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Identifying Research Trends for Technology Use in Pre-School Curricula through Content and Bibliometric Analysis Methods

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Abstract: The aim of this study is to identify research trends for technology use in pre-school curricula. Research trends were analysed by employing content and bibliometric analysis methods. A total of 3,302 articles indexed by Web of Science between 1975 and 2020 were analysed using bibliometric mapping analysis and a total of 31 studies indexed by Web of Science between 2016-2020 were analysed using content analysis. The results obtained from the study reveal that the effect of technology is examined in different fields and with different stakeholder groups. It is identified that qualitative methods, interview/focus group interview forms, articles as document types and pre-school teachers among other sample groups were preferred more frequently. The country with the highest number of citations is identified as the United States of America and the organisation with the highest number of citations is identified as University of Virginia. It is recommended that researchers design their studies by following the trends in the field and conduct studies that address the gaps in the field.

Keywords: *Bibliometric analysis, curriculum, content analysis, pre-school education, technology, technology use in pre-school education.*

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1. Introduction

Pre-school education has a particularly significant place today for a child's self-knowledge and development. Pre-school education, which is the first social environment that children get to know other than their family and immediate environment, shapes their social skills by taking on the care and development of children while parents are working and it forms the foundations of lifelong learning by preparing children for the primary education level (European Commission, 2019; Çimen & Koçyiğit, 2010; Wang et al., 2019). It focuses on developing children's creative skills, and is also of vital importance for the child's development (Shulha et al., 2021). Its contribution to the cognitive development, socialisation and early childhood education of the child is indispensable for parents (Kamerman, 2007). The significance of pre-school education cannot be challenged for children to gain qualifications in many areas, to cope with problems and for the greater development of countries in various aspects (Melhuish, 2014). Referring to the significance of well-educated societies for the social and economic development of countries, Aslanargun and Tapan (2011) state that pre-school education, which covers the 0-6 age period, supports both the growth processes at home and children's social and language development. Tuncer (2015), stating that pre-school education is the most important period in an individual's life, highlights the necessity of educational programmes for a high quality pre-school education.

Educational programmes cover learning experiences that shape the daily lives and experiences of children, set goals to meet their needs and prepare them for school (Jenkins et al., 2019; Pechtelidi & Stamou, 2017). Furthermore, the curricula should be designed in such a way that will support children's acquisition of 21st century skills, and equip them with qualifications necessary for the information society. Particularly in the post-modern age, the development of children's artistic creativity is important for them to interpret the world and culture surrounding them. Reforms carried out to increase the effectiveness of pre-school education aim to bring out the creativity of children and aim to develop pedagogical technologies accordingly (Shulha et al., 2021).

Shulha et al. (2021) draws attention to the lack of pedagogical technologies aimed at developing children's creativity skills in the pre-school period and points out that technology should also be developed for the development of creative skills. Bicen and Haidov (2021) express that individuals' lives in the modern age are interlinked with technology and emphasise that it is impossible to think of a modern individual without

thinking of technology. In the same line as Bicen and Haidov (2021), Gurevych et al. (2021) state that the modern world cannot be imagined without technology and point out to the significance of technology in all areas of human activities, particularly in education.

Gimbert and Cristol (2004) address the use of technology in the pre-school curricula and emphasise the effectiveness of technology use on student achievement and teacher quality. In a similar line, Otterborn et al. (2019) state in increasingly digitalised societies, pre-school curricula take account of technology and science issues as priority learning areas. Stating that technology, which has an important place in children's cognitive knowledge acquisition and learning should be included in curricula, Stošić (2015) explains that the use of technology is necessary to effectively interact with students and motivate them to learn. Kol (2012) states that the use of technology in pre-school education motivates children, provides better learning of and enriches the pre-school curricula. Technology, which is an important field in pre-school curricula, provides an environment to develop children's creativity; strengthens family participation and home-school communication by enhancing children's learning (Snell et al., 2020; Sundqvist & Nilsson, 2018). From a different point of view, Mustafaoğlu et al. (2018) state that there are studies that highlight the benefits of technology for children and on the other hand there are studies that demonstrate the health risks and address the negative effects of digital technology use with children. In this context, both parents and preschool teachers should take on the guiding role in order for children to use technology effectively and protect children from risks in virtual environments.

Technology that provides individuals with rich experiences, individualises education, affects the structure and function of educational institutions, should be used to support and improve teaching activities; teachers should possess the knowledge and skills for the use of new technologies to support learning and teaching (Akpınar, 2003; Farjon et al., 2019). Furthermore, it is also not sufficient for teachers to only know the technology, they are expected to have competence in the use of technology (Yücel & Koçak, 2010). In a similar line, noting that the educational needs have changed; Shevchenko et al. (2021) point out to the need for education that focuses on teaching more flexible, accessible, applicable, creative and problem-solving skills. Supporting Yücel and Koçak (2010), Shevchenko et al. (2021) state that teachers should also be able to apply technology at a high level in order to adapt to change.

Providing pre-school teachers with technological competence is only possible through well-designed teacher training programs. While one of the

bases of pre-school education is education programs, the other one is teacher training programs and teachers. In a similar line, parents should take an active role in their children's academic and personal development, and collaborate with their children's teachers. In order to educate individuals needed in today's information societies, contributions should be provided for pre-school education, innovations should be followed and the development of education stakeholders should be supported in a way to meet their needs. In this context, the aim of this study is to identify the tendencies for technology use in pre-school curricula and to provide resources to researchers in this regard. In the study answers to the following questions were sought:

1. How are the distribution of studies on technology use in pre-school curricula according to their;
   1.1. subject area,
   1.2. methodology,
   1.3. data collection tools,
   1.4. sample group,
   1.5. document type,
   1.6. year of publication?
2. Who are authors with the highest number of citations?
3. Which are the countries with the highest number of citations?
4. Which are works with the highest number of citations?
5. Which are organisations with the highest number of citations?
6. Who are authors with the highest number of co-citations?
7. Which are the sources with the highest number of co-citations?
8. What are the most common keywords used by researchers in studies?

2. Methodology

In the study, articles indexed by Web of Science, one of the online electronic resources, were analysed using content and bibliometric analysis methods. Web of Science, an information and technology provider for scientific research communities, offers reliable research data with more than 76 million records, more than 111,000 books and more than 8 million conference papers, and features a rich collection of citation indices (Web of Science, 2020). In a similar line, Web of Science covers a large number of journals and offers researchers extensive opportunities for research (Demir and Erigüç, 2018). In this context, Web of Science was chosen as the source to form the data set in the study.

2.1. Data collection, data collection tool and analysis

The data collection process was carried out in 2 stages. In the first stage of the study, data for content analysis was collected and the analysis was completed, and in the second stage, bibliometric analyses were carried out.

2.2. Data collection for the content analysis, data collection tool and analysis

In order to determine the research trends for the use of technology in pre-school curricula, the articles indexed by Web of Science within the last 5 years were included in the data source of the study. The study covers studies published between 2016-2020 (Data collection process was finalised on 31 May 2020). The sources indexed by Web of Science have been filtered with the language option as "English" and document types as "article". The search was conducted with the Advanced Search function and the options of title, abstract, author, keywords, keywords plus were selected; a detailed literature search was performed and the search strings "pre-school curriculum" and "technology" were used. The indices of the articles written in English within the last 5 years were identified as SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH and ESCI, and a total of 41 articles were identified. The study was limited with the "education educational research" category, which is one of the Web of Science categories, and a total of 32 articles in this category were analysed. However, the content of 1 article could not be retrieved and the content analysis of the study was carried out with 31 articles. Content analysis is a research method that enables the systematic and reliable analysis of qualitative data, and allows the researcher to make generalisations about the categories of interest (Haggarty, 1996). The Publication Classification Form prepared by Çelik (2017) was used as the data collection tool in the study. The form consists of the following sections; "publication type, year, data collection tools, sample group and selection method, sample size, data analysis method, keywords used, research method and subject areas". Articles examined in within the scope of the study (n=31) are analysed according to their publication type, year, subject areas, sample group, research method and data collection tools.

The data obtained from the study was classified by the researcher, coded, collected under themes and categories, and their frequencies and percentages were calculated. In order to increase the reliability of the content analysis, the researcher obtained approval for the convenience of the data by receiving the views of two other experts.

2.3. Data collection and analysis for the bibliometric analysis

The bibliometric analysis method was employed in order to examine the research on the use of technology in pre-school curricula with a broader perspective. Bibliometric analysis is a quantitative method that uses the citation history of scientific research as data to measure the scientific impact, evaluates scientific research, analyses articles, sources that publish these articles, citations, and the link between articles and authors and their fields of study (Lee et al., 2005; Rehn et al., 2014). The Advanced Search function and topic option in Web of Science Core Collection was preferred for bibliometric analysis. In the bibliometric analysis, in addition to the keywords used as search strings for the data collection of content analysis, the keywords related to pre-school education were included in the search strings and a comprehensive analysis was aimed. By using search strings in Web of Science (TS=(technology AND preschool education OR preschool education program OR preschool curriculum OR learning for preschool OR teaching for preschool); all languages, all document types (Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI) and all years were included in the data source. No limitations were made for the bibliometric analysis and a total of 3,302 publications published in the education educational research category from 1975 to 2020 were analysed (Data collection process was finalised on May 3, 2020). The network structures of the publications examined within the scope of bibliometric analysis were completed with VOSviewer software, which is frequently used in bibliometric studies (version 1.6.15, 2020). VOSviewer, developed by Van Eck and Waltman (2010), is a software tool used to create and visualise bibliometric networks; it offers a text mining function used to visualise journals, researchers or individual publications based on citation, bibliographic matching, co-citation or co-authorship relationships, and particularly to create networks of terms in the literature (VOSviewer, 2020).

2.4. Limitations of the study

The study is limited with Web of Science among online electronic resources and the "Education Educational Research" category among the categories listed in Web of Science categories. In this study, in which content analysis and bibliometric analysis methods are used, content analysis is limited with articles as type of documents and English as language. Also the content analysis is limited with the analysis of studies that are conducted within the last 5 years. Furthermore, the search strings are limited with the terms "*preschool curriculum, preschool education, preschool education program, learning for preschool, teaching for preschool and technology*" in the study.

3. Results

In this part of the study, the findings obtained from the content analysis and bibliometric analysis are presented.

3.1. Findings obtained from the content analysis

The findings obtained from the content analysis were tabulated and interpreted according to the articles' subject area, methodology, data collection tool, sample group, type of publication and year.

The distribution of articles according their subject area

The distribution of the studies carried out for the use of technology in pre-school curricula between 2016-2020 according to their subject areas is presented in Table 1.

Table 1. Distribution according to subject area

Source: Authors' own conception

Theme	Category	n	%
Technology supported education environment	Integration of digital tablets	2	6,4
	STEM integration	2	6,4
	ICT supported classrooms	2	6,4
	Digital games	2	6,4
	Literacy and collaboration skills	2	6,4
	Use of AR technology	1	3,2
	Class interaction	1	3,2
Technology supported education programme	Maths exercises and technology	4	12,9
	Bilingual education/language teaching	2	6,4
	Cultural-historical activities and technology	1	3,2
	Social learning	1	3,2
	Learning with technology	1	3,2
	Literacy	1	3,2
	Reggio Emilia Approach	1	3,2
	Technology education	1	3,2
Technology supported family education	Development of speaking skills	1	3,2
Healthy nutrition and technology	Prevention of child obesity	1	3,2
Science and technology education	Use of technology in science education	1	3,2
The role of teacher in technology use	Pre-school teachers' use of ICT	2	6,4
	Advantages and limitation in the use of technology	1	3,2
Technology supported evaluation	Online child evaluation system	1	3,2
Total		*31*	*100*

The findings obtained from the content analysis are examined under 7 themes. Findings from the study reveal that the articles focus on the integration of technological tools in pre-school education environments (n=12, 38,4%). Similarly, it is identified that studies on the use of technology in pre-school curricula have also been conducted (n=12, 38,5%). The studies under this theme tend to focus on technology and media integration, mostly in mathematics activities (n=4, 12,9%). Some of the studies carried out within the last 5 years are studies in which family education (n=1, 3.2%), healthy nutrition (n=1, 3.2%), science and technology (n=1, 3.2%), teacher competencies (n=3, 9.6%), evaluation (n=1, 3.2%) are linked with technology.

The distribution of articles according to their methodology and data collection tools

It is identified that a qualitative research methodology was mostly preferred in the articles (n=10). While 7 of the articles examined within the data source of the study were conducted with mixed method, it is identified that 2 articles were conducted with quantitative research method.

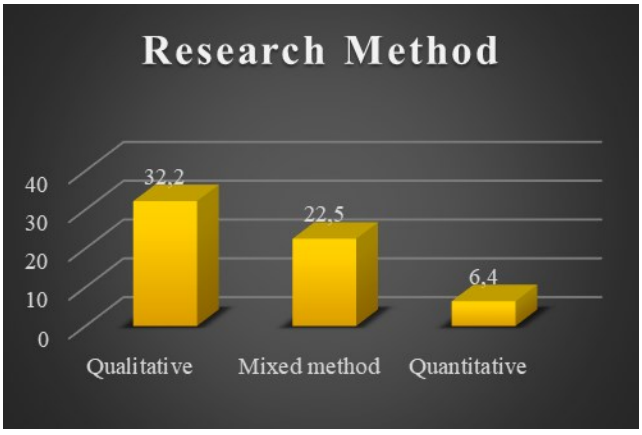


Figure 1. Distribution according to methodology

Source: Authors' own conception

It is identified that the interview/focus group interview forms were preferred as the data collection tools in the articles (n=11, 35.4%). The findings obtained from the study reveal that online surveys (n=6), observations (n=6), literature review/documents (n=6) and achievement tests (n=3) are also preferred as data collection tools in the articles.

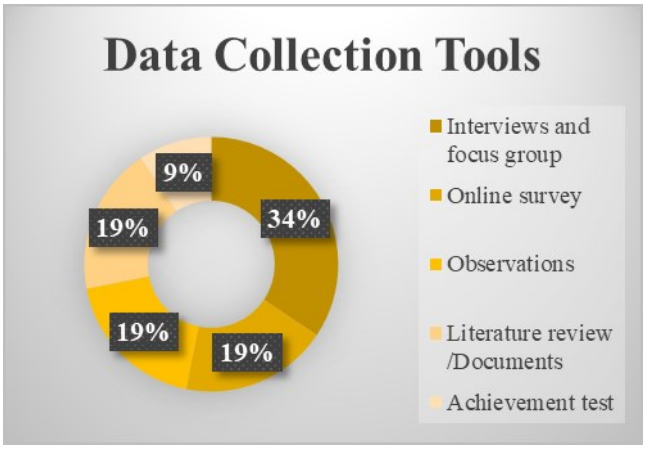


Figure 2. Distribution according to data collection tools
Source: Authors' own conception

The distribution of articles according to their sample group

When the findings for the sample group of the articles are examined, it is seen that the studies were mostly carried out with pre-school teachers (n=14, 45,1%). Besides, another sample group that is studied extensively in articles is children (n=10, 32,2%). In a limited number of studies the sample groups constitute classroom teachers (n=2, 6.45%), child development specialists (n=1, 3.2%), day care staff (n=1, 3.2%) and parents (n=1, 3.2%). In order to contribute to the personal and academic development of children, more studies should be carried out particularly with parents. It is considered a necessity to identify existing shortcomings and to design parent trainings that will address these shortcomings. In addition, it is believed that it is important to design studies preschool teachers, children and parents come together in collaborative learning environments.

Distribution of articles according to document type and year of publication

A total of 56 publications were accessed in this study, in which research trends towards the use of technology in pre-school curricula are examined. The distribution of studies according to Web of Science categories is identified as; for the "*Education Educational Research*" category (n=31), for the "*Education Scientific Disciplines*" category (n=5), for the "*Psychology Developmental*" category (n=4), "*Engineering Multidisciplinary*" (n=3), for the "*Computer Science Interdisciplinary Applications*", "*Language Linguistics*", "*Linguistics*" and "*Psychology Educational*" categories (n=1). The distribution of

the studies (n=56) indexed in all categories of Web of Science by document type is presented in Table 2.

Table 2. Distribution according to document type
Source: Authors' own conception

Document Types	n	% of **56**
Article	45	80.357
Proceedings Paper	11	19.643 %
Book Chapter	2	3.571 %

As seen in Table 2, most of the studies were published as articles (n=45, 80.3%). A total of 11 of the studies were classified as Proceedings Paper (19.6%) and 2 of them were published as Book Chapters (3.5%). In this study, only the articles in the "Education Educational research" category of Web of Science were analysed by content analysis. In this context, the distribution of 32 articles according to their year of publication is presented in Table 3.

Table 3. Distribution according to publication year
Source: Authors' own conception

Publication Years	n	% of **32**
2020	2	6.250 %
2019	6	18.750%
2018	7	21.875 %
2017	10	31.250 %
2016	7	21.875 %

When the distribution of the studies published in the "*Education Educational Research*" category of Web of Science between 2016 and 2020 is examined, it is identified that the studies were mostly published in 2017 (n=10, 31.2%). Besides, it is identified that 7 studies were published in 2016 and 2018 (21.8%), 6 (18.7%) in 2019 and 2 (6.2%) studies were published in 2020.

Findings obtained from bibliometric analysis

In this section, the distribution of the studies (n=3,302) published between 1975-2020 in the "*Education Educational Research*" category of Web of Science by years, research areas, publication languages and document type are tabulated and presented. Furthermore, studies were analysed using bibliometric analysis method in order to identify current research topics and citation trends. The publications in the data set (n=3,302) were analysed using citation and co-citation methods. While citation is considered as partial indicators of the impact and quality of publications, the frequency of citing two documents together is defined as co-citation (Meho & Yang, 2007; Small, 1973). The most frequently used keywords in publications were determined using keyword analysis (co-occurrence).

Distribution of publications according to year

In the study, the distribution of the publications according to their year of publication is analysed by bibliometric analysis. The findings reveal that the studies in the field of pre-school education have gained intensity in recent years. It is identified that the studies were mostly published in 2017 (n=459, 13.901%). The year 2017 is followed by 2019 (n=428, 12.962%), 2018 (n=415, 12.568%) and 2016 (n=404, 12.235%), respectively. The years when studies were limited in number were identified as 1999 (n=7, 0.212%), 1996 (n=8, 0.242%), 2001 and 2005 (n=9, 0.273%). The findings reveal that studies on pre-school education and technology use were limited in the past years. This situation shows that the rapid changes and developments in the field of technology today are reflected in pre-school education.

Table 4. Distribution according to years
Source: Authors' own conception

Publication Years	n	% of 3302
2020	130	3.937
2019	428	12.962
2018	415	12.568
2017	459	13.901
2016	404	12.235
2015	358	10.842
2014	216	6.541
2013	159	4.815

2012	154	4.664
2011	105	3.180
2010	99	2.998
2009	72	2.180
2008	63	1.908
2007	36	1.090
2006	26	0.787
2005	9	0.273
2004	27	0.818
2003	13	0.394
2002	13	0.394
2001	9	0.273
2000	12	0.363
1999	7	0.212
1998	14	0.424
1997	15	0.454
1996	8	0.242

Distribution of publications according to areas of research

The distribution of the publications according to their area of research in the data set is presented in Table 5.

Table 5. Distribution according to research areas
Source: Authors' own conception

Research Areas	n	% of 3302
Education educational research	3302	100.000
Psychology	790	23.925
Social sciences other topics	79	2.392
Computer science	65	1.969
Linguistics	64	1.938
Business economics	49	1.484
Public environmental occupational health	28	0.848
Engineering	23	0.697
Health care sciences services	17	0.515

Music	15	0.454
Sport sciences	9	0.273
Art	8	0.242
Family studies	8	0.242
Arts humanities other topics	7	0.212
Communication	6	0.182
Environmental sciences ecology	6	0.182
Social work	5	0.151
Sociology	5	0.151
Anthropology	4	0.121
Information science library science	4	0.121
Mathematics	4	0.121
Social issues	4	0.121
Criminology penology	3	0.091
Ethnic studies	3	0.091
History philosophy of science	3	0.091

As Table 5 reveals, mostly the studies were carried out in the field of "*Education educational research*" (n=3,302). Similarly, it is identified that there is an intensity of studies in the field of "*psychology*" (n=790, 23.925%). The research areas that feature in the data set with fewer studies are identified as "*criminology penology, ethnic studies and history philosophy of science*" (n=3, 0.091%).

Distribution of publications according to publication language and document type

It is identified that most of the 3,302 studies included in the study were published in English (n=3029, 91,732%). While a total of 115 studies were published in Spanish (3.483%), only 1 study was published in Estonian, Italian, Latin, Serbian and Slovak languages (0,030%). When the distribution of the studies by document type was examined, it is revealed that most of the publications were published as articles (n=2580, 78,134%). The findings also reveal that researchers have a tendency to publish in the type of proceeding paper (n=652, 19,746%). However, there are very few publications in document types such as book reviews (n=5, 0.151%), books (n=2, 0.061%) and notes (n=1, 0.030%). In this context, it can be stated that most of the researchers prefer publications as articles.

Table 6. Distribution of studies according to their language
Source: Authors' own conception

Languages	n	% of 3302
English	3029	91.732
Spanish	115	3.483
German	34	1.030
Russian	34	1.030
Turkish	29	0.878
Portuguese	16	0.485
Latvian	14	0.424
Bulgarian	7	0.212
Slovenian	6	0.182
Ukrainian	4	0.121
French	3	0.091
Chinese	2	0.061
Croatian	2	0.061
Dutch	2	0.061
Estonian	1	0.030
Italian	1	0.030
Latin	1	0.030
Serbian	1	0.030
Slovak	1	0.030
Unspecified	1	0.030

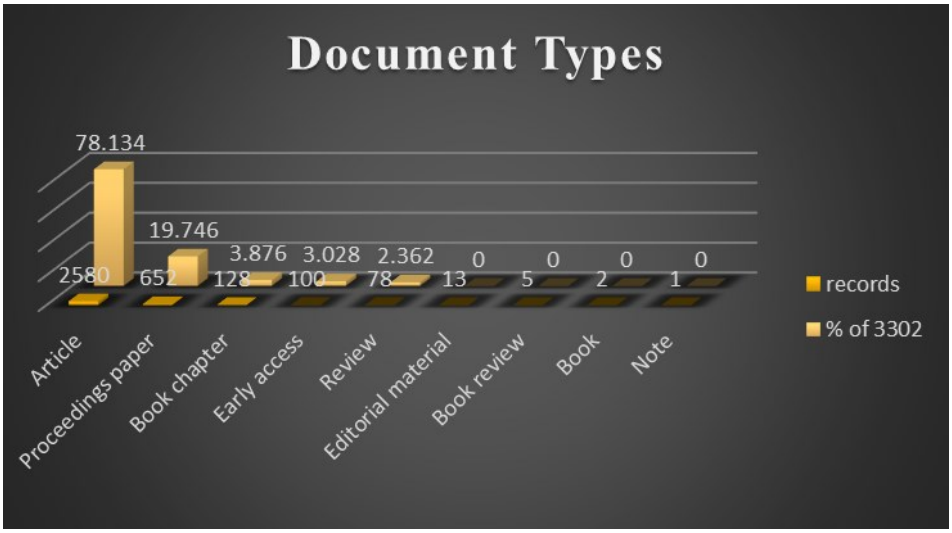


Figure 3. Distribution of publications according to document type
Source: Authors' own conception

Findings obtained from citation analysis

Studies published in the field of pre-school education (n=3,302) were analysed to identify the most cited authors, countries, documents and organisations. It can be stated that the most cited studies and researchers have an important impact on the field and they lead the way in determining the trends in the related field.

The authors with the highest number of citations

The VOSviewer programme was employed to identify the authors with the highest number of citations and the publications in the data set were analysed with the citation analysis method. For each of the authors, the total strength of citation links with other authors was calculated and the authors with the highest total link strength were selected. The author with the highest number of citations was identified as *Pianta, Robert C.* (955 citation, 401 total link strength). *Clements, Douglas H.* (821 citation, 288 total link strength), *Howes, Carollee* (815 citation, 268 total link strength), *Sarama, Julie* (770 citation, 298 total link strength), *Burchinal, Margaret* (753 citation, 294 total link strength) and *Justice, Laura M.* (703 citation, 275 total link strength) are other authors with high number of citations in field. The bibliometric mapping analysis findings for the authors are demonstrated in Figure 4.

The countries with the highest number of citations

The country with the highest number of citations related with the field is identified as the United States of America with a total number of 20864 citations (1825 total link strength). When the findings related to the publication performance of the countries are analysed, it is revealed that Canada (citation 2137, 353 total link strength), Australia (citation 1242, 381 total link strength), Sweden (citation 861, 238 total link strength), Brazil (citation 801, 60 total link strength) and China (citation 730, 343 total link strength) demonstrate a high performance. The bibliometric mapping analysis findings for the most productive countries for the pre-school education are presented in Figure 5.

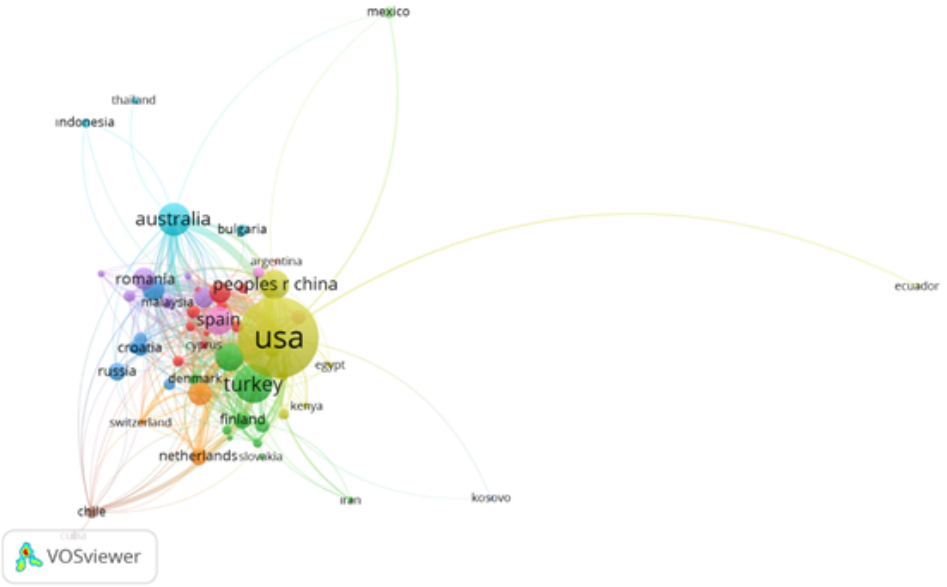


Figure 4. Bibliometric mapping analysis of the authors with the highest

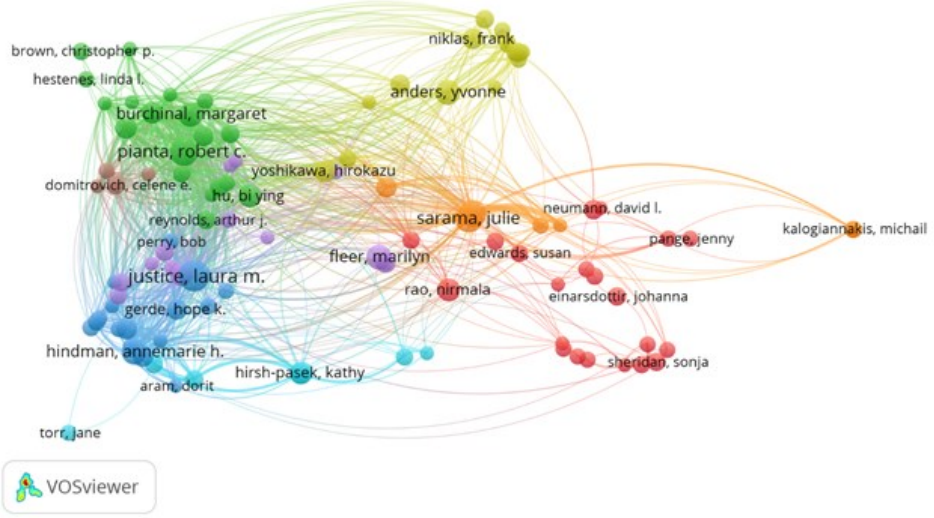


Figure 5. Bibliometric mapping analysis of countries with the highest number of citations

The documents with the highest number of citations

The document with highest number of citations is the study by Bus (1995) with a citation score of 928 (total link strength 54). The findings reveal that the citation scores of the studies published in the past years are higher than the current studies. In this context, it can be stated that these studies constitute the main source for the field and lead the other researchers.

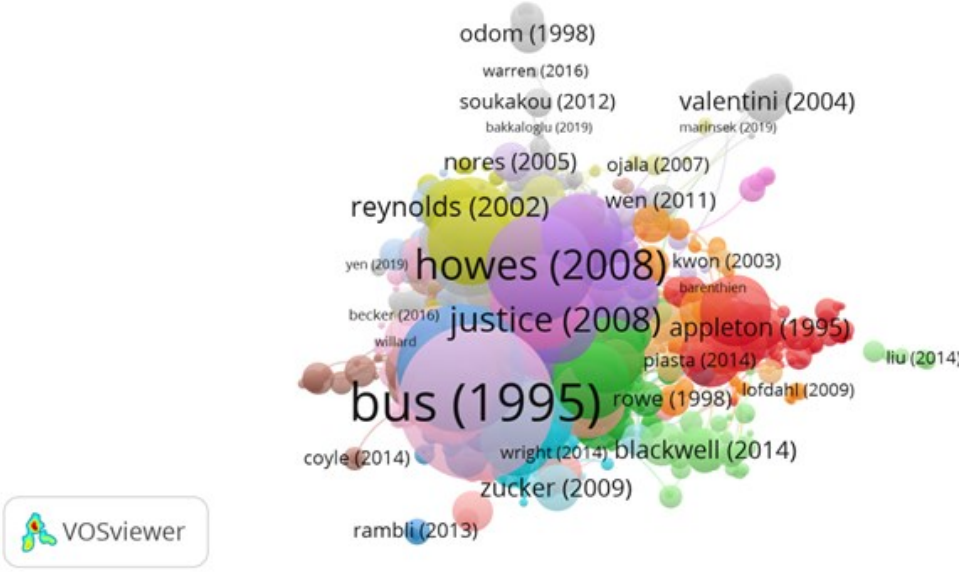


Figure 6. Bibliometric mapping analysis of the publications with the highest number of citations

The organisations with the highest number of citations

When the organisations with the highest number of citations in the field are examined, it is identified that the organisation with the highest number of citations is the University of Virginia (2671 citation, 1082 total link strength). Similarly, University of Carolina (1804 citation, 759 total link strength), Columbia University (1382 citation, 368 total link strength) and University of Michigan (1171 citation, 431 total link strength) can be stated as the most productive organisations for the research conducted on pre-school education and technology use. It can be said that these institutions have made important contributions to the developments in the field. The bibliometric map of organisations is presented in Figure 7.

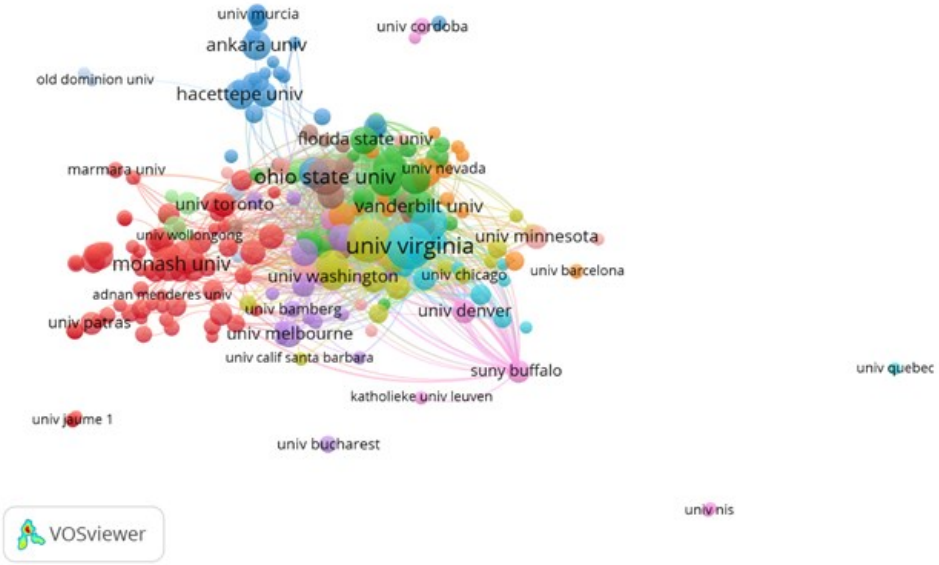


Figure 7. Bibliometric mapping analysis of the organisations with the highest number of citations

Findings obtained from co-citation analysis

Clements, dh (570 citation 18736 total link strength), *barnett, ws* (470 citation 14729 total link strength) ve *pianta, rc* (448 citation 15316 total link strength) are identified as the authors with the highest number of co-citations. The bibliometric mapping analysis consisting of 5 data sets is presented in Figure 8.

The reference with the highest number of co-citations is a study by Vygotsky "*vygotsky l. s., 1978, mind soc dev higher*" (194 citation 975 total link strength). The other references with the highest number of co-citations are identified as "*duncan gj, 2007, dev psychol, v43, p1428, doi 10.1037/0012-1649.43.6.1428*" (184 citation 1884 total link strength), "*mashburn aj, 2008, child dev, v79, p732, doi 10.1111/j.1467-8624.2008.01154.x*" (139 citation 1963 total link strength), "*hart b., 1995, meaningful differenc*" (133 citation 1657 total link strength), "*pianta r. c., 2008, classroom assessment*" (132 citation 1769 total link strength) and "*whitehurst gj, 1998, child dev, v69, p848, doi 10.1111/j.1467-8624.1998.00848.x*" (108 citation 1168 total link strength), respectively. The bibliometric mapping analysis findings, distributed across 6 datasets, provide researchers with a summary of the most preferred references for the field (Figure 9).

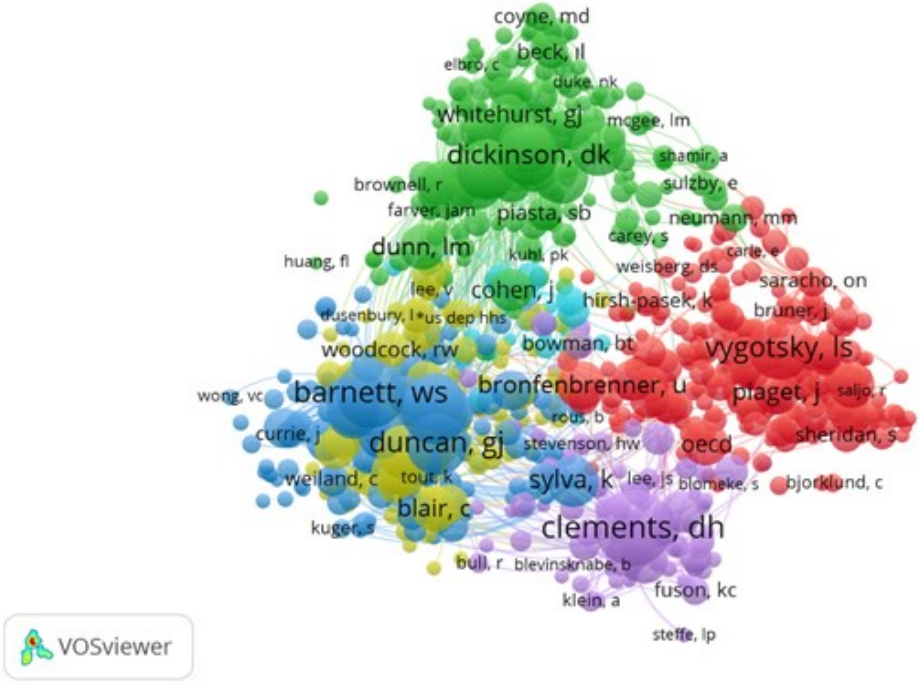


Figure 8. Bibliometric mapping analysis of authors with the highest number of co-citations

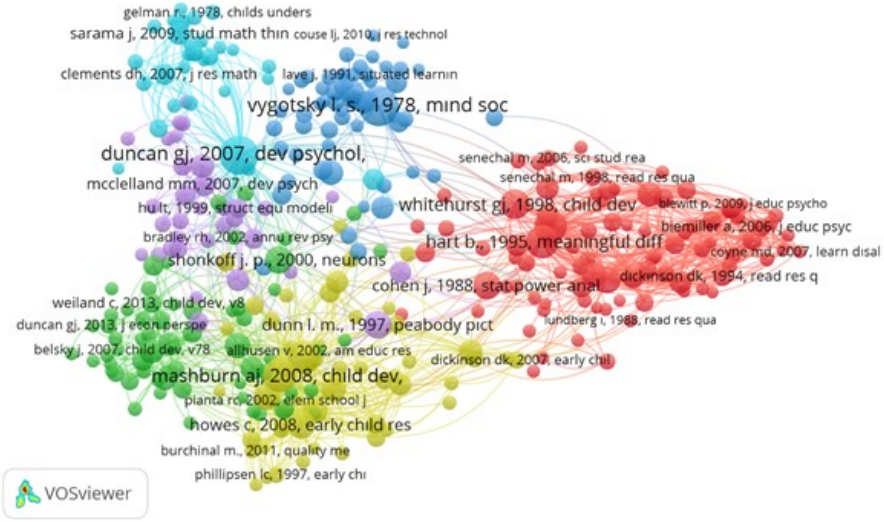


Figure 9. Bibliometric mapping analysis of references with the highest number of co-citations

Findings obtained from co-occurrence analysis

The co-occurrence analysis method was used to identify the most commonly used keywords by the researchers. Author was selected as the keyword for the analysis. The findings obtained reveal that the researchers use most commonly the keywords *preschool* (410 keyword occurrences, 780 total link strength), *early childhood education* (217 keyword occurrences, 376 total link strength), *preschool education* (189 keyword occurrences, 200 total link strength), *early childhood* (183 keyword occurrences, 403 total link strength), *kindergarten* (77 keyword occurrences, 155 total link strength) and *curriculum* (69 keyword occurrences, 165 total link strength). Bibliometric mapping analysis also reveals that the keywords such as "*professional development, preschool teacher, pre-service teachers, early literacy, school readiness, home learning environment, augmented reality, ipad, preschool child multimedia and ict, head start, instructional strategies, children with disabilities, storytelling, social and emotional learning, culture, language skills, cooperative learning, metacognition, early writing"* are used intensively by the researchers (Please see Figure 10). The keywords provide strong data regarding the contents and trends of the studies conducted in the field of preschool education.

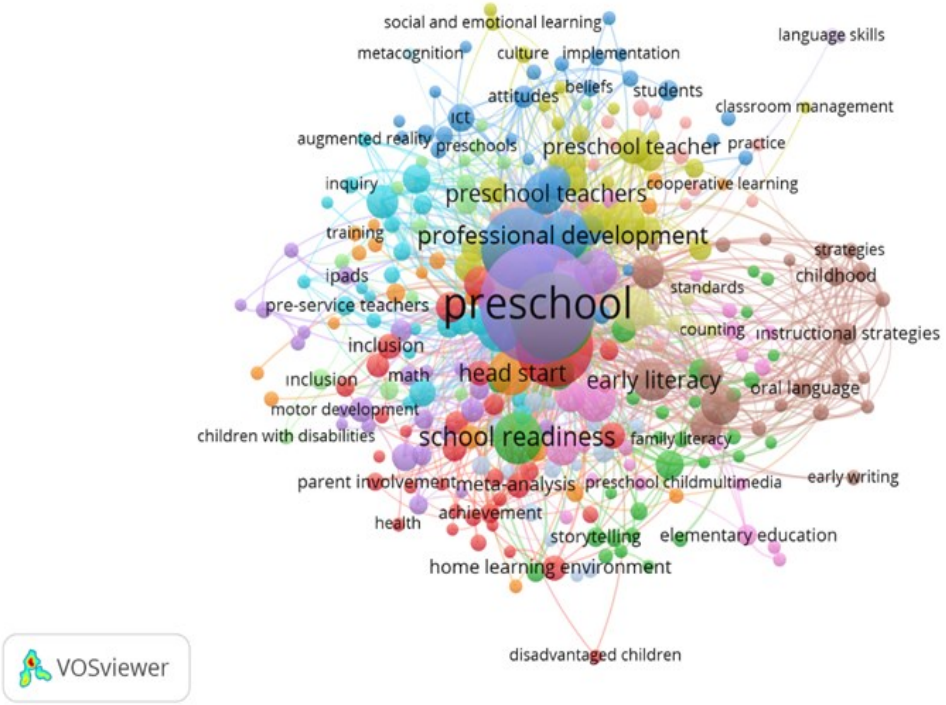


Figure 10. The keywords that are most commonly used by the researchers

4. Discussion

This study aims to analyse the tendencies towards technology use in pre-school curricula by content and bibliometric analysis methods. Studies indexed by Web of Science have been analysed according to their subject area, methodology, data collection tools, sample group, document type, publication year, most commonly used keywords. The studies are also analysed to identify the authors with the highest number of citations and co-citations, countries, documents, organisations and references with the highest number of citations. Studies carried out within the last 5 years have revealed that technology is mostly used in pre-school education environments, curricula, family education, healthy nutrition, science education and evaluation processes. Some of the studies were carried out to determine the competence of pre-school teachers for technology. Sigdel (2017) supports this result and emphasises the necessity of pre-school teachers to use technology to benefit children by investigating the effect of technology on children. In this context, determining the competencies of pre-school teachers for technology is considered as a necessity.

The results obtained from the study reveal that technology in pre-school education is used in different disciplines and on different stakeholders and its effects are investigated. The use of technology in the pre-school period is a global issue; it plays an important role in children's educational activities, games and experiences (Slutsky et al., 2019). At the same time, it is stated that information and communication technologies, in particular, are cultural mediators that mediate children's cultural literacy (Masoumi, 2015). Technology in pre-school education facilitates communication between pre-school teachers and families, supports children's learning, strengthens individual development, and brings children and their peers together (NAEYC & Fred Rogers Center, 2011). Related studies reveal the importance of the use of technology in pre-school education for pre-school curricula, children, preschool teachers and parents.

Another result obtained from the study reveals that qualitative methods are preferred more in studies conducted within the last 5 years. Baltacı (2019) defines the form of knowledge production developed by individuals to recognise themselves, solve problems and discover the social structure they build as qualitative research and states that the interview technique is mostly used in the qualitative research process. In the studies conducted, it is identified that the interview/focus group interview forms were mostly preferred as data collection tools. The results support the results of Baltacı (2019) and reveal that the preferred research method and data

collection tools complement each other. A result obtained from the content analysis is that the pre-school teachers feature as the most preferred sample group in the studies. Teachers play an important role in the personal and academic development of children, become the main practitioners of pre-school curricula, contribute to the learning and teaching process by designing the educational environment.

In the study, it is revealed that the researchers mostly prefer the article as the document type. In addition, it is identified that studies on the use of technology in pre-school curricula were carried out mostly in English and in the year of 2017. It is also revealed in the studies that are analysed with bibliometric analysis method (n=3,302), the researchers mostly preferred the keywords; pre-school, early childhood education, pre-school education, early childhood, kindergarten and curriculum, professional development, pre-school teacher, pre-service teachers, early literacy, school readiness, home learning environment, augmented reality, ipad, pre-school child multimedia and ICT, head start, instructional strategies, children with disabilities, storytelling, social and emotional learning, culture, language skills, cooperative learning, metacognition, early writing. The keywords preferred in the studies lead and guide researchers in determining the tendency towards pre-school education and curricula. *Pianta, Robert C*, who contributed to studies on early childhood curricula, teacher-child interaction, teacher qualifications, teaching in pre-school teaching preparation programmes, and innovative web-based professional development of pre-school teachers, was identified as the author with the highest number of citations (955 citation, 401 total link strength). Furthermore, the country with the highest number of citations for the studies on use of technology in pre-school curricula is identified as the United States of America with a total number of 20864 citations (1825 total link strength) and the organisation with the highest number of citations is identified as University of Virginia (2671 citation, 1082 total link strength). The study conducted by Bus in 1995 with a total of 928 citation score was identified as the publication with the highest number of citations (total link strength 54). By proposing an interactive reading model in her study, Bus (1995) refers to the necessity of programmes to provide a secure basis on which to explore children's literacy. Two main studies by Bus are indexed by Web of Science in 1995, and these studies aimed at improving the reading behaviours of preschool children. This reveals that the studies that aim at improving children's literacy skills are well-accepted in the literature. The authors with the highest number of co-citations in the field are identified as *clements, dh* (570 citation 18736 total link strength), *barnett, ws* (470 citation 14729 total link strength)

and *pianta, rc* (448 citation 15316 total link strength). Besides, the reference with the highest number of co-citations is identified as "*vygotsky l. s., 1978, mind soc dev higher*" (194 citation 975 total link strength). It is believed that Vygotsky's "Mind in society: the development of higher psychological processes" has made a significant contribution to the literature and researchers, particularly in terms of child development.

5. Conclusions

It is believed that the results obtained from this study will contribute to researchers in identifying the trends in pre-school education. It is recommended that researchers design their studies by taking into account the trends in pre-school education and include studies to fill the gaps in the field. In a similar line, it is considered a necessity for all countries to improve in the field of pre-school education, and for organisations to cover scientific studies on pre-school education and technology use. Furthermore, it is recommended to raise pre-school teachers' and parents' awareness on the effective use of technology.

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