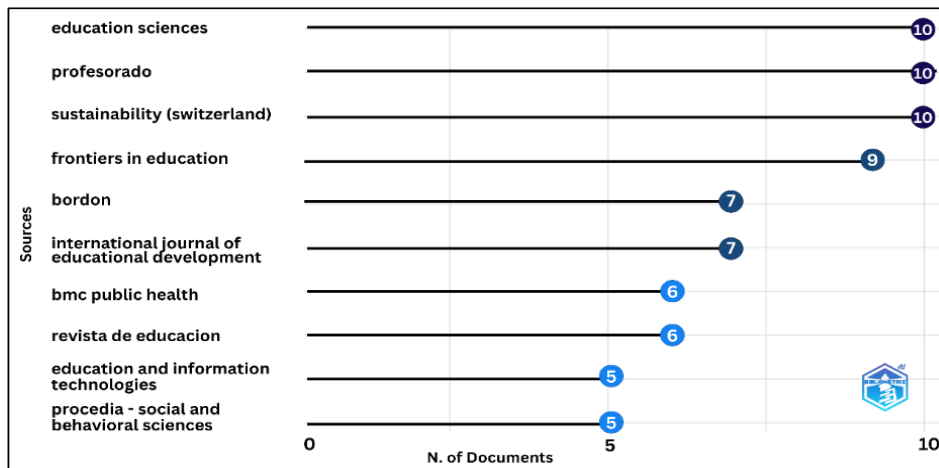


Figure 3 shows the average citation pattern of studies published between 1977 and 2025. Citation activity first appeared in the late 1970s at a very low rate, then gradually increased from the mid-1990s onward. A sharp rise occurred around 1998, reaching its first central peak in 2007 with an average of nearly four citations per article. This pattern was followed by fluctuations,

with renewed increases around 2017 and 2021, before declining toward 2025. Overall, the pattern indicates that citation impact in this field evolves cyclically rather than linearly, with several distinct years marking peaks of academic influence. Figure 4 displays the results of the analysis of the top ten journals in this field.

**Figure 4.**  
*Top Ten Most Relevant Journal Sources*



As shown in Figure 4, the journals with the highest number of publications are Education Sciences, Profesorado, and Sustainability (Switzerland), each publishing ten articles. They are followed by Frontiers in Education (nine), Bordón and the International Journal of Educational Development (seven each), BMC Public

Health and Revista de Educación (six each), and Education and Information Technologies and Procedia – Social and Behavioral Sciences (five each). This pattern suggests that research in this area is predominantly published in journals focused on education and sustainability. Figure 5 presents the most active institutions in this research field.

**Figure 5.**  
*Top Ten Most Relevant Affiliations*

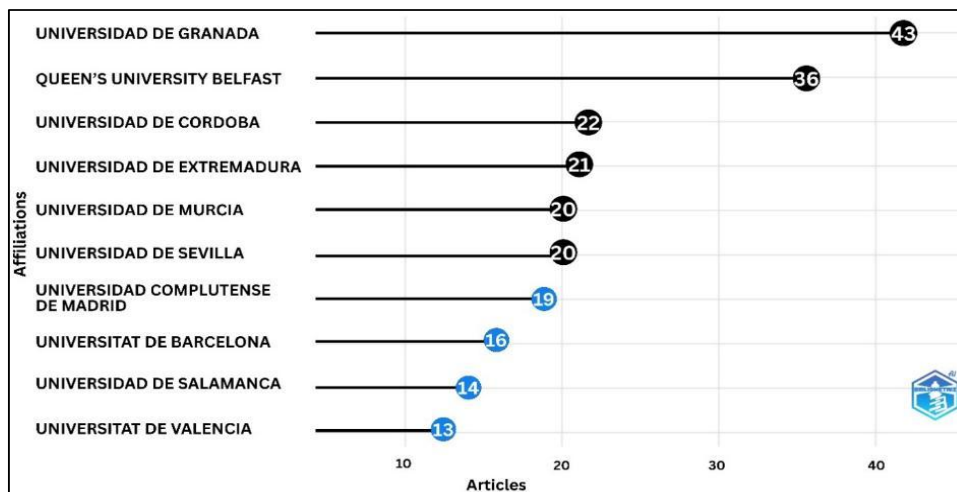


Figure 5 reveals that the Universidad de Granada ranks first with 43 publications, making it the most productive institution in this area. Queen’s University Belfast follows with 36 publications—the only non-Spanish university in the top ten. Universidad de Córdoba ranks third with 22 articles, followed by Universidad de Extremadura (21), Universidad de Murcia, and Universidad de Sevilla (20 each).

Universidad Complutense de Madrid produced 19 publications, while Universitat de Barcelona, Universidad de Salamanca, and Universitat de València each recorded 16. Overall, these results indicate that Spanish universities dominate research productivity in this field, demonstrating their active academic engagement in teacher training evaluation. Figure 6 shows the most prolific contributing authors.

**Figure 6.**  
*Top Ten Most Relevant Authors*

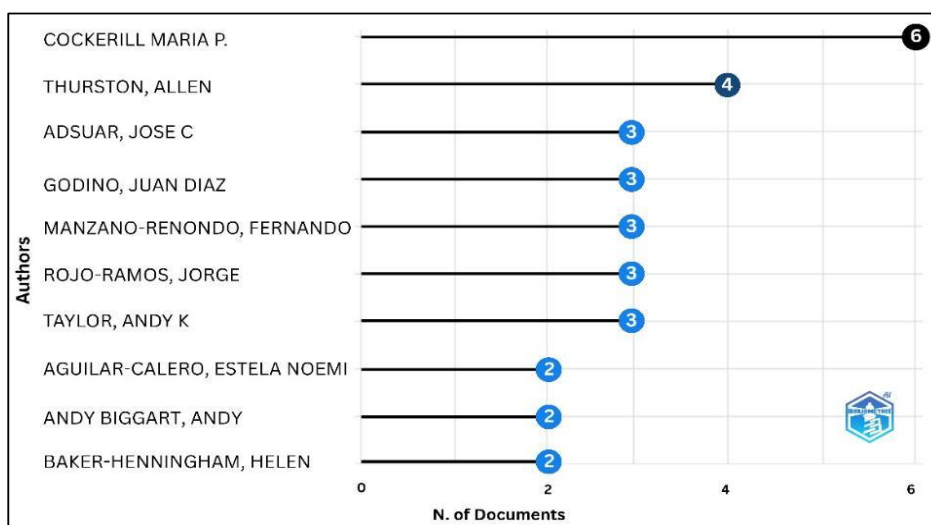


Figure 6 shows that Cockerill is the most prolific author, contributing six publications, followed by Thurston, with four. Other notable contributors include Adsuár, Godino, Manzano-Redondo, Rojo-Ramos, Taylor, and Aguilar-Calero, each with three publications. Andy and Baker-

Henningham follow with two publications. This pattern indicates that while Cockerill is the most active researcher in this domain, several other authors have also made significant contributions, collectively enriching the field. Table 1 presents the most frequently cited documents globally.

**Table 1.**  
*Top Ten Most Globally Cited Documents*

| Paper  | DOI                                | TC  |
|--|------------------------------------|-----|
| Aber et al. (1998), <i>Dev. Psychopathol.</i>                            | 10.1017/S0954579498001576          | 181 |
| Poulou (2007), <i>Educ. Psychol.</i>                                     | 10.1080/01443410601066693          | 171 |
| Howlin et al. (2007), <i>J. Child Psychol. Psychiatry Allied Discip.</i> | 10.1111/j.1469-7610.2006.01707.x   | 166 |
| Beurden et al. (2003), <i>Prev. Med.</i>                                 | 10.1016/S0091-7435(02)00044-0      | 160 |
| Koh et al. (2017), <i>J. Educ. Comput. Res.</i>                          | 10.1177/0735633116656848           | 152 |
| Lee and Yeo (2022), <i>Comput. Educ.</i>                                 | 10.1016/j.compedu.2022.104646      | 117 |
| Brush et al. (2003), <i>Educ. Technol. Res. Dev.</i>                     | 10.1007/BF02504518                 | 114 |
| Gibson et al. (2008), <i>Int. J. Behav. Nutr. Phys. Act.</i>             | 10.1186/1479-5868-5-36             | 111 |
| Jacob et al. (2017), <i>J. Res. Educ. Eff.</i>                           | 10.1080/19345747.2016.1273411      | 106 |
| Lynch et al. (2004), <i>J. Prim. Prev.</i>                               | 10.1023/B:JOPP.0000018052.12488.d1 | 91  |

Table 1 shows that Aber et al. (1998) and Poulou (2007), in *Development and Psychopathology and Educational Psychology*, respectively, received the highest number of citations. They both achieved the highest number of citations with 181 and 171, respectively, highlighting the significant influence of their work in the study of elementary teacher training evaluation. The next most cited article was Howlin et al. (2007) in the *Journal of Child Psychology and Psychiatry and Allied Disciplines* (166 citations), followed by Beurden et al. (2003) in *Preventive Medicine* (160 citations). Koh et al. (2017) in the *Journal of Educational Computing Research* ranked fourth with 152 citations. Other highly cited works include Lee and Yeo (2022) in *Computers & Education* (117), Brush et al. (2003) in *Educational Technology Research and*

*Development* (114), and Gibson et al. (2008) in the *International Journal of Behavioral Nutrition and Physical Activity* (111). Jacob et al. (2017) in the *Journal of Research on Educational Effectiveness* recorded 106 citations, and Lynch et al. (2004) in the *Journal of Primary Prevention* received 91 citations. The high number of citations for these studies reflects their substantial scientific impact and their continuing relevance to global research on teacher training evaluation.

***Dominant Themes in Elementary School Teacher Training Evaluation Research***

The results of the cluster mapping analysis of elementary school teacher training programs using VOSviewer are presented in Figure 7.

**Figure 7.**  
*Network Visualization of Keyword Co-Occurrence Analysis*

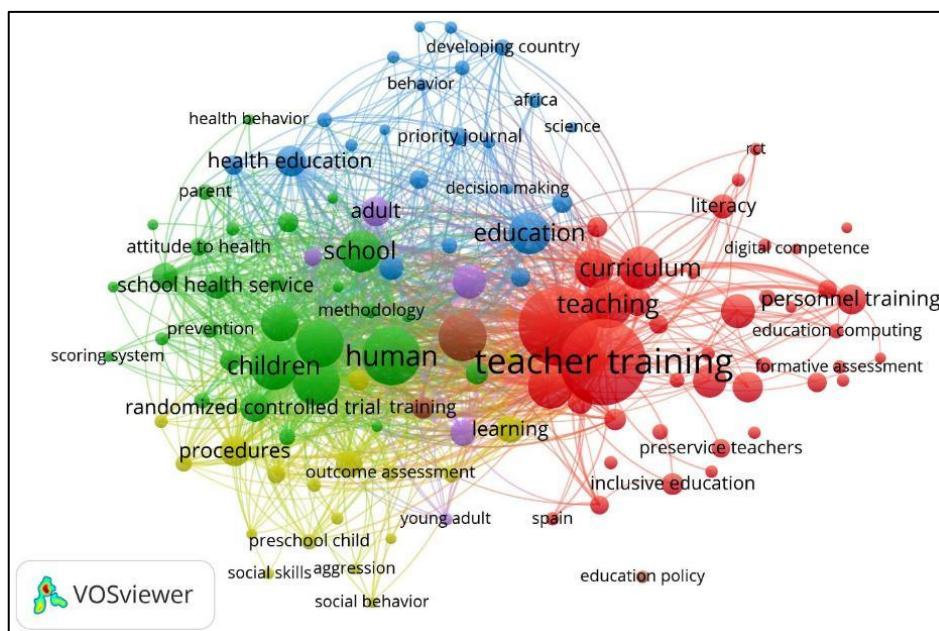


Figure 7 presents the results of keyword co-occurrence analysis, which are divided into six main clusters. The first cluster (red) consists of 39 items, with the most prominent keywords including primary education, teacher training, teacher education, teacher professional development, professional development, curriculum, evaluation, teaching, learning, student, personnel training, higher education, high school, and early childhood education.

The second cluster (green) comprises 21 items, including key terms such as education, health education, health care quality, knowledge, attitude, behavior, organization and management, sex education, developing countries, and decision-making. The third cluster (blue) also contains 21 items, with the most frequent keywords being human, school, children, adolescent, health promotion, school child, school health service, exercise, in-service training,

physical activity, and physical education. The fourth cluster (yellow) includes 18 items, among which the most prominent are school teachers, attitude to health, parents, middle-aged, human experiment, female, male, adult, and socioeconomics. The fifth cluster (purple) consists of 15 items, including evaluation programs, psychology, prevention, child behavior, health programs, mental health, preschool child, procedures, violence, social skills, and academic achievement. Meanwhile, the sixth cluster (brown) contains three items: educational policy, teachers, and training. Overall, these

six clusters represent the thematic structure of global research on teacher training evaluation, encompassing domains such as professional development, curriculum innovation, health and well-being education, psychological aspects, and policy orientation.

**Potential Themes for Future Elementary School Teacher Training Evaluation Research**

The results of the co-occurrence analysis using VOSviewer based on the overlay visualization are presented in Figure 8.

**Figure 8.**  
*Overlay Visualization of Keyword Co-Occurrence Analysis*

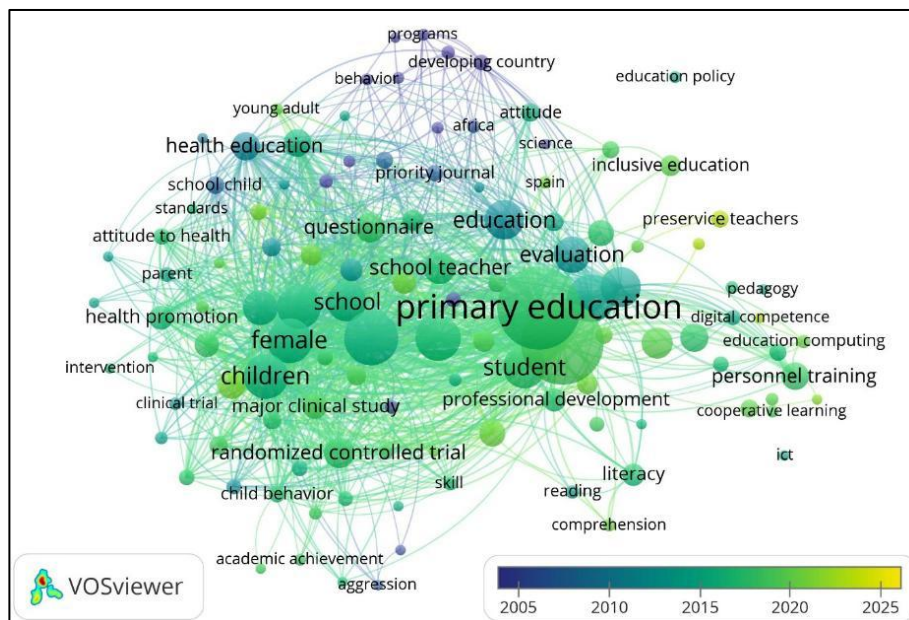


Figure 8 illustrates the emergence of several keywords, with the earliest appearing in dark blue, representing publications around 2005. These include health care quality, health care planning, behavior, programs, evaluation studies, sex education, science, faculty, United States, Africa, organization and administration, violence, and aggression. Subsequently, several keywords appearing during the middle period—marked in light green and representing publications around 2015—include teaching, evaluation, curriculum, education, health education, human, program evaluation, and organization and management. Meanwhile, the most

recent items, marked in yellowish-green and representing the period around 2025, include preservice teachers, sustainable development, computational thinking, early childhood education, middle-aged, procedures, prevention and control, human experiment, digital competence, physical education and training, and learning. Overall, these emerging keywords indicate a progressive shift in research focus—from early discussions on health education and program evaluation toward contemporary themes such as digital competence, sustainability, and technology integration in teacher training evaluation.

## Discussion

### *Global Trends and Publication Landscape in Elementary School Teacher Training Evaluation Research*

The increasing trend in annual publications reflects a significant evolution of academic interest in evaluating elementary school teacher training programs. This finding aligns with the growing global emphasis on learning quality and teacher professionalization. Moreover, the rising number of publications indicates a broadening research agenda—from studies initially centered on program effectiveness and educational management to more contextual themes such as teacher digital competence, student health and well-being, preservice training, and the integration of sustainable development principles into educational practice (Fischer et al., 2022; Pulimeno et al., 2020; Silber-Varod et al., 2019; Thompson et al., 2024). The surge in publications after 2015 can be linked to the influence of global initiatives such as the Sustainable Development Goals (SDGs) and the rapid adoption of educational technologies, which have spurred a wave of new evaluation projects in teacher learning contexts (Fischer et al., 2022; Kalsoom & Qureshi, 2021). These developments demonstrate that the field of elementary school teacher training evaluation has evolved from fragmented, isolated studies into a more systematic, multidisciplinary, and integrated research domain that addresses global challenges in 21st-century education.

Furthermore, the observed fluctuations in annual citation rates suggest that the academic influence of research in this field tends to occur in waves, often triggered by the publication of seminal works in particular years. The citation surge in the late 1990s and early 2000s, for instance, corresponded with the emergence of school-based intervention studies that assessed the effectiveness of teacher training and violence prevention programs at the elementary level, such as the works of Aber et al. (1998) and Beurden et al. (2003). Both studies became highly cited for introducing context-based evaluation approaches and fostering collaboration among educational stakeholders—foundations that later informed subsequent research methodologies. The citation peak in 2007 was likely

influenced by the studies of Poulou (2007) and Howlin et al. (2007), which broadened the analytical focus to include teacher efficacy and the effectiveness of training for inclusive education.

The renewed increase in citations between 2017 and 2021 marked a resurgence of scholarly interest in teacher professional development within the digital and 21st-century learning context. Research by Koh et al. (2017) on technological pedagogical content knowledge (TPACK) based training and by Jacob et al. (2017) on mathematics training illustrated a paradigm shift toward evidence-based, technology-enhanced models of teacher education. The surge in citations during this period demonstrates that literature emphasizing technology integration and outcome-based evaluation has gained global relevance. However, the subsequent decline in citations toward 2025 can be attributed to the diversification of publication topics, leading to a more dispersed citation distribution. This trend suggests that the field's scientific influence largely depends on the emergence of pivotal studies that bridge theoretical evaluation frameworks with practical innovations in teacher training and elementary education.

The distribution of publications across journal sources indicates that research on the evaluation of elementary school teacher training programs is concentrated in reputable journals within the fields of education and sustainability. The three most productive journals—*Education Sciences*, *Profesorado*, and *Sustainability* (Switzerland)—show a strong trend toward interdisciplinary research integrating pedagogical, social, and environmental perspectives. The prominence of education-focused journals such as *Frontiers in Education*, *Bordón*, and the *International Journal of Educational Development* reflects how teacher training evaluation has increasingly been situated within broader discussions on improving learning quality, professionalizing educators, and strengthening basic education systems. Meanwhile, the inclusion of *Sustainability* (Switzerland) highlights a notable shift in research direction toward embedding sustainability education within teacher training programs—consistent with the findings of Fischer et al. (2022) and Kalsoom and Qureshi (2021), who emphasize the

importance of sustainability literacy in building educator capacity. These results also provide valuable guidance for researchers in selecting appropriate journals as primary publication outlets in this field.

An analysis of the most productive institutions reveals that Spanish universities dominate research on the evaluation of elementary school teacher training programs. The Universidad de Granada ranks first, followed by Queen's University Belfast, Universidad de Córdoba, Universidad de Extremadura, and Universidad de Sevilla. This dominance underscores Spain's central role as a European hub for educational research, supported by national policies emphasizing teacher professionalization and evidence-based evaluation (Butar et al., 2024). The inclusion of Queen's University Belfast in the top ten further underscores cross-border collaborations, particularly within the European context, reinforcing the globalized nature of this research field (Ananin & Lovakov, 2022). Overall, this pattern indicates that the firm research productivity of Spanish institutions not only highlights the robustness of national education research but also opens new opportunities for international collaboration. Moreover, an analysis of the most prolific authors shows that contributions to this field are led by a group of researchers who consistently focus on empirical evaluations of teacher training effectiveness in improving elementary students' literacy outcomes, particularly in the English educational context. Cockerill emerges as the most influential author, with six publications—mostly randomized controlled trials (RCTs)—assessing the impact of programs such as fluency into comprehension, reciprocal reading, and vocabulary or spelling interventions on student achievement. Her studies, including those on improving reading skills among low-ability students (Cockerill et al., 2023) and a controlled trial of a vocabulary instruction program (Cockerill et al., 2020), underscore her pivotal role in promoting evidence-based approaches to teacher training. Thurston, with four publications—all co-authored with Cockerill—has also contributed significantly to the development of methodological frameworks for intervention-based research in elementary schools. Their collaboration exemplifies how sustained research

partnerships and consistent thematic focus underpin progress in this domain. Additionally, emerging authors such as Aduár, Godino, and Rojo-Ramos, from Spain, reflect the expansion of international collaboration networks and methodological diversification, strengthening the field's position as a global and multidisciplinary research area.

An analysis of the most highly cited works reveals that the globally influential studies in elementary school teacher training evaluation are dominated by research integrating experimental designs with evidence-based educational interventions. Aber et al.'s (1998) study, ranking first in citation impact, showed that variations in teachers' training intensity within the Resolving Conflict Creatively Program produced differential effects on students' developmental outcomes related to aggression and competence. Building on this foundation, Poulou's (2007) article in *Educational Psychology*, ranked second, advanced theoretical discussions on teacher efficacy and preservice teachers' perceptions of teaching effectiveness. These insights informed subsequent research linking teacher self-efficacy, identity formation, and the quality of professional preparation. Similarly, Howlin et al. (2007) and Beurden et al. (2003), positioned next in citation rankings, expanded the research landscape through studies on inclusive education for children with autism and health-promotion-based physical education interventions. Both placed strong emphasis on student-centered training designs and outcome-oriented evaluation, illustrating how training programs adapt to diverse learner needs. More recent studies by Koh et al. (2017) and Lee and Yeo (2022) indicate a shift toward technology-infused teacher training, focusing on digital competencies and AI-supported simulations to enhance reflective and adaptive teaching. Collectively, these highly cited studies highlight an evolving trajectory in teacher training research—one that progresses from context-sensitive and preventive-intervention models toward personalization, adaptive learning, and technologically mediated evaluation frameworks.

### ***Dominant Themes in Elementary School Teacher Training Evaluation Research***

The results of knowledge mapping

using VOSviewer indicate that research on the evaluation of elementary school teacher training programs is increasingly interdisciplinary. The interconnectedness among keywords confirms that teacher training is no longer viewed merely as a process of enhancing pedagogical competence, but as a complex learning system encompassing curriculum, health, social behavior, and educational policy dimensions. This finding aligns with Thompson et al. (2024), who argue that teacher training programs are now conceptualized as multicomponent learning systems involving curriculum design, social interaction, health aspects, and diverse educational policies. Similarly, Baker-Henningham et al. (2019) assert that teacher training outcomes can reduce teacher-perpetrated violence, foster emotionally supportive classroom environments, and enhance students' early learning skills.

The six clusters emerging from the network analysis represent a broad research landscape, ranging from teacher professionalization to the social context and well-being of students. These findings indicate a paradigm shift from a purely technical approach to a more holistic, ecosystem-based understanding of education. The first and second clusters demonstrate a shift in research focus within elementary teacher training evaluation—from the enhancement of professional competencies to the integration of broader contextual educational values. The first cluster highlights teacher professionalization and curriculum innovation, representing the mainstream focus on teacher competency development, training effectiveness, and curriculum reform. Current evaluations increasingly emphasize sustainability, reflective practice, and the relevance of teacher training to 21st-century learning demands. Altun and Yucel-Toy (2023) demonstrated that reflective-collaborative training models positively transform teachers' instructional approaches, while Voinea (2019) emphasized the importance of orienting teacher training toward sustainability and developing six macro-level competencies for future education. Likewise, Briede and Drelinga (2023) advocated a sustainable evaluation approach that prioritizes student learning and contextual teaching experiences. The second

cluster, meanwhile, relates to education and health promotion in schools, signaling an expansion toward integrating health education, behavioral change, and character development within primary education. This finding is consistent with Pulimeno et al. (2020), who highlighted the role of schools as ideal environments for early health promotion, and with Hossain et al. (2023), who showed that well-being has become central to student development. Marin et al. (2025) further demonstrated that comprehensive training programs significantly enhance educators' attitudes and skills toward inclusion. Collectively, this theme underscores a research trend positioning teacher training as a driver of healthy and inclusive school cultures.

The third and fifth clusters further demonstrate the close linkage between teacher training and students' holistic well-being. The third cluster focuses on health promotion and physical activity in learning, whereas the fifth cluster emphasizes program evaluation focused on children's mental and behavioral health. Studies within these clusters reveal a new direction in teacher training evaluation—one that integrates pedagogical, physical, and psychological dimensions to comprehensively assess training effectiveness. This perspective situates teacher training as a means of fostering children's overall development. Such an approach aligns with Pulimeno et al. (2020), who argue that schools play a crucial role in promoting student well-being, thereby reducing adverse health outcomes and improving academic achievement. Matingwina (2018) also found a statistically significant relationship between health and academic performance, showing that healthier students face fewer school-related difficulties. Furthermore, Nopriansyah et al. (2025) emphasize the need for evaluation models that incorporate changes in behavioral and learning outcomes as indicators of training impact.

Meanwhile, the fourth cluster highlights sociodemographic dimensions and parental participation, while the sixth cluster focuses on educational policy and teacher training governance. These two clusters underscore the strengthening of social and structural perspectives within teacher training evaluation discourse, emphasizing that program success depends not only on the

training content but also on the broader social environment, demographic background, and policy context. The roles of parents, communities, and socioeconomic conditions are essential in building a learning ecosystem that supports effective teaching practices (Daniel et al., 2019). Schleicher (2018) further emphasize that education systems must strengthen connections among schools, parents, and communities to prepare students for future complexities. Additionally, studies within the policy cluster highlight the need for evidence-based educational governance, as noted by Kitsing and Kukemelk (2020) and Nurhayati et al. (2024), to ensure that evaluation results contribute directly to strategic decision-making. This integration of social and policy dimensions signifies a shift from individual-level to systemic evaluation, positioning teacher training as part of a sustainable, inclusive mechanism to improve the quality of basic education.

### ***Potential Themes for Future Elementary School Teacher Training Evaluation Research***

The results of the overlay visualization analysis indicate that research on the evaluation of elementary school teacher training programs has evolved dynamically and adaptively in response to global educational changes. Early research themes, characterized by keywords such as health care quality, behavior, and evaluation studies, reflect the field's initial orientation, which emphasized the effectiveness and efficiency of training programs. This stage primarily focused on how training influenced participant behavior and teacher performance (Maritasari et al., 2020; Nazim et al., 2024). This finding is consistent with Stufflebeam (2000), who developed the CIPP Model as a foundational framework for program evaluation, emphasizing that the ultimate purpose of evaluation is to improve rather than merely prove. Gandomkar (2018) further noted that the model has since evolved to embrace complexity theory, viewing educational programs as dynamic, adaptive, and interactive systems.

Research conducted in the mid-to-recent period shows a clear thematic expansion toward pedagogical and digital dimensions. The emergence of keywords such as preservice teachers, computational thinking, digital competence, and sustainable

development suggests that teacher training evaluation has become a multidimensional field integrating pedagogy, technology, and sustainability. This finding aligns with Jibril and Adedokun-Shittu (2024), who, through the TPACK framework, emphasized the importance of combining technological, pedagogical, and content knowledge in teacher professional competencies. Similarly, Silber-Varod et al. (2019) and Canavesi and Cattaneo (2024) highlight that mastery of digital competence is no longer supplementary but an essential prerequisite for effective 21st-century learning that can navigate complex educational environments. The theme of sustainability has also gained prominence in line with the global education for SDGs agenda, which calls for research exploring how teacher training can promote environmentally, socially, and economically sustainable learning practices (Fischer et al., 2022; Kalsoom & Qureshi, 2021).

Building upon these trends, several potential research themes can be explored in the future. These include the development of digital and artificial intelligence-based models for evaluating teacher training, the integration of sustainability literacy principles into training curricula, and the exploration of the impacts of training on teachers' and students' social-emotional competencies. Future research could also focus on developing adaptive evaluation frameworks to assess the effectiveness of training in hybrid and inclusive learning environments, as well as on examining how national education policies can support their implementation at the elementary level. This direction aligns with Zhao (2023), who stressed the importance of evidence-based evaluation systems to strengthen strategic decision-making in teacher professional development. Overall, this research area holds substantial potential to evolve toward more innovative, more sustainable, and evidence-oriented evaluation practices aimed at enhancing teacher capacity to meet future educational challenges.

### ***Implications of the Findings for Research Advancement and Educational Practice***

The findings of this bibliometric analysis reveal that elementary school teacher training is increasingly conceptualized as an interdisciplinary and ecosystem-based domain. This shift opens

opportunities for future researchers to design evaluation models that are more holistic and contextually grounded. The study also uncovers strong thematic linkages among curriculum innovation, health promotion, socioemotional development, and policy governance. These connections provide a broader analytical foundation that encourages scholars to move beyond narrow competence-focused evaluations and adopt frameworks reflecting the complexity of real educational environments. The results enrich existing literature by highlighting theoretical gaps—particularly the limited integration of well-being, sustainability, and socio-contextual dimensions. These gaps can guide future studies toward multidimensional indicators of training effectiveness. Moreover, the growing emphasis on digital competence, AI-supported learning environments, and sustainability literacy offers promising pathways for aligning teacher training evaluation with emerging global educational challenges.

In practical terms, the themes identified in this study can help address persistent issues recognized by experts and practitioners. Many schools continue to struggle with creating inclusive classrooms, supporting student well-being, and helping teachers navigate increasingly digital and diverse learning contexts. The presence of clusters related to mental health, behavioral development, and physical well-being indicates that evaluation studies grounded in holistic child development may produce more actionable insights for improving daily teaching practices. The prominence of governance and policy-related themes further suggests that research can play a stronger role in supporting evidence-based decision-making. This area has often been criticized for lacking robust empirical grounding. By integrating structural, contextual, and technological dimensions into evaluation designs, future studies can generate findings that are theoretically meaningful and directly applicable to the improvement of teacher training programs, school ecosystems, and national development strategies.

### Conclusion

The bibliometric analysis of global publications on the evaluation of elementary school teacher training programs reveals

significant growth over the past two decades. Annual publication trends have risen sharply since 2015, reflecting an expanding research interest in teacher professionalization, training effectiveness, and technology integration in primary education. Meanwhile, annual citation patterns exhibit cyclical fluctuations influenced by seminal works such as Aber (1998), Poulou (2007), and Koh (2017), which broadened the evaluation framework to encompass context-based learning, inclusivity, and technology, in the context of publication sources, journals such as *Education Sciences*, *Profesorado*, and *Sustainability* (Switzerland) dominate, reflecting the integration of education, sustainability, and pedagogical innovation. At the institutional level, Spanish universities, particularly Universidad de Granada, Universidad de Córdoba, and Universidad de Sevilla, have emerged as the most productive research centers, indicating an intense concentration of scholarship within the European region.

Moreover, an analysis of the most prolific authors reveals that key contributors are led by researchers such as Cockerill and Thurston, who consistently use randomized controlled trials to evaluate the effectiveness of teacher training. Highly cited works demonstrating their influence in this field include Poulou (2007), Howlin et al. (2007), and Koh et al. (2017). These works have significantly influenced the study and methodological direction of evidence-based teacher training evaluation globally. Thematic mapping identified six main research clusters, namely teacher professionalization, curriculum innovation, student health and well-being, education policy, and teacher training governance. In addition, the overlay visualization highlights emerging themes, including digital and artificial intelligence-based evaluation, sustainability literacy, and adaptive evaluation frameworks for hybrid and inclusive learning. Collectively, these findings confirm that research in this field has evolved from traditional approaches to a more integrative, evidence-based, and multidisciplinary paradigm.

This study contributes significantly to educational science by clarifying the dynamics, evolution, and future directions of global research on elementary school teacher training evaluation. The bibliometric mapping reveals key patterns

of collaboration, research productivity, and thematic development, offering a strong empirical foundation for designing evaluation models that reflect the interdisciplinary and complex nature of teacher training. The findings also provide practical guidance for policymakers and educational institutions in formulating training strategies that respond to social change, technological advancement, and the demands of 21st-century learning. By identifying emerging themes such as digital competence, sustainability literacy, and socioemotional well-being, this study highlights areas requiring deeper inquiry and offers policy directions for more evidence-based and contextually responsive teacher development. These insights support efforts toward sustainable educational improvement, in line with SDG 4's call for equitable, high-quality education and the empowerment of educators as key agents of change.

While offering a comprehensive overview of the global research landscape, this study is limited by its reliance on a quantitative bibliometric approach without an in-depth qualitative review of the content or methodological rigor of the analyzed articles. Consequently, it may not fully capture the conceptual depth and narrative insights attainable through systematic literature reviews or content analysis. Future research is therefore encouraged to integrate bibliometric methods with qualitative approaches to achieve a deeper understanding of conceptual frameworks, applied evaluation models, and the relationship between research findings and the implementation of education policy. Such a mixed-method bibliometric review would enrich academic discourse and enhance the practical relevance of research findings for the continued development of elementary school teacher training programs.

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All authors declare that there is no conflict of interest associated with the publication of this article.

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### Ethical Approval

This study constitutes a review-based investigation employing a bibliometric analysis approach and does not involve the collection or examination of data derived from human or animal subjects. Therefore, approval from an Institutional Review Board or Ethics Committee was not required for the conduct of this research.

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