



Bibliometric Profile of Scientific Studies on Pedagogical Content Knowledge

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Abstract. The purpose of this study is to conduct the bibliometric analysis of 2,092 studies on pedagogical content knowledge, published in the period of 1970-2019 (until 27 March 2019) and to reveal the clues about scientific communication and the general picture in the last 50 years. In this study, bibliometric analysis method was used. All studies obtained as a result of the scanning about pedagogical content knowledge in the Web of Science database were analyzed bibliometrically. The survey data consists of 2,092 studies published on pedagogical content knowledge between 1970 and 2019, revealed by scanning Web of Science database. 2,092 studies obtained through the scanning of Web of Science Core Collection database under “Pedagogical Content Knowledge” title were analyzed according to publication year, publication type, publication language, title, author name, authors’ country, keywords and references.

Social network analysis was used to identify the collaborations between countries that published joint studies on pedagogical content knowledge, to determine the co-citation network of the journal-author-publication and the concept-subject trends. CiteSpace application has been used in social network analysis. The data obtained from 2,092 studies were analyzed through this application.

In this research, bibliometric properties of 2,092 studies on Pedagogical Content Knowledge, indexed in Web of Science between 1970 and 1919 were analyzed, first of all it was found that the most publications were made in 2016-2019. In addition, it was understood that the studies were mainly in the form of articles and proceedings paper and carried out in English. Regarding country collaborations, it is seen that the USA is a pioneer in providing scientific communication in the field and plays a key role. As a result of the word analysis, it was concluded that the most commonly used concepts were Pedagogical Content Knowledge and education. The most studied subjects in the field were technological Pedagogical Content Knowledge and learning progress.

Keywords: *pedagogical content knowledge, teacher education, bibliometri.*

Introduction

In order to clarify the questions of “*What should teacher know? What should teacher do while instructing?*” Shulman (1986) created hypothetical fields and a new model about the qualities that teachers should have. In this respect, he attempted to form a distinction between “subject matter knowledge, curriculum knowledge and pedagogical knowledge”, considering that there was a relationship between teachers’ subject matter knowledge and the way they presented it to the students.

As a result of his research, Shulman (1996) restructured the teacher knowledge model including field knowledge, curriculum knowledge, Pedagogical Content Knowledge. In this formation, the pedagogical content knowledge that he presented as “subject area knowledge for the teacher” had a great impact in the research and application fields. Shulman (1986) described pedagogical content knowledge as follows:

“...Pedagogical Content Knowledge is a special form of subject matter knowledge, which includes the aspects of subject content knowledge related to teachability. The sub-dimensions of pedagogical content knowledge include the most useful notation forms, the most powerful analogies, illustrations, examples, explanations and demonstrations of ideas of a subject area. In other words, it is a way to show and formulate the content of the subject to be more understandable to others...Pedagogical content knowledge also includes what specific subjects make learning easy or difficult, in other words the understanding and insight that students with different ages and different backgrounds brought to the topics and lessons taught when they come to the learning environment”.

In 1987, Shulman promoted PCK from being a subcategory and included it in the knowledge base of teaching. The knowledge bases of this teaching were Content Knowledge, General Pedagogical Knowledge, Curriculum Knowledge, Knowledge of Learners, Knowledge of Educational Contexts and Knowledge of Philosophical and Historical Purposes of Education. Shulman also increased the knowledge bases of education from six to seven by promoting PCK to the same level with the others (Gess-Newsome, 1999). Shulman (1987) explained the types of knowledge that teachers should have, in other words, the categories that form the basis of knowledge of teaching (by Unat, 2011):

- Content Knowledge: it includes the organization of the basic concepts and the content in the mind of the teacher
- General Pedagogical Knowledge: It covers how the teacher will teach the knowledge to the students, which includes the knowledge and skills such as learning theories, material development and usage, student recognition, principles and strategies in classroom management, measurement and evaluation etc.
- Curriculum (Education Program) Knowledge: It includes the understanding of the objective, content, learning-teaching process and evaluation dimensions in the curriculums.

- Knowledge of Learners: It includes students' developmental periods, the functioning of their mental and social structures, their needs, their interests, and how they can learn better.
- Knowledge of Educational Contexts (Knowledge of Educational System): It includes educational technologies, tools and materials, the structure of the school and classroom.
- Knowledge of Philosophical and Historical Objectives of Education: It includes the general purposes and objectives of education and its philosophical foundations.
- Pedagogical Content Knowledge: It contains knowledge about how to teach any course or subject by using appropriate teaching-methods and techniques and how to make it understandable for students.

The person, who first introduced PCK into the literature was Lee Shulman, afterwards some researchers expanded some of Shulman's categories and introduced a number of different categories of teacher knowledge (Unat, 2011). Following the modelling of Shulman (1986) Grosman (1990) expanded the knowledge that teachers should have within the framework of PCK and modeled it.

In Grosman's model, the areas surrounding PCK were Pedagogical Knowledge, Learning Environment Knowledge, and Subject Field Knowledge. Grosman (1990) described these areas as follow: Pedagogical Knowledge covers knowledge and beliefs about learners and learning, curriculum, classroom management, beliefs and knowledge about the purposes and objectives of education; context knowledge includes the opportunities available in the region where the teacher works, Expectations and limitations, Knowledge about the interests and backgrounds of the students, Knowledge about the school environment and the families of the students.

After Grosman (1990), Cochran, DeRuiter and King (1993) constructed PCK as Knowing Pedagogical Field. In their model, these researchers have particularly stated that teachers should know about their students' learning and the environment in which the learning-teaching process occurs.

In the model of Gess-Newsome (1999), which was considered as *Integrative Model* after Grosman, PCK was taken as a separate knowledge area. Here the knowledge that teachers should have was formed as the result of the intersection of the following three concepts: subject matter knowledge, pedagogical knowledge and contextual knowledge. In her transformative model, Gess-Newsome (1999) created Pedagogical Content Knowledge by transforming subject matter knowledge, pedagogical knowledge and contextual knowledge into a single form. Integrative and transformative models have been introduced by Gess-Newsome (1999) and the difference between these two models can be expressed by compound-mixture analogy, where the mixture shows the properties of the substances added into it, while the compound does not have the properties of the constituent substances, i.e. a new substance is formed. Here, the compound is the

transformative model and the mixture is the integrative model. In the transformative model, there is a new form of comprised of PCK's subject area, pedagogy and learning environment knowledge, whereas in the integrative model, this three knowledge come together in the classroom and get integrated (Gess-Newsome, 1999).

Methodology

The bibliometric method was used to determine the characteristics of the studies published in the Pedagogical Content Knowledge subject area. Bibliometric methods have been used to address the bibliographies of scientific studies by using statistical methods and to reveal the scientific thinking of these researches (Ding, 2011).

Data Collection Process

The data of this research was obtained through the scanning of Web of Science Core Collection database for "Pedagogical Content Knowledge" title, in 1970-2019. For the 2,092 researches published in the Pedagogical Content Knowledge subject area, their publication year, publication type, publication language, title, author names, authors' countries, the number of citations that they made and the number of sources that they were cited, keywords and bibliography information were accessed.

Data Analysis

In order to determine common citation networks and concept-subject orientations of the 2,092 researches accessed through the Web of Science database, the data were loaded to the Cite Space program in the appropriate format and the analyzes were carried out. Cite Space is a Java application used to visualize and analyze emerging trends and changes in scientific literature (Chen, Ibeve-San Juan & Hou, 2010). Various characteristics of the network that emerged as a result of the analysis of the data obtained for Pedagogical Content Knowledge topic through Cite Space were calculated. These are; network density, mean silhouette value of the network and the modularity (Q) of the network. Among these computations, network density indicates the number of connection used in a network (Al & Doğan, 2012). The Modularity (Q) value of the network indicates whether the network can be divided into modules, and it takes a value between 0-1 expressing certain meaning according to its magnitude. In a well-structured network, the modularity value is high; whereas the modularity value of a poorly structured network is low, i.e. a network that cannot be reduced to clusters with net borders (Chen et al., 2010). A modularity value equal to or greater than 0.6 indicates

that the division is significant (Newman, 2004). As the final computation, the mean silhouette value of the network takes a value between -1 and +1 (Chen et. Al., 2010). Mean silhouette value indicates the clustering formed in the network and for a good clustering, this value should be greater than 0.7 (Simovici, 2007).

In this study, the positions of country collaborations, cited journals and publications, and concepts in the network were determined according to their betweenness centrality value, which indicates the degree of the connection between a node and other nodes that are not connected to each other. The higher level indicates that the node acts as a bridge between the other nodes (Ni, Sugimoto & Robbin, 2017). Another important finding of the study is citation bursts, which indicate statistically significant fluctuations of a frequency over the total time period (Chen et al., 2010). Regarding the topic tendencies of the articles, the Term Frequency-Inverse Document Frequency (TF-IDF) and Log-Likelihood Ratio (LLR) algorithm were used and the trendy topics of Pedagogical Content Knowledge subject area were discussed.

Findings

Number of Publications According to Years

Table 1
Distribution of Publications by Years

Years	Frequency (n)	Percentage (%)
1988-1991	10	0.48
1992-1995	31	1.48
1996-1999	31	1.48
2000-2003	52	2.49
2004-2007	72	3.44
2008-2011	288	13.77
2012-2015	632	30.21
2016-2019	976	46.65
TOTAL	2,092	100

The distribution of the 2,092 researches in the “Pedagogical Content Knowledge” field, in 1988-2019 according to years is displayed in Table 1. Accordingly, it was found that the highest number of studies was published in the period of 2016-2019 (n = 976). The number of studies have generally increased in each time period.

Types of Publication

Table 2

Distribution of Publications According to Type

Type of Publication	Frequency (n)	Percentage (%)
Article	1604	76.6
Proceedings Paper	407	19.4
Meeting Abstract	37	1.7
Review	37	1.7
Editorial Material	18	0.8
Book Review	4	0.1
Book Chapter	2	0.09
Note	2	0.09

The types of publications in the Pedagogical Content Knowledge subject area are given in Table 2. Accordingly, it can be seen that 8 different types of publications were made. As some of the studies were included in more than one category, the percentages were calculated over 2,111. Regarding the types of publications, the majority are in the form of article and proceedings paper, which have a rate of 96% among other types of publications.

Language of publication

Table 3

Distribution of Publications According to Languages

Language	Frequency (n)	Percentage (%)
English	1917	91.63
Spanish	96	4.59
German	32	1.53
Turkish	20	0.96
Portuguese	10	0.48
Dutch	4	0.19

The publication language of the studies in the Pedagogical Content Knowledge subject area is given in Table 3. Accordingly, the studies were written in 14 different languages. Of the 2,092 studies, 91.63% of them were English, followed by Spanish (4.59%). Among the studies, there are some publications in Turkish with a percentage of 0.96%.

Citation Analysis

The total number of citation made to 2,092 studies in Pedagogical Content Knowledge subject area, published in 1988-2019, is 26,228. For these studies, the average

number of citations per research is 12.54 and the average number of citations per year is 846.06.

Table 4

Number of Citations Received according to Years

Years	Number of Received citation	Percentage (%)
1989-1994	68	0.26
1995-1999	207	0.79
2000-2004	416	1.59
2005-2009	1831	6.98
2010-2014	8119	30.95
2015-2019	15587	59.43
TOTAL	26228	100

The number of citations taken in the Pedagogical Content Knowledge subject area is given in Table 4. Accordingly, it was reported that the highest number of citations to 2,092 studies have been made in 2015-2019 ($n = 15,587$). The citations received in the determined time periods constantly increased over the years. The number of received citations increased significantly after 2009, and the citations made after this year account for 90.38% of all citations.

Country Collaborations

Social network analysis was performed to determine the studies that researchers from different countries have performed together. The name of the countries were scaled according to the degree of centrality and they are show in Figure 1.



Figure 1. Country Collaborations

As a result of the analysis performed in Pedagogical Content Knowledge subject area, a network consisting of 83 nodes and 171 connections was obtained and shown in Figure 1. The network is comprised of 10 clusters and has a density of 0.12. Modularity value of the network is found to be $Q = 0.32$, and mean silhouette value is 0.30. The network values of top 10 countries, which have a significant place in the network, are given in detail, in Table 5.

Table 5

Country Collaborations and Degree of Centrality

Countries	Frequency	Year	Cluster#	Countries	Frequency	Year	Cluster#
USA	590	1992	4	USA	0.39	1992	4
Turkey	209	2008	1	Australia	0.38	2004	1
Germany	146	2006	1	Netherlands	0.19	2001	2
Australia	115	2004	1	England	0.19	2006	2
Spain	96	2010	3	Peoples China	0.14	2007	0
Taiwan	94	2008	0	Germany	0.13	2006	1
Netherlands	85	2001	2	Spain	0.09	2010	0
South Africa	84	2011	2	Malaysia	0.09	2010	0
Peoples China	81	2007	0	Chile	0.09	2015	3
England	73	2006	2	Turkey	0.07	2008	1

Country collaborations and degree of centrality of the studies carried out in the Pedagogical Content Knowledge area are given in Table 5. Accordingly, it is seen that the USA takes first place in country collaboration (n = 590). Regarding the degree of centrality, USA was found to have the highest degree of centrality (n = 0.39).

Table 6

Citation Burst Values of the Countries according to Years

Countries	Burst	Start	End	1970-2019
USA	49.8103	1992	2008	
England	3.9563	2006	2009	
Taiwan	5.0719	2008	2013	
Malaysia	5.0822	2010	2014	
Singapore	6.946	2011	2014	

Regarding the citation burst values in Table 6, the country with the highest citation burst was USA between 1992 and 2008 (49.8103). Furthermore, USA is the country where the studies that directed the field in the 17-year period between 1992 and 2008 were performed. The countries where recent studies published in the Pedagogical Content Knowledge subject area are Malaysia (2014) and Singapore (2014).

Journal's Common Citation Network

The common citation network analysis of the journals aims to determine the journals, in which the significant scientific works that were cited by other studies have been published in the field of Pedagogical Content Knowledge.



Figure 2. Journal's Common Citation Network

The network consists of 282 nodes (journals that are the source of citation), 1,510 connections and 39 clusters. The density of the network is 0.03. Modularity value of the network is $Q = 0.53$, and mean silhouette value is 0.21.

Table 7

Journals Receiving Common Citations and Their Degree of Centrality

Journals	Frequency	Year	Cluster#	Journals	Frequency	Year	Cluster
Educational Research	1254	1989	1	Teachers College Record	0.18	1989	3
Teaching & Teachers Education	974	1993	1	Educational Research	0.16	1992	1
Harvard Education Review	906	1990	1	Educational Psychology	0.13	1997	5
Teachers College Record	745	1989	3	The Elementary School Journal	0.11	1993	4
Journal of Teacher Education	743	1991	1	Educational Leadership	0.11	1993	0
Journal of Research in Science Education	673	1998	0	Journal of Educational Psychology	0.09	1991	1
International Journal of Science Education	608	2001	0	Journal of Food Science	0.09	1994	4
American Educational Research Journal	531	1993	1	Housing and Development Board Research Teaching	0.09	1989	1

Journals	Frequency	Year	Cluster#	Journals	Frequency	Year	Cluster
Computers & Education	530	2008	3	Housing and Development Board Resource Teacher Education	0.09	1993	0
Review of Educational Research	518	1993	0	Teaching & Teacher Education	0.08	1993	1

The journal that has been cited the most by the researches published in the field of Pedagogical Content Knowledge subject area is “*Educational Research*” (n = 1254). “*Teachers College Record*” journal is positioned at the most central position of the network.

Table 8

Citation Burst Values of the Journals according to Years

Journals	Burst	Start	End	1970-2019
<i>Housing and Development Board Research Teaching</i>	33,7853	1989	2010	
<i>Harvard Education Review</i>	5,2238	1990	1994	
<i>Journal of Curriculum Studies</i>	6,8462	1991	1999	
<i>American Educational Research Association</i>	18,1585	1991	2014	
<i>Educational Psychology</i>	6,1057	1991	1999	

Author’s Common Citation Network

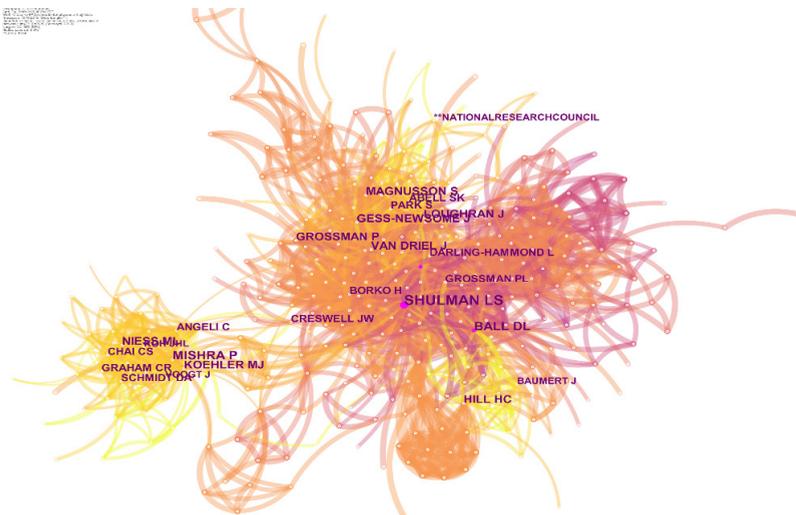


Figure 3. Author’s Common Citation Network

Author's common citation network consists of 427 nodes (authors that are source of the citations), 2,026 connections and 69 clusters. Its density is 0.02, Modularity value is $Q = 0.01$, and mean silhouette value is 0.20.

Table 9

Number of Citation for Commonly Cited Authors

Authors	Number of Citation	Year	Cluster#
Lee Shulman	1439	1989	0
Punya Mishra	562	2007	3
Deborah L. Ball	416	1989	0
Matthew J. Koehler	397	2006	3
Shirley Magnusson	354	2002	1
Jan H van Driel	352	2001	1
Pamela L. Grossman	336	1994	1
John Loughran	294	2004	1
Harold C. Hill	250	2006	5
Julie Gess-newsome	245	2002	1

The authors who were cited in the researches performed in Pedagogical Content Knowledge subject area are shown in Table 9. Accordingly, the most cited author in 2,092 studies is Lee Shulman ($n = 1439$) followed by Punya Mishra ($n = 562$) and Deborah L. Ball ($n = 416$).

Table 10

Citation Burst Values of the Authors According to Years

Authors	Burst	Start	End	1970-2019
Robert J. Marks	20,8595	1991	2009	
Gaea Leinhardt	23,2302	1991	2011	
Svala Gudmundsdottir	14,1031	1991	2004	
Sharon Feiman-Namser	7,0141	1991	2005	
Wilson W. Smith	16,8666	1991	2011	

Publication's Common Citation Network

The network formed as a result of the analysis consists of 482 nodes (publications that are source of the citations), 1,579 connections and 88 clusters. The density of the network is 0.01, Modularity value is $Q = 0.76$, and mean silhouette value is 0.22.

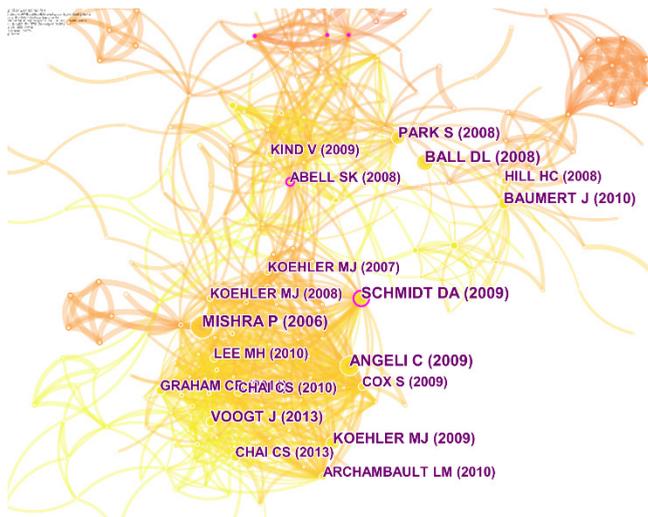


Figure 4. Publication's Common Citation Network

Table 11

Number of citations taken by Citation Sources

Sources	Number of Citations	Year	Cluster#
Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge.	168	2006	0
Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK).	158	2009	0
Denise A. Schmidt, Evrim Baran, Ann D. Thompson, Punya Mishra, Matthew J. Koehler & Tae S. Shin (2009) Technological Pedagogical Content Knowledge (TPACK),	136	2009	0
Ball, D. L., Thames, M.H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special?	130	2008	6
Park, S., & Oliver, J. S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): PCK as a conceptual tool to understand teachers as professionals.	113	2008	1
Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., ... Tsai, Y.M. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress.	112	2010	6
Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge?	107	2009	0
Voogt, J., Fisser, P., Pareja Roblin, Tondcur, J., & van Braak, J. (2012). Technological content knowledge-a review of the literature.	93	2013	0

Sources	Number of Citations	Year	Cluster#
Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework.	90	2010	0
Graham, C., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris, R. (2009). TPACK Confidence of Inservice Science Teachers.	89	2011	0

The source mostly cited by the researches published in the Pedagogical Content Knowledge subject area is the article included in Cluster #0, performed by Mishra and Koehler, in 2006. Moreover, the most recent reference source among the most significant 10 sources is the study in Cluster #0, handled by Voogt, Fisser, Pareja Roblin, Tondcur & van Braak, in 2013 (n = 93).

Table 12

Citation Sources' Degree of Centrality

Sources	Centrality	Year	Cluster#
Borko, H. and Putnam, R. (1996). Learning to each. In D. C. Berliner and R.C. Calfee.	0.31	1996	3
Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources and development of pedagogical content knowledge for science teaching.	0.29	1999	3
Schempp, P.G., Manross, D., Tan, S. et al. (1998b). Subject expertise and teachers' knowledge.	0.28	1998	2
Putman, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning?	0.20	2000	3
Sandra K. Abell, (2008). Twenty Years Later: Does pedagogical content knowledge remain a useful idea?	0.16	2008	1
Driel, J. H. Van, (2002). The Development of Preservice Chemistry Teachers' Pedagogical Content Knowledge.	0.16	2002	1
Denise A. Schmidt, Evrim Baran, Ann D. Thompson, Punya Mishra, Matthew J. Koehler & Tae S. Shin (2009) Technological Pedagogical Content Knowledge (TPACK).	0.15	2009	0
Loughran, J., Mulhall, P. & Berry, A, (2004). In Search of Pedagogical Content Knowledge in Science: Developing Ways of Articulating and Documenting Professional Practice.	0.15	2004	1
Hashweh, M. Z. (2005). Teacher pedagogical constructions: A reconfiguration of pedagogical content knowledge.	0.13	2005	1
Van Driel, J. H., Verloop, N., & De Vos, W. (1998). Developing science teachers' pedagogical content knowledge	0.13	1998	3

It can be seen that among the studies published in Pedagogical Content Knowledge subject area the sources with the highest centrality are the article written by Borko and Putnam in 1996 (0.31) and the one written by Magnusson, Krajcik & Borko in 1999 (0.29).

Table 13

Citation Burst Values of the Sources according to Years

Authors	Burst	Start	End	1970-2019
Shulman, L. S. (1986). Those Who Understand; Knowledge Growth In Teaching,	11.61	1989	1994	
Shulman, L. S. (1987). "Knowledge and Teaching: Foundations Of The New Reform"	14.85	1990	1995	
Marks, R. (1990). Peda- gogical Content Knowl- edge: From a Mathemat- ical Case to a Modified Conception	6.63	1992	1998	
Wilson, S. M., Shulman, L. S., & Richert, A. (1987). 150 different ways of knowing: Representations of knowledge in teaching.	5.40	1993	1995	
Smith D.C. (1989).The Construction of Subject Matter Knowledge in Pri- mary Science Teaching.	4.69	1993	1997	

When the sources are analyzed according to the citation burst, it is seen that the source with the highest citation value is the article realized by Lee Shulman (1987).

Topic Clusters of Pedagogical Content Knowledge

Table 14

Topic Clusters Formed according to Citation Sources

Cluster	Size	Mean Silhouette	Label (TFIDF)	Label (LLR) p-value	Average Citation Year
0	86	0.878	Process	Technological Pedagogical Content Knowledge (6704,03, 1.0E-4)	2009
1	66	0.759	Integration	Learning Progression (2675,86, 1.0E-4)	2006
2	55	0.997	Physical Education	Physical Education (9687,27, 1.0E-4)	1991
3	46	0.927	Practical Knowledge	Research Project (3274,59, 1.0E-4)	1997
4	26	0.938	Students	Mathematics Teacher (2093,39, 1.0E-4)	2003
5	25	0.916	Stem Education	Teacher Educator (1990,75, 1.0E-4)	2014
6	21	0.933	Pedagogical Knowledge	Learning Opportunities (2455,68, 1.0E-4)	2010
7	18	1	Benefits	Architectural Education (1592,76, 1.0E-4)	2005

Topic clusters of the studies performed in pedagogical content knowledge subject area are given in Table 14. Accordingly, the largest cluster is Cluster # 0, which contains publications related to *process* (n = 86). Mean Silhouette value of this cluster is 0.878 and the average citation year for the studies in the cluster is 2009. The most recent research topic in the Pedagogical Content Knowledge subject area is *Teacher Educator* (2014).

Word Analysis

Table 15

Common Words Used in Publications and their Degrees of Centrality

Word	Frequency	Year	Word	Centrality	Year
Pedagogical Content Knowledge	795	1995	Pedagogical Content Knowledge	0.15	1995
Education	406	1995	Education	0.14	1995
Pedagogical Content Knowledge	357	2002	Belief	0.11	2001
Tpack	227	2010	knowledge	0.09	1996
Acience	209	1998	Classroom	0.09	2009
Framework	202	1995	Teacher Knowledge	0.09	2003
Knowledge	196	2010	Ict	0.09	2009
Student	169	1996	Framework	0.07	2010
Belief	166	1998	Mathematic	0.07	2002
Professional development	154	2001	Instruction	0.07	1993

The common words used in the studies in the Pedagogical Content Knowledge subject area and their centralities are given in Table 15. Accordingly, the most commonly used concept in this field is “*Pedagogical Content Knowledge*” (n = 795), followed by “*Education*” (n = 406). At the same time, the concept of “*Pedagogical Content Knowledge*” has the highest degree of centrality (n = 0.15).

Conclusion

Bibliometric characteristics of 2,092 studies on pedagogical content knowledge, published in the period of 1970-2019 (until 27 March 2019), accessed from Web of Science Core Collection database were analyzed. It was found that even though there are fluctuations in the distribution of publications by years, the number of studies has usually increased since 1970 and the highest number of studies was published between the years 2016-2019.

In this study, it was found that 8 different types of studies, namely article, proceedings paper, meeting abstract, review, editorial material, book review, book chapter and note were published in Pedagogical Content Knowledge subject area. According to these figures, the most produced types of publication are article and proceedings paper.

It is seen that in the Pedagogical Content Knowledge subject area, the studies were published in 14 languages including English, Spanish, German, Turkish, Portuguese, Dutch, Chinese, Korean, Italian, Afrikaans, French, Icelandic, Russian and Serbian. The most commonly used language is English and constitutes 91.63% of the studies, which indicates that English is the universal science language in scientific studies.

Regarding the number of citations taken by 2,092 studies published in Pedagogical Content Knowledge subject area, between 1970 and 2019 according to years, the highest number of citations was realized in 2015-2019. This shows that in recent years, certain sources have been widely used in the researches performed in the field.

Regarding the country collaborations, it can be concluded that US is the pioneer country in providing scientific communication in the Pedagogical Content Knowledge subject area and undertakes a key role. Australia is ahead of the Netherlands in the field after the US. Meanwhile, it can be said that Turkey is the country having the most studies after US. In addition, the country with the highest citation rate was found to be the United States.

In the Pedagogical Content Knowledge subject area, the most cited journal is “*Educational Research*”. The journal with the highest centrality is the “*Teachers College Record*” journal. It can be said that this journal is a guide and an important source for the studies in the field.

The most cited authors are Lee Shulman and then Punya Mishra & Deborah L. Ball. From this, it can be concluded that the authors made important contributions to the Pedagogical Content Knowledge subject area. When the sources are analyzed according

to citation burst, it is seen that the source with the highest citation burst value is the article of Lee Shulman (1987). This paper has been effective in the Pedagogical Content Knowledge subject area in the period 1989-1994 and it can be expressed as a publication which has been directed the studies in the field between these years.

As a result of the word analysis, it was concluded that the most used concepts in the studies were “*Pedagogical Content Knowledge*” and “*Education*”. The most studied subjects in the field were “*Technological Pedagogical Content Knowledge*” and “*Learning Progression*”.

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Pedagoginio turinio žinių bibliometrinis profilis

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Santrauka

Šio tyrimo tikslas yra atlikti 2 092 pedagoginio turinio straipsnių, paskelbtų 1970–2019 m. (iki 2019 m. kovo 27 d.), bibliometrinę analizę ir atskleisti pedagogikos mokslo komunikacijos ypatumus ir tendencijas per pastaruosius 50 metų. Visi pedagoginio turinio straipsniai buvo ieškomi „Web of Science“ duomenų bazėje ir analizuojami, taikant bibliometrinės analizės metodą.

Taip pat buvo pasitelktas socialinių tinklų analizės metodas, siekiant nustatyti šalis, paskelbusias jungtines pedagoginio turinio studijas. Socialinių tinklų analizė padėjo nustatyti „citavimo tinklą“, atskleisti „žurnalo, autoriaus ir publikacijos“ bendravimo tinklą ir „konceptijos ir dalyko“ raidos tendencijas. Analizuojant socialinius tinklus buvo naudojama „CiteSpace“ programa. Duomenys buvo gauti iš 2 092 straipsnių.

Bibliometrinė ir socialinių tinklų analizė atskleidė, kad daugiausia pedagoginio turinio publikacijų buvo paskelbta 2016–2019 m. Dauguma pedagoginių studijų buvo pristatyta straipsnių forma, paskelbta anglų kalba. Kalbant apie mokslininkų bendradarbiavimą, matyti, kad JAV yra mokslinės komunikacijos pedagogikos srityje pradininkė ir užima lyderio pozicijas. Terminų analizė parodė, kad straipsniuose dažniausiai vartojamos sąvokos buvo „pedagoginio turinio žinios“ ir „švietimas“. Studijose dažniausiai nagrinėti mokymo(si) technologijų ir mokymo(si) pažangos klausimai.

Esminiai žodžiai: *pedagoginio turinio žinios, mokytojų rengimas, bibliometrija.*

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