

## Global research trends in pre-service teacher leadership: a bibliometric analysis (2018-2024)

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### ABSTRACT

Pre-service teacher leadership is an emerging and crucial area of educational research, gaining significant attention due to its impact on future educational outcomes. The purpose of this study is to investigate research trends in pre-service teacher leadership globally from 2018 to 2024 using bibliometric analysis with the Scopus database. A total of 1278 articles were identified and examined using VOSviewer and mapping analysis. The results show a steady increase in research on pre-service teacher leadership, with the United States leading in contributions, followed by the United Kingdom. The analysis covers publication trends, types, languages, citation analysis, country collaborations, common citation networks, and topic tendencies. The study identifies key authors, their works, and their interactions. A word analysis was conducted to ascertain concepts used in the field, resulting in cognitive maps that show patterns of relationships and cooperation. The evaluation also included national partnerships, journals, authors, publications, and citation sources within the network. The findings are valuable for researchers in pre-service teacher leadership and can serve as a foundation for future studies in this field.

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## 1. INTRODUCTION

In an era marked by rapid technological advancements and evolving educational paradigms, the expectations placed on educators have increased substantially. Modern teachers now hold greater and more impactful responsibilities than previous generations in the ever-changing landscape of education [1], [2]. The responsibilities of teachers extend beyond the classroom, with pre-service teacher leadership emerging as a key element in this transformation. Teachers are now envisioned not just as knowledge transmitters but as visionary leaders capable of addressing complex issues in modern education [3], [4]. Pre-service teacher leadership, as revealed through bibliometric analysis, emerges as a promising field of study and application, addressing the pressing need to equip aspiring teachers with leadership abilities that extend beyond the classroom.

The analysis demonstrates how pre-service teacher leadership challenges conventional ideas of teacher preparation, which have traditionally prioritised pedagogical expertise and classroom management skills. Given the significant impact that teachers have on the educational system, pre-service teachers are now encouraged to develop their leadership skills [5]. This concept reimagines the transition from student to teacher as a transformative process, emphasising that teachers actively advance knowledge rather than merely

consume it. However, while previous studies have explored the importance of teacher leadership in classroom settings, they have largely focused on pedagogical and instructional aspects, neglecting a deeper examination of how leadership skills are developed during the pre-service phase. There is a lack of research that systematically explores the evolving roles of pre-service teachers as leaders beyond the classroom, particularly in terms of collaboration, innovation, and influencing school-wide changes. Furthermore, existing studies often center on Western contexts, with limited attention given to how these leadership practices may differ across regions and cultural settings [6]. Over the past two decades, pre-service teachers have become a crucial focus in educational development and a significant driving force in shaping future education and research, as evidenced by bibliometric analyses conducted by researchers.

Ultimately, pre-service teacher leadership has the power to revolutionise both the field of education and teacher education [7]. This publication aims to initiate a meaningful conversation about the transformative potential of pre-service teacher leadership among practitioners, researchers, educators, and policymakers. Aspiring teachers must build strong leadership abilities during their training because these are the cornerstone of success in the teaching field. The concept of pre-service teacher leadership varies by region. Western researchers, describe pre-service teacher leadership using the term “student teacher candidate leadership”, focusing primarily on the classroom environment and influencing student learning [8], [9]. They emphasise abilities such as inspiring and motivating others, effective communication, collaboration, creative problem-solving, and acting with integrity and responsibility.

Conducting a bibliometric analysis for pre-service teacher leadership in the field of teacher education is crucial for identifying trends and patterns over time. On top of that, examining publication data, citation metrics, and authorship details, researchers can uncover how the focus on pre-service teacher leadership has evolved [10]. This approach highlights emerging themes, shifts in research focus, and the overall growth of interest in this area. Such insights are essential for understanding the development of this field and guiding future research directions [11].

This bibliometric analysis provides a quantitative measure of the impact and influence of research through metrics such as total citations (TC), average citations per publication (C/P), h-index, and g-index [12]. These metrics help identify the most influential studies, key contributors, and seminal works shaping the field. Understanding the impact of these studies underscores the importance of pre-service teacher leadership in educational contexts. The focus of this bibliometric analysis highlights the leadership potential of pre-service teachers in teacher preparation programs. By analysing research trends and impacts from 2018 to 2024, the study underscores the active leadership roles of pre-service teachers and their potential to shape future education. Therefore, this paper conducts a bibliometric analysis of pre-service teacher leadership, with a focus on three main research questions (RQs): i) how has the development and dissemination of pre-service teacher leadership research evolved?; ii) what are the primary topics covered in pre-service teacher leadership research?; and iii) who are the leading contributors to pre-service teacher leadership research, and what collaborative efforts have they engaged in?

## 2. METHOD

This study employs a bibliometric analytic approach to examine scientific publications on “pre-service teacher leadership in teacher education” as shown in Figure 1. It maps the research literature on pre-service teacher leadership using metadata extracted from Scopus over 6 years, from 2018 to 2024. The methodology follows updated preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines for performing systematic reviews of studies [13], [14]. It was claimed that the Scopus database is more comprehensively covered than the other databases [15]. Additionally, Scopus is an effective indexed database that can export publication data and metadata for a range of study topics [16].

Selecting a timeline is the next step followed which emphasises on research field maturity [17]. The data-gathering process was conducted in May 2024, wherein 1,278 articles were identified using the established standards. This analysis limited the screening procedure to publications published between 2018 and 2024 (May). This period was selected since sufficient research papers (1,278 articles) allowed for a comprehensive review. Various methods were employed to analyse the data for the research topics. Some results were obtained using the search result analysis tool directly from Scopus, which historically stores data in formats such as RIS and CSV. Additional findings were manually inputted or transferred to a new Excel file in these formats. Data, including percentages and cumulative percentages, were analysed from the comprehensive outcomes file. Harzing’s Publish or Perish software was used to compute citation metrics. VOSviewer, a publicly available tool, was utilised to visualise the bibliometric networks, illustrating research trends in pre-service teacher leadership in teacher education from 2018-2024.

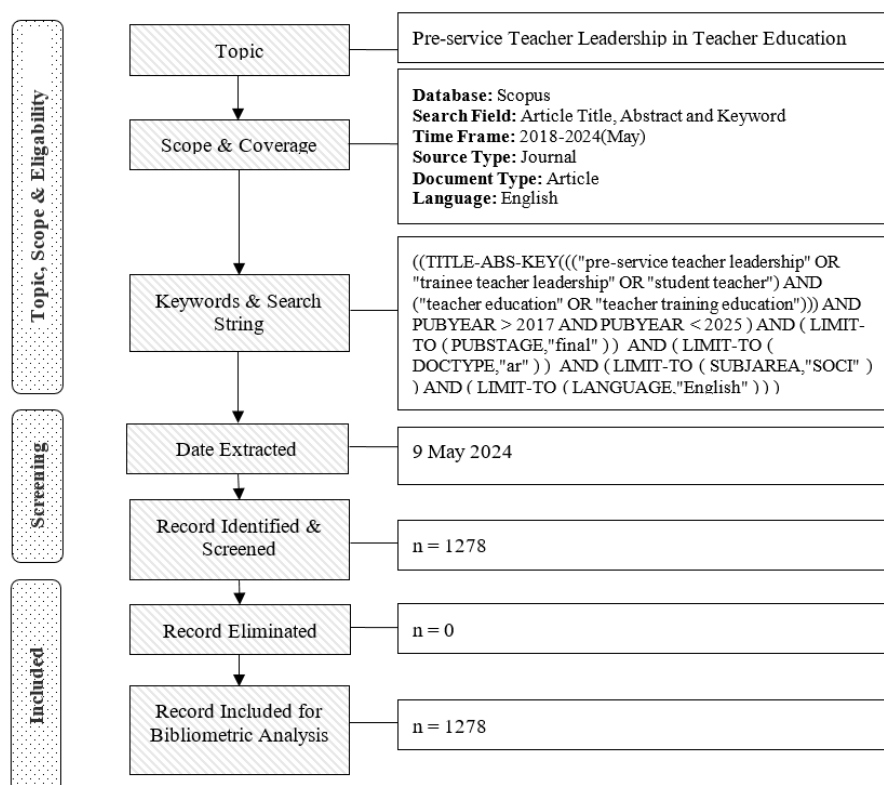


Figure 1. Flow diagram of the search strategy [14]

### 3. RESULTS AND DISCUSSION

#### 3.1. Development and dissemination of pre-service teacher leadership research

Table 1 provides the analysis of productivity in research in terms of the number of documents published each year as the trend and importance of the research topic can be monitored over time by analysing the papers according to the year of publication [18]. The analysis of the publication years reveals a significant growth in the number of publications related to pre-service teacher leadership from 2018 to 2024. The total number of publications (TP) in the dataset is 1,278, with a notable increase from 2018 to 2020, where the peak of 223 publications was reached. This upward trend indicates a growing interest and investment in research on pre-service teacher leadership during this period. The year 2024, however, exhibits a decrease in publications, which may be due to the recentness of the year and the time required for publications to be indexed.

Table 1. Year of publication

Year	TP	Percentage (%)	Cumulative percentage (%)	NCP	TC	C/P	C/CP	<i>h</i>	<i>g</i>
2024	70	5.48	5.48	20	52	0.74	2.60	4	5
2023	221	17.29	22.77	120	357	1.62	2.98	8	12
2022	206	16.12	38.89	174	832	4.04	4.78	13	17
2021	220	17.21	56.10	196	1348	6.13	6.88	17	21
2020	223	17.45	73.55	203	3663	16.43	18.04	25	53
2019	192	15.02	88.57	181	2228	11.60	12.31	23	35
2018	146	11.43	100.00	140	2185	14.97	15.61	24	39
Total	1278	100.00							

Notes: NCP=number of cited publications; C/P=average citations per publication; C/CP=average citations per cited publication; *h*=*h*-index; and *g*=*g*-index.

The citation analysis provides further insights into research impact, as seen in Figure 2. TC peaked in 2020 with 3,663 citations, showing that research produced this year was highly influential. The C/P and C/CP were also highest in 2020, with C/P reaching 16.43, indicating that these publications were both prolific and impactful. Moreover, the *h*-index and *g*-index for 2020, at 25 and 53 respectively, confirm that the research conducted in this year contributed significantly to advancing the field.

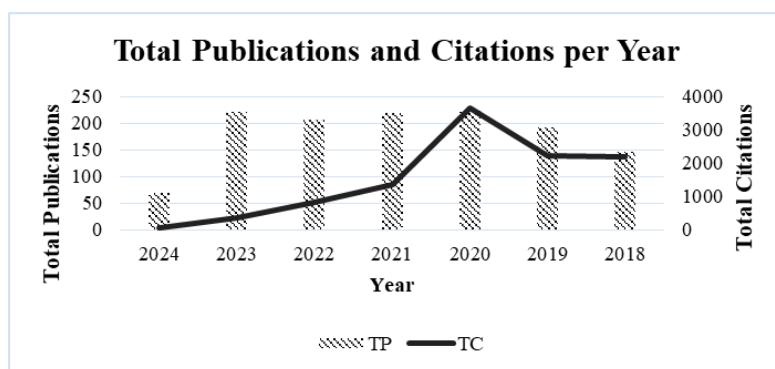


Figure 2. Total publications and citations per year

The growth and spread of pre-service teacher leadership research have expanded significantly. This bibliometric analysis, covering 1,278 articles indexed in Scopus from 2018 to 2024, shows a clear upward trend in publications. This increase reflects a strong and growing interest in developing leadership skills among future educators, highlighting the need for teachers who can lead and manage change in complex educational environments. Exploring educational leadership is seen as essential for shaping the future of education and influencing students, educators, and institutional dynamics [19]. The US and the UK are the top contributors to this research, indicating a focus on teacher leadership in their educational policies [20]–[22]. It is also emphasized that teacher leadership is prioritized in these countries to foster innovation and enhance staff management [23]. High-ranking universities and research institutions in these regions also play a role in supporting this research tradition.

The themes in pre-service teacher leadership research have shifted over time. Early studies mainly focused on defining teacher leadership and its key components. Recently, the focus has expanded to more complex issues, such as incorporating technology into teacher leadership and the effect of leadership training on teacher performance, reflecting the field's adaptation to new educational challenges [24]. It was emphasized that the “new normal” in education calls for innovative approaches, including integrating technology, AI, and global perspectives [25]. This shift has led to new leadership training programs that prepare pre-service teachers to lead in tech-driven classrooms, underscoring the critical role they play in shaping the future of education, even before they officially begin their teaching careers.

### 3.2. The primary topics covered in pre-service teacher leadership research

We analysed the citation networks of 1,278 articles to identify the top keywords and conducting a co-occurrence analysis by examining the most frequently used keywords and their co-occurrence patterns. Keyword co-occurrence analysis is a robust content analysis method for assessing the degree of association among keywords in the literature [26]. The most frequently used keywords in research on pre-service teacher leadership in teacher education were identified. Keywords from the 1,278 studies were summarised and presented in Table 2. The keyword “teacher education” representing 39.75% of occurrences, emerged as the most frequently used term in the literature. The second most common keyword was “student teachers” (14.40%), reflecting the integral role of student teachers in teacher education. Another frequently appearing keyword was “initial teacher education” which appeared 105 times.

Table 2. Top keywords

Author keywords	Total publications (TP)	Percentage (%)
Teacher education	508	39.75
Student teachers	184	14.40
Initial teacher education	105	8.22
Student teacher	50	3.91
Teaching	48	3.76
Teacher training	44	3.44
Mentoring	42	3.29

Figure 3, created using VOSviewer, provides a visual representation of a term co-occurrence network based on the title and abstract fields of the analysed articles [27]. This visualisation employs full

counting to illustrate the connections and frequency of various terms [28]. The network map helps identify clusters of related keywords, indicating the primary focus areas within pre-service teacher leadership research. This method highlights the central themes and uncovers the underlying structure of the research domain, facilitating a deeper understanding of how different topics are interconnected [29]. The visualisation underscores the prominence of terms like “teacher education” and “student teachers” while highlighting the diverse topics covered in this field, including mentoring, professional development, and teacher identity.

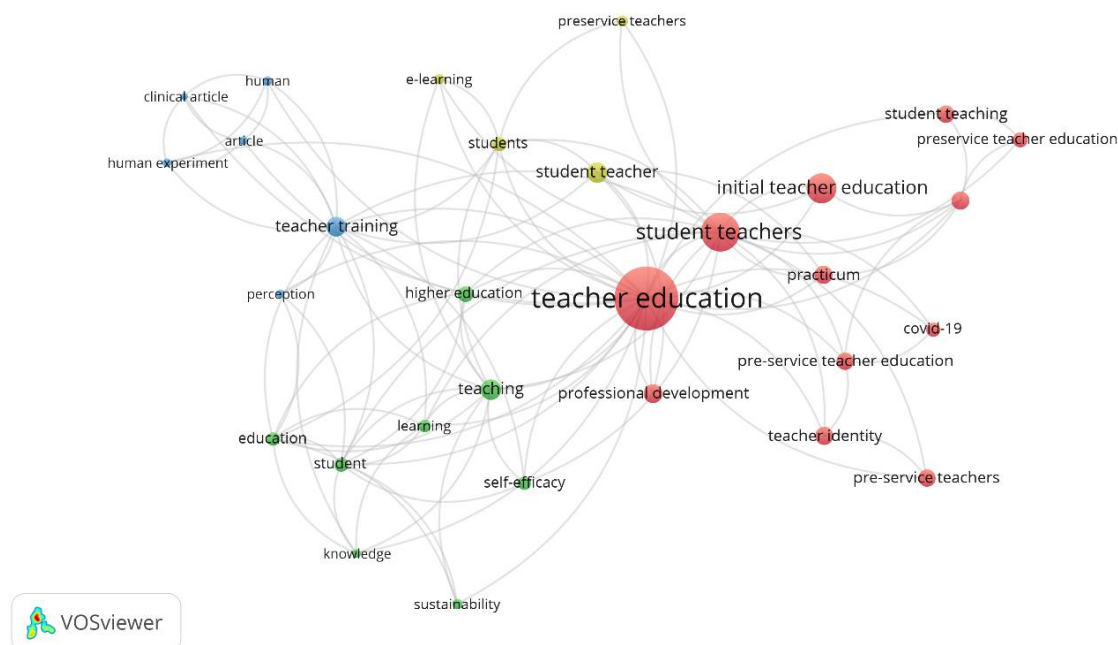


Figure 3. Visualisation of a term co-occurrence network

The topics in pre-service teacher leadership research are varied, covering leadership development in teacher education programs, the influence of digital competence, and the role of leadership in managing crises like the COVID-19 pandemic. From 2018 to 2024, the research garnered 10,847 total citations, with an average of 8.48 citations per paper, reflecting strong scholarly interest. The h-index of 37 and g-index of 68 further highlight the quality and sustained impact of these publications. These metrics indicate that pre-service teacher leadership research is both prolific and influential within educational research. Additionally, it has been noted that pre-service teacher research fosters an inquiry habit that shapes teacher identity [30]. Citations peaked in 2020, driven by the COVID-19 pandemic, which led to a surge in studies addressing the challenges of remote learning [31]–[33]. These studies highlighted the critical leadership role of pre-service teachers in adapting to virtual education, and their high citation rates reflect the significant impact of this research during the global crisis. This demonstrates the importance of pre-service teacher leadership in ensuring educational continuity during major disruptions [34]–[36].

### 3.3. Leading contributors to pre-service teacher leadership research and collaborative efforts engagement

#### 3.3.1. Top countries contribute to the publication

Table 3 highlights the leading countries in pre-service teacher leadership research from 2018 to 2024, demonstrating significant international contributions. The United States tops the list with 127 publications (9.94% of the total) and 102 cited papers, accumulating 1,298 citations. It averages 10.22 citations per publication and 12.73 per cited publication, with an h-index of 17 and a g-index of 31. The United Kingdom follows closely with 126 publications (9.86%) and 106 cited papers, totaling 843 citations, averaging 6.69 citations per publication and 7.95 per cited publication, with an h-index of 15 and a g-index of 22. Overall, the geographic distribution of research indicates a wide international interest, with contributions from both established research countries and emerging nations. This diversity enriches the literature with various perspectives, which is essential for developing comprehensive and globally relevant educational practices and policies.

Table 3. Top countries contributed to the publications

Country	TP	%	NCP	TC	C/P	C/CP	h	g
United States	127	9.94	102	1298	10.22	12.73	17	31
United Kingdom	126	9.86	106	843	6.69	7.95	15	22
Finland	105	8.22	95	853	8.12	8.98	16	21
Norway	103	8.06	85	1139	11.06	13.40	18	30
Germany	90	7.04	70	911	10.12	13.01	18	26

Figure 4 shows a network visualisation map of citations by country, created using VOSviewer. The color gradation map illustrates global citation relationships in research on pre-service teacher leadership [37]. This visualisation highlights the collaborative nature of research in pre-service teacher leadership, demonstrating how academic discourse transcends national boundaries and fosters a more integrated global understanding of the subject.

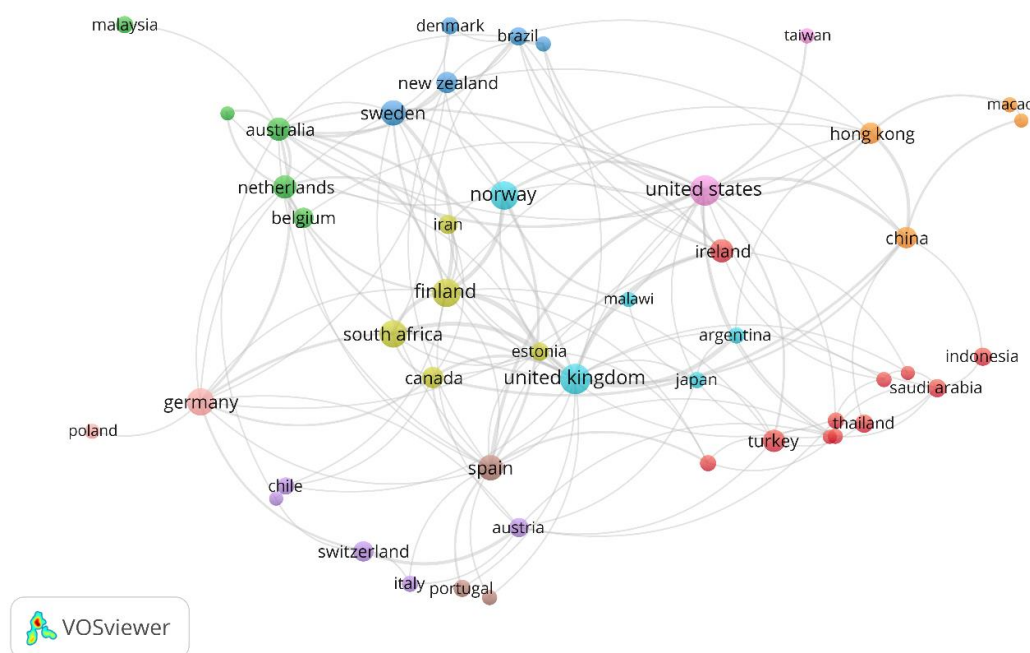


Figure 4. Network visualisation map of the citation by country

### 3.3.2. The greatest influential institutions

The analysis identifies several key institutions leading in pre-service teacher leadership research. Table 4 presents the most influential institutions, each with a minimum of ten publications. Helsingin Yliopisto (University of Helsinki) in Finland is the top contributor, with 47 TP and 44 NCP, resulting in 398 TC. This institution averages 8.47 C/P and 9.05 C/CP, with an h-index of 12 and a g-index of 16, indicating its significant impact in the field.

Table 4. Most influential institutions

Affiliation	Country	TP	NCP	TC	C/P	C/CP	h	G
Helsingin Yliopisto	Finland	47	44	398	8.47	9.05	12	16
University of Johannesburg	South Africa	26	18	86	3.31	4.78	5	8
University of Jyväskylä	Finland	23	21	142	6.17	6.76	8	11
OsloMet-StorbyUniversitetet	Norway	19	17	413	21.74	24.29	6	17
The Education University of Hong Kong	Hong Kong	18	16	175	9.72	10.94	8	13

The University of Johannesburg in South Africa follows with 26 publications, of which 18 are cited, accumulating 86 citations. It has an average of 3.31 citations per publication and 4.78 citations per cited

publication, along with an h-index of 5 and a g-index of 8, showing a growing influence. The University of Jyväskylä in Finland also makes notable contributions, with 23 publications and 21 cited, garnering a total of 142 citations. It averages 6.17 citations per publication and 6.76 per cited publication, supported by an h-index of 8 and a g-index of 11. These top institutions demonstrate substantial contributions to pre-service teacher leadership research, highlighting the international interest and collaborative efforts in advancing this field.

### 3.3.3. The most active journal

Table 5 presents the analysis of the most active journals in pre-service teacher leadership research from 2018 to 2024. Leading the list is *Teaching and Teacher Education*, with 66 publications and a total of 801 citations. Published by Elsevier, this journal has a CiteScore of 6.5, an SJR of 1.616, and an SNIP of 2.474, indicating its strong reputation and substantial influence in educational research, particularly in teacher education and leadership. Following closely is the *European Journal of Teacher Education*, which has published 52 articles and accumulated 1,612 citations. This Taylor and Francis journal boasts a high CiteScore of 13.3, an SJR of 1.892, and an SNIP of 2.849 in 2022, reflecting its significant impact in disseminating research on teacher education both in Europe and globally.

The *Journal of Education for Teaching*, published by Taylor and Francis, has 50 publications and 953 citations, with a CiteScore of 7.9, an SJR of 1.315, and an SNIP of 2.128, contributing valuable insights into teacher education and pre-service teacher leadership. Additional journals also contribute valuable research. Despite having fewer publications, these journals highlight the diverse and global interest in pre-service teacher leadership, with varying citation impacts and focus areas. Overall, these journals play crucial roles in disseminating research on pre-service teacher leadership, contributing to the development of educational practices and policies worldwide. Their varied focuses and impacts underscore the multifaceted nature of research in this area.

Table 5. Most active source title

Source title	TP	TC	Publisher	Cite score	SJR 2022	SNIP 2022
Teaching and Teacher Education	66	801	Elsevier	6.5	1.616	2.474
European Journal of Teacher Education	52	1,612	Taylor and Francis	13.3	1.892	2.849
Journal of Education for Teaching	50	953	Taylor and Francis	7.9	1.315	2.128
Frontiers in Education	43	173	Frontiers Media SA	2.3	0.661	1.329
Education Sciences	38	133	Multidisciplinary Digital Publishing Institute (MDPI)	4	0.605	1.295
Teaching Education	14	73	Taylor and Francis	3.1	0.608	1.168

### 3.3.4. The citation analysis

The bibliometric study of pre-service teacher leadership research from 2018 to 2024 highlights significant metrics reflecting its influence and reach, as shown in Table 6. Over this period, 1,278 papers were published, accumulating 10,847 citations, averaging 1,807.83 citations per year and 8.48 citations per paper, indicating substantial impact. Additionally, the citations per author metric is 5,501.95, with an average of 673.51 papers per author, showcasing prolific contributions from individual researchers. The average number of authors per paper is 2.54, suggesting a collaborative research approach. The h-index of 37 and g-index of 68 further emphasise the high quality and influence of these publications, with the h-index indicating that 37 papers have been cited at least 37 times each and the g-index showing that the top 68 papers have collectively garnered citations squaring to this number. These metrics collectively highlight the robust scholarly impact of research in pre-service teacher leadership over the analysed six-year period.

Table 6. Citations metrics

Metrics	Data
Publications years	2018-2024
Papers	1,278
Citations	10,847
Years	6
Cites_year	1,807.83
Cites_paper	8.48
Cites_author	5,501.95
Papers_author	673.51
Authors_paper	2.54
H_index	37
G_index	68

### 3.3.5. Highly cited articles

The top 5 articles on pre-service teacher leadership in teacher education, detailed in Table 7, reveal significant insights, especially in response to the COVID-19 pandemic. Notably, the most highly cited article by C. Carrillo and M. A. Flores, “COVID-19 and teacher education: a literature review of online teaching and learning practices,” amassed 536 citations, averaging 134 per year. This study emphasised the swift shift to online education and the crucial leadership roles pre-service teachers played in this transition. The second most cited article by M. A. Flores and M. Gago, “Teacher education in times of COVID-19 pandemic in Portugal: national, institutional and pedagogical responses,” garnered 293 citations, averaging 73.25 per year. In third place, G. B. Gudmundsdottir and O. E. Hatlevik’s article, “Newly qualified teachers’ professional digital competence: implications for teacher education,” published in 2018, has garnered 275 citations, averaging 45.83 per year. This study focused on the digital competencies required of newly qualified teachers, highlighting the leadership pre-service teachers must demonstrate in mastering and applying digital tools and methodologies to enhance teaching effectiveness. The remaining highly cited articles also contribute to understanding pre-service teacher leadership.

Table 7. Highly cited articles

No.	Authors	Cites	Title	Year	Cites per year
1	C. Carrillo and M. A. Flores	536	COVID-19 and teacher education: a literature review of online teaching and learning practices	2020	134
2	M. A. Flores and M. Gago	293	Teacher education in times of COVID-19 pandemic in Portugal: national, institutional and pedagogical responses	2020	73.25
3	G. B. Gudmundsdottir and O. E. Hatlevik	275	Newly qualified teachers’ professional digital competence: implications for teacher education	2018	45.83
4	J. Kim	253	Learning and teaching online during COVID-19: experiences of student teachers in an early childhood education practicum	2020	63.25
5	P. Sepulveda-Escobar and A. Morrison	215	Online teaching placement during the COVID-19 pandemic in Chile: challenges and opportunities	2020	53.75

### 3.3.6. The most productive authors

Table 8 identifies the most productive authors in the field of pre-service teacher leadership. Among them, Lindqvist, H. from Linköpings Universitet in Sweden leads with 11 publications and 80 citations, averaging 7.27 citations per publication and 10 citations per cited publication. Similarly, Thornberg, R., also from Linköpings Universitet, has 10 publications with 61 citations, averaging 6.1 citations per publication and 8.71 per cited publication. Banegas, D. L. from the College of Arts, Humanities and Social Sciences in Edinburgh, UK, has published nine articles with a total of 74 citations, yielding an average of 8.22 citations per publication. Additionally, Wernerson, A. from Karolinska Institutet and Weurlander, M. from Stockholms Universitet, both in Stockholm, have each published nine articles with 51 citations, averaging 5.67 citations per publication. These authors demonstrate significant contributions and impact within the academic community. In summary, other notable authors with significant impact include Hatlevik, O. E. from OsloMet-StorbyUniversitetet in Norway, with six publications totalling 362 citations, averaging 60.33 per publication.

Table 8. Most productive authors

Author’s name	TC	Affiliation	Country	TP	NCP	C/P	C/CP	<i>h</i>	<i>g</i>
Lindqvist, H.	80	Linköpings Universitet Linköping	Sweden	11	8	7.27	10.00	5	8
Thornberg, R.	61	Linköpings Universitet Linköping	Sweden	10	7	6.10	8.71	5	7
Banegas, D.L.	74	College of Arts, Humanities and Social Sciences, Edinburgh	United Kingdom	9	9	8.22	8.22	6	8
Wernerson, A.	51	Karolinska Institutet, Stockholm	Sweden	9	6	5.67	8.50	5	6
Weurlander, M.	51	Stockholms universitet, Stockholm	Sweden	9	6	5.67	8.50	5	6
Hagenauer, G.	44	Universität Salzburg, Salzburg	Austria	6	6	7.33	7.33	4	6
Hatlevik, O.E.	362	OsloMet-StorbyUniversitetet, Oslo	Norway	6	6	60.33	60.33	4	6

Leading contributors to pre-service teacher leadership research include prominent scholars such as C. Carrillo, M. A. Flores, and G. B. Gudmundsdottir, whose highly cited works have significantly influenced the field. The most cited article by C. Carrillo and M. A. Flores (2020) has received 536 citations and emphasizes the critical role of pre-service teachers in adapting to online teaching during the COVID-19 pandemic. Their research highlights how online learning encourages pre-service teachers



to access resources, be creative, and teach flexibly [38], [39]. By documenting effective online teaching strategies, this study underscores the leadership skills necessary to navigate unprecedented challenges.

Following closely is the work by M. A. Flores and M. Gago (2020), which has garnered 293 citations. Their study examines teacher education responses in Portugal during the pandemic, emphasizing the importance of leadership at national and institutional levels. This research shows that pre-service teacher leadership was essential in addressing the disruptions caused by the pandemic. To effectively tackle these challenges, pre-service teachers must become adaptable and engaged subject specialists through reflective learning and collaboration [40], [41]. Additionally, G. B. Gudmundsdottir and O. E. Hatlevik's study, with 275 citations, focuses on the digital competence of newly qualified teachers. It highlights the need for digital leadership skills among pre-service teachers, emphasizing their readiness to lead in technologically advanced educational settings [42]. These influential studies collectively highlight the vital leadership skills pre-service teachers need to respond to significant educational challenges.

While this analysis reveals valuable insights, it is important to acknowledge some limitations. This study focused on a specific timeframe and dataset, which may omit relevant research outside this scope. Future studies should explore a broader range of databases and include diverse publication types, such as book chapters and conference proceedings, to gain a more comprehensive understanding of the field. Additionally, expanding the research categories can help capture the complexities of leadership in teacher education. Implications for future research include the necessity to explore how pre-service teachers can enhance their leadership skills through various innovative approaches. Our findings suggest that pre-service teacher leadership is crucial for educational resilience, particularly in times of crisis. Future studies could examine effective methods for fostering leadership qualities in pre-service teachers, ensuring they are well-prepared to face evolving educational challenges.

Collaborative efforts among researchers play a key role in advancing knowledge in pre-service teacher leadership. This analysis highlights many co-authored papers and international projects, indicating a strong collaborative environment. Co-authorship allows scholars to combine expertise, resulting in comprehensive studies [43], [44]. Cross-institutional research enhances data collection from diverse contexts, while international projects provide global perspectives on pre-service teacher leadership development [45]. These collaborations facilitate resource sharing and improve the quality and applicability of research findings [46].

Interdisciplinary teams further strengthen collaborative efforts by addressing challenges from various perspectives, including pedagogy, psychological resilience, and digital integration. Such collaborations attract significant funding and support, enabling more extensive and impactful projects, as noted [47]. Many highly cited articles adopt these interdisciplinary approaches, especially in response to the COVID-19 pandemic. This comprehensive focus on professional skills and personal growth enriches research and leads to more effective solutions in teacher education. Additionally, these collaborations foster global exchanges of ideas through international conferences and joint publications, promoting continuous improvement in teacher leadership education [48]. Ultimately, this bibliometric analysis reveals significant trends and patterns in pre-service teacher leadership research, guiding future studies and informing educational policy and practice [10], [11]. Analysing geographic distribution reveals leading countries and institutions, uncovering global and regional differences and collaborations [49]. Insights from bibliometric analysis inform educational policy and practice by identifying key research areas and impactful studies [50]. This helps policymakers and educators enhance teacher education programs, preparing future teachers for leadership roles.

#### 4. CONCLUSION

This bibliometric analysis of pre-service teacher leadership research in the Scopus database from 2018 to 2024 provides conclusive evidence of a robust and expanding field. Our findings demonstrate a steady rise in publications, with a notable peak in citations in 2020, reflecting increased interest and the significant impact of research during that period. The analysis highlights the growing importance of leadership skills among pre-service teachers, particularly during the COVID-19 pandemic, which emphasized the critical role of pre-service teacher leadership in maintaining educational quality amidst crises. Key themes such as digital competence and adaptable teaching practices emerged as central topics of study.

The results suggest that pre-service teacher leadership is pivotal in shaping resilient and innovative educators capable of navigating modern educational challenges. While this study offers valuable insights for educators, policymakers, and researchers, the limitations must be acknowledged. As with any bibliometric review, this analysis cannot fully capture the entire scope of the discipline, and relevant studies may have been omitted due to the search strategy employed. Future research should expand the scope by including alternative databases like WoS, ERIC, PsyInfo, and PubMed, and by incorporating diverse publication types such as book chapters and grey literature. Additionally,

exploring broader categories of leadership beyond those considered in this study would provide further insights into the complexities of leadership in teacher education.

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## AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Amirul Fahmie Abdul Razak	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Muhammad Faizal A. Ghani	✓	✓		✓		✓	✓		✓	✓		✓		✓
Norfariza Mohd Radzi	✓	✓		✓		✓	✓		✓	✓		✓		✓
Nur Diyana Zakariah	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

## CONFLICT OF INTEREST STATEMENT

There are no declared conflicts of interest.

## INFORMED CONSENT

Informed consent was obtained from all individuals involved in the study.

## ETHICAL APPROVAL

The research involving human participants was conducted in accordance with all applicable national regulations and institutional guidelines, adhering to the principles outlined in the Helsinki Declaration, and received approval from the University Malaya Research Ethics Committee (UMREC).

## DATA AVAILABILITY

Data availability does not apply for this paper as no new data were created or analyzed in this study.

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