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A Bibliometric Review on Teachers' Professional Learning Community (PLC), 2012 to 2022

Phey S. Ling[1*], Fadzilah Amzah[1]

[1] School of Educational Studies, University of Science, Penang, Malaysia

*Corresponding Author: pheysling@student.usm.my

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Abstract: *There has been sustained research effort over the years in Professional Learning Community (PLC) in education. However, there are only a few alternative points of view in terms of research bodies. Thus, this study sought to investigate and provide examples of the current trend of research on teachers' PLC (2012 -2022) using bibliometric analysis. The data was collected from Scopus-indexed documents based on the 'article title, abstract, and keywords'. 217 journal articles (JAs) and conference papers (CPs) were used for analysis. The frequency and percentage were analysed using Microsoft Excel, and data visualisation was done using VOSviewer and Harzing's Publish or Perish. The standard bibliometric indicators were used to report the findings. This study found that 94.47% of the total publication were JAs. Then, the growth of related publications was increased. English was the most prevalent language used in publications. The United States of America (USA) was the most productive in publishing most of both documents, followed by China. Science Social contributed the most to publishing both documents (93.09%) over the eleven years. An analysis of the most influential institution also was done. The institution from Singapore (Nanyang Technological University) had the most publications. The Journal of Professional Development in Education published the greatest number of articles related to the PLC of teachers. The citation analysis results can help to identify key authors and documents that shaped the course of this review. The keywords from a JA or CP summarise the key contents of papers. The emerging keywords used in JAs or CPs for PLC of teachers are Science, Technology, Engineering and Mathematics (STEM), computer, and climate change, which aligns with The Sustainable Development Goal 2030 (SDG 2030). The result from this bibliometric review provides researchers a reference for any future research in this 21st century of Education.*

Keywords: Bibliometric, Professional Learning Community (PLC), Scopus Database, journal article, proceeding

1. Introduction

A Professional Learning Community (PLC) provides a collaborative learning environment for teachers, administrators, other school staff, parents, and community members with diverse knowledge and skill sets. PLCs have become part of the culture at schools. Professional Learning Communities (PLCs) contribute to UNESCO's Education 2050's desire for the future of schools Learning to Become (Wasylenki, 2020) and Malaysian Education Blueprint 2013-2025, which outlined teachers' transformation into their profession of choice. PLCs assist in

developing high-quality teachers who can achieve their full potential (Hajar & Siti Mistima, 2021).

In addition to their vital role in promoting student learning and school success, PLCs hold enormous promise for boosting teacher learning. It has gained worldwide attention and has been intensively studied on a global scale. According to Havea and Mohanty (2020), Professional development through education and training increases an individual's capabilities and enhances workforce productivity. The Sustainable Development Goals (SDGs) are organised into five primary fields: education, economics, environment, health, and human rights are concerning professional development (UNESCO, 2015). Due to the critical nature of these sectors for maintaining social harmony and economic growth, training professionals in these areas is a crucial step toward achieving the 17 SDGs through international collaboration by 2030. Under the subtitle “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for everyone,” Goal 4 of the Sustainable Development Agenda is concerned with the theme of "Quality Education" (Havea & Mohanty, 2020). Professional development through PLCs of teachers in education not only improves education quality but also contributes to the attainment of goals and SDGs.

From 2012 to the present, many research reports about PLCs. Many studies show that professional learning communities (PLCs) among educators improve both teacher and student outcomes. However, to date, only a few systematic or bibliometric reviews of PLCs have been performed. We collected three past bibliometric analyses and PLC-related studies, as shown in Table 1.

Table 1: The Past Articles on Bibliometric Analysis on Teachers’ PLCs

Author	Title	TDE	Bibliometric Attributes Examined
Halliner and Kulophas (2019)	The Evolving Knowledge based on Leadership and Teacher Professional Learning: A Bibliometric Analysis of The Literature, 1960-2018	793 (1960-2018)	Volume, growth trajectory, geographic distribution, journal distribution of studies, authors, documents, and how leadership knowledge and teacher professional learning are put together intellectually
You and Xiang (2020)	An Analysis of The Research Status of Teachers PLC in The Past Decade-Bibliometric Analysis Based on CNKI	854 (2010-2019)	Authors, organisation source, keywords
Gao et al. (2022)	A bibliometric Analysis of The Online Faculty Professional Development (OFPD) in Higher Education	248 (1997-2021)	Distribution pattern, main contributors (journals, authors, countries documents) themes, and corresponding evolving trends in higher education OFPD

Notes: TDE=Total Documents Examined

Therefore, this bibliometric analysis was carried out to describe the state of research on the PLC of teachers between 2012 to 2022, to provide a comprehensive understanding of the literature, and to serve as a helpful resource for the PLC's research and development over the next eleven years, from 2012 to 2022. There were four specific research questions (RQs).

RQ1: What are the total and percentage of JAs and CPs published between 2012 and 2022?
RQ2: How does the research of PLC of teachers in education evolve and become distributed between 2012 and 2022?

RQ3: What are the journals, authors, and articles that have received the most citations between 2012 and 2022?
RQ4: What are the fascinating topics focused on by PLC of teachers in education scholars between 2012 to 2022?

The results from this study will fill in the gaps of a forthcoming literature review of teachers' participation in PLCs in the 21st century.

2. Methods

Bibliometric analysis has gained popularity for reporting research trends and patterns (Ahmi & Mohamad, 2019). The bibliometric analysis employs mathematical and statistical techniques to evaluate the quantity and quality of published materials in a specific research field. According to Hallinger and Kovacevic (2021), bibliometric review, also known as a science mapping review, aims to examine all published studies in an area analysing large quantities of bibliographic data to comprehend the structural and relational characteristics of the literature. Publication classification, citations, publication impact, and country of focus are the most common aspects of bibliometrics analysis. The bibliometric study can provide insight into the dissemination of knowledge-targeted literature across these journals and their relative impact, as well as the identification of key researchers and scholarly work within a particular field of study (Hallinger & Kovacevic, 2019). As a result, these indicators became the focus of our bibliometric analysis.

The systematic review adopted in this study was the modified Preferred Reporting Items for Systematic Review (PRISMA) standard (Liberati et al., 2009; Zakaria et al., 2021). Figure 1 shows the process for identifying sources for PLC of teachers, 2012-2022. The data was from the Scopus database on 3 November 2022. A complete search was carried out using the common keywords in the article's keyword list, abstract, and title, which were "professional learning communities", "PLCs", "professional learning community", "PLC", "teachers", and "instructor". The search was then scoped into 2012 to 2021 and limited to published JAs and CPs.

The search gave a result of 217 documents. A careful screening was made to ensure that uncertain documents regarding PLC and Education were excluded. As a result, no doubtful record was found. So, the total of papers included in this bibliometric remained at 217. Data from the Scopus database were downloaded in two formats: "RIS" (research information systems) and "CSV" (comma-separated values). The RIS format file was opened in Microsoft Excel to calculate the frequency and percentage of published contents and to create the charts for this evaluation. We also employed Harzing's Publish or Perish software to calculate the citation metrics. Meanwhile, the CSV format file was transferred to VOSviewer to visualise the bibliometric networks.

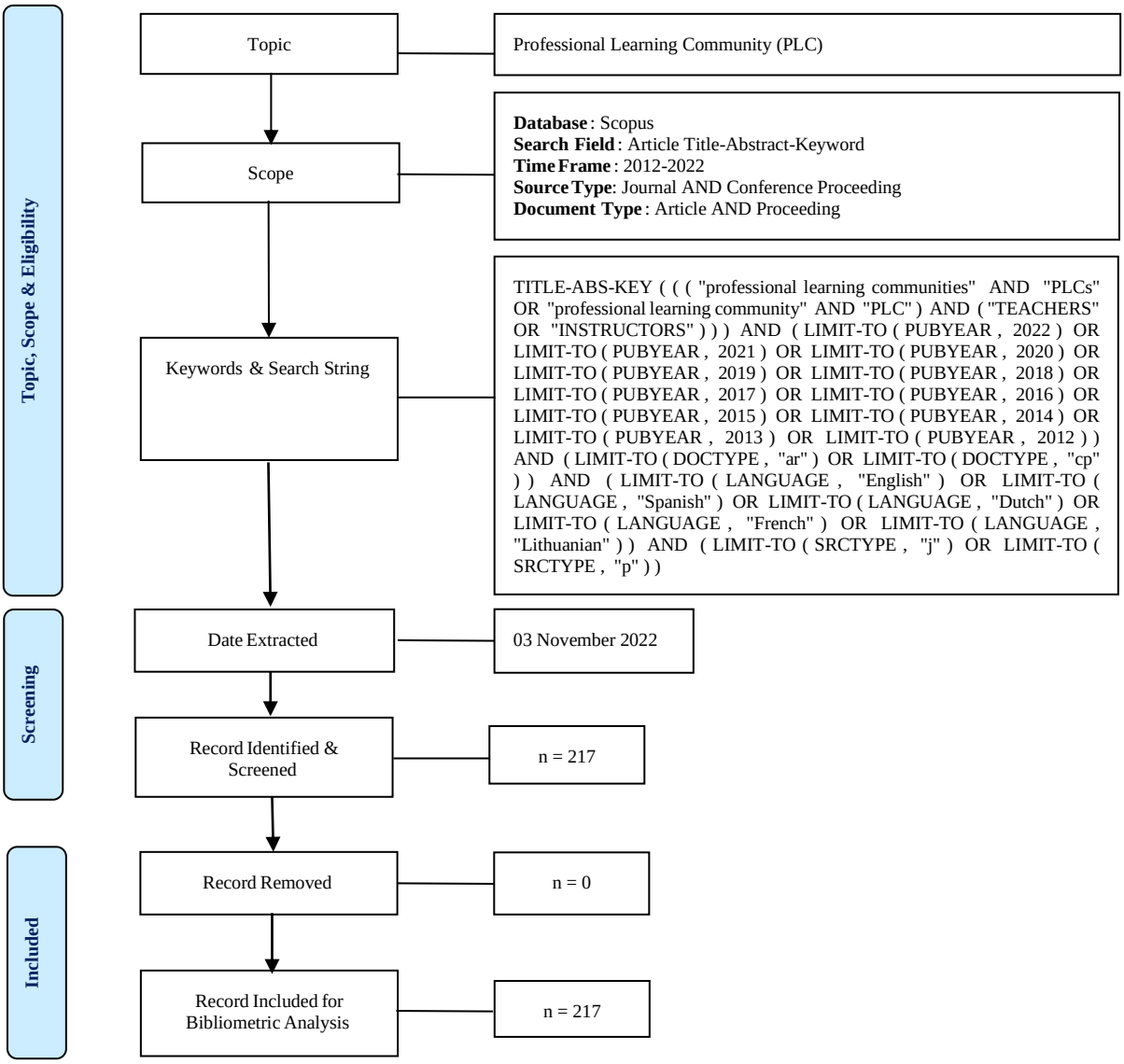

Figure 1: PRISMA Chart for Study Selection and PLC Analysis

3. Results and Discussion

The results are presented according to four research questions using quantitative analysis. Tables, diagrams, charts, and descriptive data, such as frequency, percentage, and cumulative percentage are used to represent the data collected from the Scopus database. Meanwhile, citation metrics are used to report the citation analysis.

3.1 What are the total and percentage of JAs and CPs published between 2012 and 2022?

Our first analyses focus on getting the background of the focused scholarly works in this review. This study identified two distinct types of published scholarly works on PLC of teachers in education, shown in Figure 2. Articles contributed the most, 94.47%, to all the academic documents. At the same time, journals were the top among all the publication source types.

Table 2: The Types of Documents chosen for PLC of Teachers Bibliometrics Analysis, 2012-2022

Document	Total Publications	Percentage (%)
Article	205	94.47
Conference Paper	12	5.53
Total	**217**	**100.00**

Table 3: The Types of Sources chosen for PLC of Teachers Bibliometrics Analysis, 2012-2022

Source	Total Publications	Percentage (%)
Journal	206	94.93
Conference Proceeding	11	5.07
Total	**217**	**100.00**

The capacity of the publication trend in this area of PLC was also analysed using the documents' languages. Percentages and cumulative percentages derived from Scopus database information. Table 4 demonstrates that English was the predominant language, with 97.70% of the overall publications or 212 publications of JAs and CPs between 2012 and 2022. Next was Spanish. However, Spanish only reported 0.92% of total publications. The other JAs and CPs were published in 3 different languages, which were Dutch, French, and Lithuanian. These three languages only represented 1.38% of the overall languages used in publishing academic works. English is the universal language for writing JAs and CPs of PLC of teachers in education.

Table 4: Languages

Language	Total Publications (NP)	Percentage (%)
English	212	97.70
Spanish	2	0.92
Dutch	1	0.46
French	1	0.46
Lithuanian	1	0.46
Total	**217**	**100.00**

3.2 How did the research of PLCs in education evolve and become distributed between 2012 and 2022?

We summarised the top twenty regions for the geographical distribution of PLC publications by using five continents. The PLC research works produced by the USA with 66 publications. USA was far surpassing other countries. This is not surprising because, according to Archer (2012), the term PLC first emerged among researchers as early as the 1960s in the teaching profession in USA. In the 1980s, the characteristics of work setting and work culture and their effects on employees began to be a topic of research and exploration within the public education sector in the USA (Hord, 2004). This was followed by China with 19 publications and Australia with 16 publications, the second and third countries with the most intensive research on PLC of teachers. The other Northern American country contributing to the publication is Canada (n=10), which is in the top 10 productive regions. Besides China, scholars in other Asia countries, such as Thailand with 14 publications, Malaysia with 13 publications, Singapore with 11 publications, Israel with 10 publications, Hong Kong with 8 publications, South Korea with 5 publications and Indonesia, Saudi Arabia, and Taiwan with 4 publications identically, ranked among the top 20. From the list of productive countries, Australia and New Zealand were from the Oceania continent. New Zealand ranked top 19 (n=3). Belgium (n=12), Netherlands (n=9), Sweden (n=6), Ireland (n=3), and United Kingdom

(n=3) were among the Europe continents that were productive in PLC publications. South Africa from Africa has five publications on PLC of teachers.

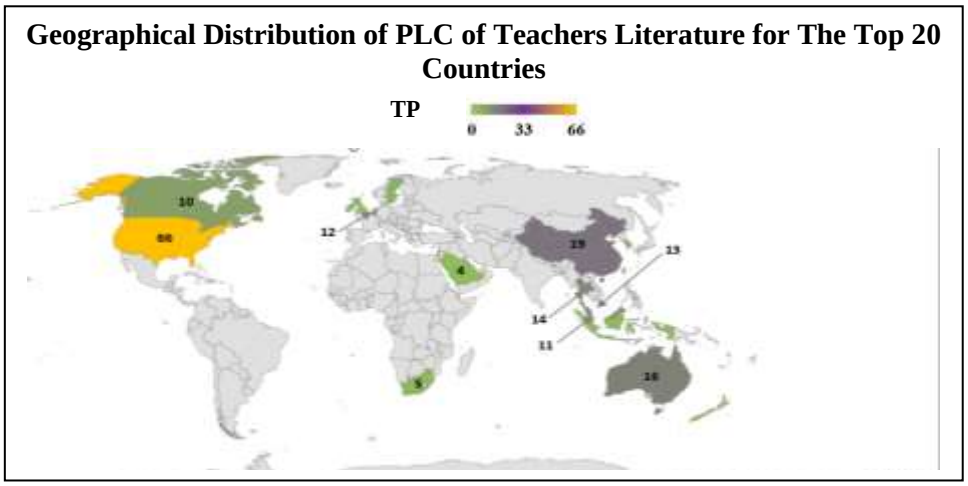

Figure 2: The Countries Contributed to The Articles on PLC of Teachers in Education Significantly 2012-2022

Table 5 displays the publication number on PLC of teachers. Observe that there had been a rise in the number of publications between 2015 and 2019, with 15 and 26 documents published during those years, respectively. The highest productivity (36 papers) was documented in 2022, while the lowest in 2015, with 5 documents only. Between 2012 and 2022, the number of publications grew in general. Thus, we assume the growing interest in PLC of teachers' research and its enormous innovation potential. However, PLC article citations dropped slowly, starting from 2017 to 2022 (Figure 3). the significance *h*-index of 12 for authors was presented in 2016.

Table 5: The Number of Publications by Year for Teachers' PLC Research 2012-2022

Year	NP	NCP	NC	PCP	CCP	*h*	*g*
2012	10	10	309	30.90	30.90	7	10
2013	9	8	184	20.44	23.00	7	9
2014	5	4	163	32.60	40.75	3	5
2015	15	14	286	19.07	20.43	9	15
2016	19	19	433	22.79	22.79	12	19
2017	14	12	252	18.00	21.00	8	14
2018	15	13	194	12.93	14.92	9	13
2019	26	20	131	5.04	6.55	7	10
2020	33	22	131	3.97	5.95	7	10
2021	35	22	67	1.91	3.05	4	6
2022	36	11	29	0.81	2.64	3	4
Total	**217**						

Notes: NP=number of publications; NCP=number of cited publications; NC=number of citations; PCP=proportion of cited publications; CCP=citations per cited publication; h=*h*-index; and g=*g*-index.

The graphs show that PLC of teachers in education publications has grown steadily over time. With ten publications in 2012, it had risen to 36 in 2022. On the other hand, fewer articles were highly cited from 2012 (10 citations per publication) to 2014 (4 citations per publication), from 2016 (19 citations per publication) to 2017 (12 citations per publication), then from 2020 (22 citations per publication) to 2022 (11 citations per publication). In 2020 and 2021, documents

had the most citations (22 citations per publication). The lowest publications in 2014 was with four citations per publication.

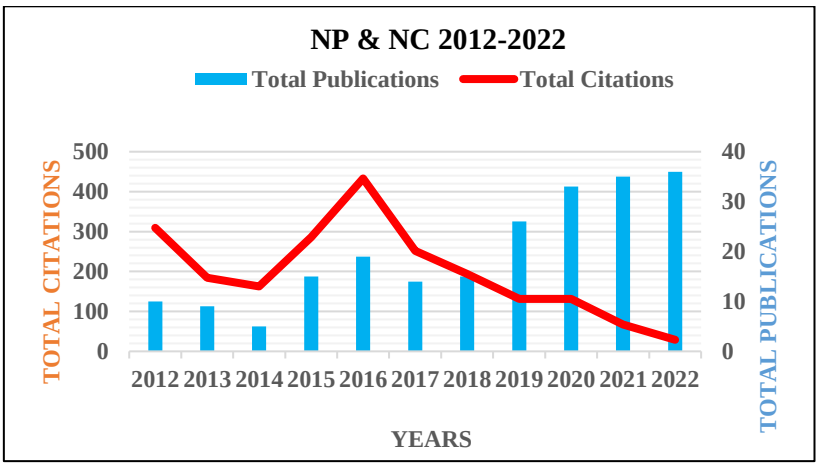

Figure 3: The Statistics of Publications and Citations of PLC research, 2012-2022

Table 6 displays the top influential institutions on PLC in education research. Out of the 217 documents, the highly-yield institution was The Nanyang Technological University, with 11 publications that contributed the most to PLC of teachers in education publications. This was followed by the National Institute of Education, Universiteit Gent, and the University of Canberra, with 10, 9, and 6 publications, respectively. Zhejiang University, the Education University of Hong Kong, Universiti Teknologi Malaysia (UTM), Beijing Normal University, China, and the University of North Texas shared the same number of 5 publications. Other Universities only contributed four and below the number of works published. The top-two institutions from Singapore presented the highest *h*-index, which contributed high-impact articles. This result depicted the institutions in Singapore had developed in producing the publications of JAs and CPs of PLC of teachers in education with high impact.

Table 6: Top 20 Influential Institutions That Contributed to The Articles on PLC of Teachers in Education 2012-2022

Affiliation	Country	NP	NCP	NC	PCP	CCP	*h*	*g*
Nanyang Technological University	Singapore	11	11	322	29.27	29.27	8	11
National Institute of Education	Singapore	10	10	318	31.80	31.80	8	10
Universiteit Gent	Belgium	9	9	264	29.33	29.33	6	9
University of Canberra	Australia	6	5	127	21.17	25.40	5	6
Zhejiang University	China	5	3	41	8.20	13.67	2	5
The Education University of Hong Kong	Hong Kong	5	4	75	15.00	18.75	3	5
Universiti Teknologi Malaysia (UTM)	Malaysia	5	3	14	2.80	4.67	2	3
Beijing Normal University	China	5	4	31	6.20	7.75	3	5
University of North Texas	United States	5	5	85	17.00	17.00	4	5
The Chinese University of Hong Kong	Hong Kong	4	4	37	9.25	9.25	3	4
Göteborgs Universitet	Sweden	4	4	39	9.75	9.75	3	4
East China Normal University	China	4	2	18	4.50	9.00	2	4
Thaksin University	Thailand	3	3	0	0.00	0.00	0	0

Brigham Young University	England	3	2	41	13.67	20.50	2	3
Interfacultair Centrum voor Lerarenopleiding	Netherlands	3	3	24	8.00	8.00	2	3
University of Washington	United States	3	1	4	1.33	4.00	1	2
University of the Witwatersrand, Johannesburg	South Africa	3	2	17	5.67	8.50	2	3
Weizmann Institute of Science Israel	Israel	3	1	4	1.33	4.00	1	2
Universiteit Leiden	Netherlands	3	3	24	8.00	8.00	2	3
Högskolan Halmstad	Sweden	3	3	43	14.33	14.33	3	3

Notes: NP=number of publications; NCP=Total cited publications; NC=number of citations; PCP=the proportion of cited publications; CCP=the citations per cited publication; h=*h*-index; and g=*g*-index.

3.3 What are the journals, authors, and articles that have received the most citations between 2012 and 2022?

We extended our analysis of PLC in education to citation analysis. The output of journals, authors, and articles was ranked by the number of citations each year. Table 7 displays the citation metric of the Scopus database-obtained papers. In the eleven years between 2012 and 2022, 2279 citations were recorded for 217 retrieved articles, with an average of 227.9 NC/Y. There were 10 NC/P of PLC of teachers in education.

Table 7: The Citations Metrics

Metrics	Data
The year of publications	2012-2022
The year of citations	10 (2012-2022)
Total of Papers	217
Total Citations	2279
Total Citations/Year (NC/Y)	227.9
Total Citations/Paper (NC/P)	10.5
Total Citations/Author (NC/A)	1144.45
Total Papers/Author (NP/A)	101.92
The *h*-index	26
The *g*-index	40

Besides productivity, it is essential to understand the source impact. Table 8 shows the top ten active journals on PLC of teachers in education. The outcomes demonstrated that publications were dispersed across a diverse range. Specifically, ten publications had published at least three of these articles. Table 8 reveals that, except for one, all the leading journals were ranked Q1 or Q2 by ScimagoJR. The International Journal of Innovation Creativity and Change needs to be assigned a quartile in 2022. This indicates that most highly referenced works about PLC of teachers in education were published in top-tier journals. Among the ten top-cited scholars, seven were primarily associated with teacher professional learning (TPL) and 3 with leadership (Lship). This shows that PLC research had piqued the interest of educators from both subfields.

When we analysed the Source Normalized Impact per Publication (SNIP) score, we determined that eight out of ten journals have a SNIP greater than 1. Greater than one SNIP score suggests that the total number of citations per article in each journal exceeds the publication's citation potential in its subject field. This implies that there were eight journals that have a significant

citation impact on education. The Journal of Educational Change had the highest SNIP with 3.172 and had the highest citation impact of PLC of teachers within the education field. Table 8's Cite Score column monitors journal performance concerning citation analysis.

Table 8: The Top 10 Active Journals

ST	NP	NC	P	CScore	SJR 2021	SNIP 2021
Professional Development in Education (TPL)	13	154	Taylor & Francis	3.8	1.094 Q1	1.664
Teaching And Teacher Education (TPL)	8	331	Elsevier	6.2	1.945 Q1	2.737
Asia Pacific Journal of Education (TPL)	6	149	Taylor & Francis	2	0.467 Q2	1.096
Educational Management Administration and Leadership (Lship)	5	85	SAGE	5.8	1.282 Q1	2.256
Journal Of Educational Change (TPL)	4	28	Springer Nature	4.3	1.517 Q1	3.172
School Effectiveness and School Improvement (Lship)	4	110	Taylor & Francis	4.1	1.047 Q1	1.731
Teachers And Teaching Theory and Practice (TPL)	4	54	Taylor & Francis	4.1	1.242 Q1	1.919
Educational Studies (TPL)	3	23	Taylor & Francis	2.9	0.53 Q2	1.085
International Journal of Innovation Creativity and Change (TPL)	3	1	Primrose Hall Publishing Group	0.5	0.225 -	0.349
International Journal of Leadership in Education (Lship)	3	14	Taylor & Francis	2.9	0.469 Q2	0.906

Notes: ST=source type; NP=number of publications; NC=number of citations; P=Publisher; CScore=Cite Score; SJR=Scimago journal rank; SNIP=Source Normalised Impact Per Paper.

Next, using citation analysis, the most influential documents on PLC in education were identified. Our PLC bibliometric analysis found the ten documents that were the most often cited articles (see Table 9). These top ten most-cited articles had an average of more than 47 citations each. The 2012 article published by Hairon and Dimmock leads in terms of both citations and average yearly citations. In the field of PLC of teachers in education, documents that are cited a lot can be used as important references.

Table 9: The Top Ten Most-Referenced Articles on Teachers' PLC

No.	Author	Title	Year	Cites	Cites per Year
1	Hairon and Dimmock (2012)	Singaporei Schools and Professional Learning Communities: Teacher Professional Development and School Leadership In An Asian Hierarchical System	2012	142	14.2
2	Neve et al. (2015)	Thei Importance of Job Resources and Self-Efficacy for Beginning Teachers' Professional Learning In Differentiated Instruction	2015	96	13.71
3	Marsh et al. (2015)	Using Data To Alter Instructional Practice: The Mediating Role of Coaches and Professional Learning Communities	2015	83	11.86
4	McConnell et al. (2013)	Virtual Professional Learning Communities: Teachers' Perceptions of Virtual Versus Face-To-Face Professional Development	2013	79	8.78

5	Vanblaere and Devos (2016)	Relating School Leadership To Perceived Professional Learning Community Characteristics: A Multilevel Analysis	2016	76	12.67
6	Watson (2014)	Effective Professional Learning Communities? The Possibilities for Teachers as Agents of Change In Schools	2014	74	9.25
7	Voelkel et al. (2017)	Understanding The Link Between Professional Learning Communities and Teacher Collective Efficacy	2017	58	11.6
8	Wang (2016)	School Leadership and Professional Learning Community: Case Study of Two Senior High Schools In Northeast China	2016	58	9.67
9	Rigelman and Ruben (2012)	Creating Foundations for Collaboration in Schools: Utilizing Professional Learning Communities To Support Teacher Candidate Learning and Visions of Teachingi	2012	49	4.9
10	Popp and Goldman (2016)	Knowledgei Building in Teacher Professional Learning Communities: Focus of Meeting Matters	2016	48	8

3.4 What are the fascinating topics focused on by the PLCs in education scholars between 2012 to 2022?

To respond to RQ4, we analysed the citation networks of 217 articles based on the publication of documents by subject areas and the most frequently used keywords. The released documents were categorized using their topic areas, as shown in Table 10. The overall distribution of subject areas revealed that PLC of teachers in education research progressed in numerous topics. As shown, most of the documents were in the Social Sciences area with 202 (93.09%), and Arts and humanities with 23 (10.60%), respectively. This makes sense because social science studies cover professional teacher development. The fields of mathematics, medicine, physics, astronomy, engineering, computer science, psychology, business, management, accounting, and the arts and humanities had more than five PLCs in education documents.

Table 10: The Subject Area

Subject Area	Total Publications (NP)	Percentage (%)
Social Sciences	202	93.09
Arts and Humanities	23	10.60
Business, Management, and Accounting	19	8.76
Psychology	18	8.29
Computer Science	12	5.53
Engineering	12	5.53
Physics and Astronomy	8	3.69
Medicine	7	3.23
Health Professions	6	2.76
Mathematics	6	2.76
Environmental Science	5	2.30
Energy	4	1.84
Biochemistry, Genetics, and Molecular Biology	2	0.92
Pharmacology, Toxicology and Pharmaceutics	2	0.92
Agricultural and Biological Sciences	1	0.46
Chemical Engineering	1	0.46
Economics, Econometrics, and Finance	1	0.46
Total	**217**	**100.00**

According to Tian et al. (2018), keywords used by authors or in articles can summarise the main points of papers. The keywords of a publication can provide valuable information, including aims, techniques, and views. Therefore, the frequency analysis of keywords is a key to investigating hot topics and development in the field (Wang et al., 2018). Those keywords were analysed based on the cluster years for this study. Figure 4 depicts the most prevalent emerging terms in PLC education research used by authors from 2012 to 2022. Keywords were analysed based on cluster years for this study. Figure 4 depicts the most prevalent emerging terms in PLC education research used by authors from 2012 to 2022. They were teacher learning, collaboration, professional development, school improvement, and leadership.

Figure 4: Word Cloud Generated by Author Keywords, 2012-2022

The most frequently used articles are also the focus of this study (see Figure 5). The keywords from 217 PLC studies were presented by using word clouds. The 'teacher teaching' keyword was the most intermittently used in PLC literature. Whereas the most exciting discovery was the word "engineering education," "STEM-Science, Technology Engineering and Mathematics," "computer," "e-learning," "climate change," and "pedagogical content knowledge." The finding is logical since educators adopt all the 21st-century elements in PLC. These keywords demonstrated that the researchers focus on PLC in curriculum, teaching, and learning by PLC, which is believed can help students improve their learning. Future studies can thus be based on these findings.

Figure 5: Word Cloud Generated by Articles Keywords, 2012-2022

4. Limitations

Although the procedure for bibliometric analysis has been strictly adhered to, this study's findings are still subject to certain limitations. First, because the data was compiled from a

single Scopus database, key papers indexed in other databases were most likely overlooked. The fact that only JAs and CPs were considered data sources is a possible omission. Because data mining in the bibliometric analysis is restricted to “titles”, “abstracts”, and “keywords” rather than a complete text analysis, some significant concepts and theme developments may differ from those produced via text data mining. Given the constraints, numerous recommendations for future research are suggested. First, the data coverage should be increased by merging content from several databases, such as Web of Science, Google Scholar, and Dimensions, so that the study has more comprehensive and accurate data. Future studies could encompass all publication sources and document types if some fascinating and essential publications still need to be included. Thirdly, other methods, such as text analysis, can be employed to unearth textually richer information that would improve the PLC's research findings.

5. Conclusion

This study examined 217 relevant documents in the Scopus database about the research of teachers' professional learning communities and came to the following conclusions: First, in terms of paper volume, the general trend is upward, and research on teacher professional learning communities has become an area of emphasis. The study results demonstrate the increasing importance of teachers’ PLCs globally. Furthermore, Discovering and analysing significant works in this field may aid the research of aspiring academics by providing essential subject matter knowledge. This work will significantly advance the field by identifying the field's research potential, its most influential contributors, and its most prevalent themes. The investigation revealed how crucial it is for the education industry to maintain a PLC-valuing culture among educators.

Secondly, teachers' PLCs have undergone significant changes. Due to the ongoing Covid-19 pandemic, Online education is growing rapidly. Transitioning from traditional face-to-face instruction to online education necessitates online faculty professional development. One of the primary reasons for the high number of publications in 2020 and 2021 could be the sudden outbreak of Covid-19 at the end of 2019. There is no doubt that teachers play a crucial role in student learning; teachers need to bridge the digital gap to implement learning 21st Century (Beteille et al., 2020). Therefore, how can teachers provide quality virtual instruction during the COVID-19 season? In any educational setting, the Professional Learning Community channel can be used to improve the academic excellence of students and teachers. When schools are closed due to the COVID-19 pandemic, virtual PLCs will aid in the development of qualified instructors who will concentrate on curriculum reform, assessment, and 21st-century pedagogical practice. Therefore, it is recommended that policymakers develop strategic plans to promote the teachers’ PLCs (Ogegbo & Salagaram, 2019). New PLC tactics via virtual strategy are being considered as a future school-based professional development endeavour to improve instructors’ teaching quality.

Thirdly, we discovered the following issues in the current research of the teacher’s professional learning community through our research. First, the degree of scientific research cooperation is low, and there is a lack of high-yield and high-impact scientific research teams in this field. The number of empirical studies supported by data is limited. Consistently expanding the depth and breadth of relevant research is expected to promote the comprehensive and sustainable development of teachers' professional learning community, which will promote the teacher's professional growth and strengthen the strength of teachers' teams, as is to be expected.

Fourthly, when considering research interests, the most common terms used by the authors and in the articles are more to Science, Technology, Engineering and Mathematics (STEM), computer, and climate change, which aligns with The Sustainable Development Goal 2030 (SDG, 2030). The result from this bibliometric review provides researchers a reference for any future research in this 21st century of Education. It is necessary to educate pupils to prepare them for the demands of global development and the workplace. 21st-century demand for mastery of thought high level, critical thinking, mastering information technology, collaborating capable, and communicative. Teachers need to be aware of the world's demands and be ready with a virtual professional learning community to develop teacher learning, collaboration, professional development, school improvement, and leadership skills to boost and grow students' greatness.

The importance of ongoing professional development for educators is also highlighted. There is concern that educators will be less invested in growing their professionalism if professional learning communities (PLCs) are not implemented sustainably. This study has significant implications for the development of teachers' PLC literature and studies, as the implementation of the program to increase the competence or professionalism of teachers in education needs to be investigated further, particularly the evaluation of PLCs implementation, characteristics, or competencies expected for the sustainability of teacher professional education. Furthermore, the research into the conceptualization and effectiveness of the concept of teachers' PLC should be continued.

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