A BIBLIOMETRIC ANALYSIS OF USING WEB 2.0s IN EDUCATIONAL RESEARCH AREA

(Research article)

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Abstract

The purpose of present study is to reveal the tendency towards Web 2.0s in the educational research area with the analysis of bibliometric mapping. As of July 5th 2021, the 786 studies have been retrieved from in the Web of Science database, and are included in the analysis. VOSviewer was used for the analysis of bibliometric mapping. As a result of the analysis of bibliometric mapping, it was concluded that the most effective countries in Web 2.0s in the educational research area are the USA, England, and Spain. According to the keyword co-occurrence analysis, technology, social media, collaborative learning, e-learning, and higher education keywords stand out on Web 2.0s in the educational research area. It was found that Timothy J. Newby is the most productive researcher. It can be concluded that the most effective researches are higher education researches. According to the analyses conducted in the context of journals, Australasian Journal of Educational Technology", "Interactive Learning Environments", and "Internet and Higher Education" were the most contributing journals.

Keywords: web 2.0, web 2.0s, bibliometric analysis, bibliometric mapping, science mapping

1. Introduction

Web 2.0s, occasionally cited to as the "read/write Web" (Ajjan & Hartshorne, 2008; Gillmor, 2004), are dynamic technological environments, different from the static technological environments of Web 1.0, that allow users to change, edit, share and comment on content through collaboration (Huang et al. 2013; Kale & Goh, 2014; O'Reilly, 2005). Although the term Web 2.0 was first used by Darcy DiNucci in 1999 (King, 2008; Knoor, 2003; Uysal & Cayci, 2022), it is generally accepted in the literature that the term was first used by O'Reilly in 2004 (Hew & Cheung, 2013; Hollinderbäumer, Hartz & Ückert, 2013; Huang et al. 2013).

It is seen that the use of Web 2.0s have been increasing since the first day of its existence and today many people, including digital learners, use them informally in their daily life (McLoughlin & Lee, 2007). This popularity of Web 2.0 is related to the fact that they make the user to be active as a content developer, that they have limited free versions, as well as paid versions, that they provide socialization among users and that they are easy to use. All of these have made Web 2.0s attractive to use as teaching tools (Dabbagh & Kitsantas, 2012; Jones et al., 2010; Magnuson, 2013). In this context, previous studies have revealed that the use of Web 2.0 in teaching-learning environments provides opportunities for both learners and teachers. Web 2.0s put the learner from consuming (passive) information to producing, questioning, and changing information (active) (Magnuson, 2013; Preston et al., 2015). As students participate and obtain tangible products, their interest in the lesson (Jones et al., 2010; Rahimi, Berg & Veen, 2015) and motivation increase (Langset, Jacobsen &

Haugsbakken, 2018; Preston et al., 2015). The flexibility of the learning environment allows them to create their own learning environments (Dabbagh & Kitsantas, 2012; Jones et al., 2010; Langset, Jacobsen & Haugsbakken, 2018; Rahimi, Berg & Veen, 2015; Mcloughlin & Lee, 2010; Weshah, 2012). As Web 2.0s allow for collaborative learning, improves students' in-class interactions (Barak et al., 2009; Chitanana, 2020; Deng, Li & Lu, 2018; Elgort, Smith & Toland, 2008; Lai & Ng, 2011; Jones et al., 2010; Mcloughlin & Lee, 2010; Preston et al., 2015), their collective intelligence (Magnuson, 2013; Rahimi, Berg & Veen, 2015), and writing skills (Hadjerrouit, 2014; Weshah, 2012; Wheeler & Wheeler, 2009). Web 2.0s enable students to develop their technology literacy (Rahimi, Berg & Veen, 2015), allow self-assessment and peer assessment (Hadjerrouit, 2014; Lai & Ng, 2011), and contribute positively to learner engagement (Clarke & Kinne, 2012; Wheeler & Wheeler, 2009). The opportunities of Web 2.0s to teachers are as follows (Byrne, 2009; Langset, Jacobsen & Haugsbakken, 2018). Webs 2.0s provide autonomy to teachers by providing the opportunity to use different activities and products in the classroom. Thus, the lessons become more effective and meaningful. These technologies support teachers to diversify their assessment products. Teachers' use of the current content for classroom instruction is promoted. Following the hyperlinks, teachers reach the data sources on the products made by students.

These opportunities of Web 2.0s to teachers and students as a teaching tool have also increased their popularity in the field of educational research. Soomro, Zai & Jafri (2020) draws attention to the increasing popularity of Web 2.0s in educational research area. It is important to reveal the current status of the researches on the use of Web 2.0/s, which has a very high popularity, in this field, to make predictions for the future and actually to reveal the general trends.

When the literature of educational research area is examined, it is seen that there are a limited number of studies to determine the general tendencies of the studies on Web 2.0. It has been determined that these studies are the systematic review, literature review (O'Connor-Petruso & Rosenfeld, 2009; Williams, Karousou & Mackness, 2011) and content analysis (Angeli, 2020; Liu & Maddux, 2008). Considering the subjects of the mentioned the systematic review studies, using Web 2.0's in higher education (Conole & Alevizou, 2010; Liu, Kalk, Kinney, Orr & Reid, 2009), problem-based learning in higher education (Ünal, 2019), K12 and higher education (Hew & Cheung, 2013), health education (Hollinderbäumer, Hartz & Ückert, 2013), language teaching (Halim & Hashim, 2019), challenges (Anastasiades & Katsidis, 2013) or all studies related to Web 2.0s (Akçayır & Akçayır, 2016; Weshah, 2012). In addition, bibliometric analysis studies focusing on technology- enhanced issues in the field (Amoozegar, Khodabandelou & Ale Ebrahim, 2018; Chen, Zou & Xie, 2020; Goksu, 2021; Khan & Gupta, 2021; Li & Wong, 2021; Lopes et al., 2017; Zawacki-Richter & Latchem, 2018) is a limited number of studies, but it is noteworthy that there is no bibliometric analysis study that includes all Web 2.0s, except for the bibliometric analysis study on social media in China (Gan &Wang, 2015). In other words, there are deficiencies in the literature in terms of revealing which key concepts or resources are focused on in the studies on the use of Web 2.0 in educational research, the changes and developments in this field, the connections between the studies, the productivity and efficiency of the authors, the citation sequences or citation associations. At this point, the necessity of making bibliometric analysis of studies using Web 2.0 in the field has arisen. Thus, the study aimed to reveal the trends of the researches in general about the use of Web 2.0 in the educational research area, to identify the key concepts or sources focused on, to reveal the changes and developments in the field, to reveal the connections of the researches with each other, the productivity and efficiency of the authors, the citation sequences or citation associations.

2. Methodology

Relevant publications in the research were analyzed using bibliometric analysis method. Disclosing the quantitative analysis of scientific editions, the bibliometric method is used extensively in numerous disciplines with the intent of displaying the changes and developments in science (Relevant publications in the research were analyzed using bibliometric analysis method. Disclosing the quantitative analysis of scientific editions, the bibliometric method is used extensively in numerous disciplines with the intent of displaying the changes and developments in science (Koza-Çiftçi et al., 2016) analyzing the links among studies (Zupic & Cater, 2015) and revealing general attitudes in any fields (Kasemodel, Makishi, Souza & Silva, 2016).

Koza-Çiftçi et al., (2016) analyzing the links among studies (Zupic & Cater, 2015) and revealing general attitudes in any fields (Kasemodel, Makishi, Souza & Silva, 2016).

2.1. Procedure

The publications are retrieved from the Web of Science (WoS), which includes the most extensive coverage of bibliographic and citation records in natural sciences, educational sciences, social sciences, and humanities publications (Aghaei-Chadegani et al., 2013; Olijnyk, 2015). Compared to Scopus, WoS has a strong coverage dating back to 1990. However, Scopus covers a large number of journals, but the impact is small and limited to recent articles (Aghaei-Chadegani et al., 2013). A 5-stage process was followed for the bibliometric analysis study. The applied research process is shown in Figure 1.
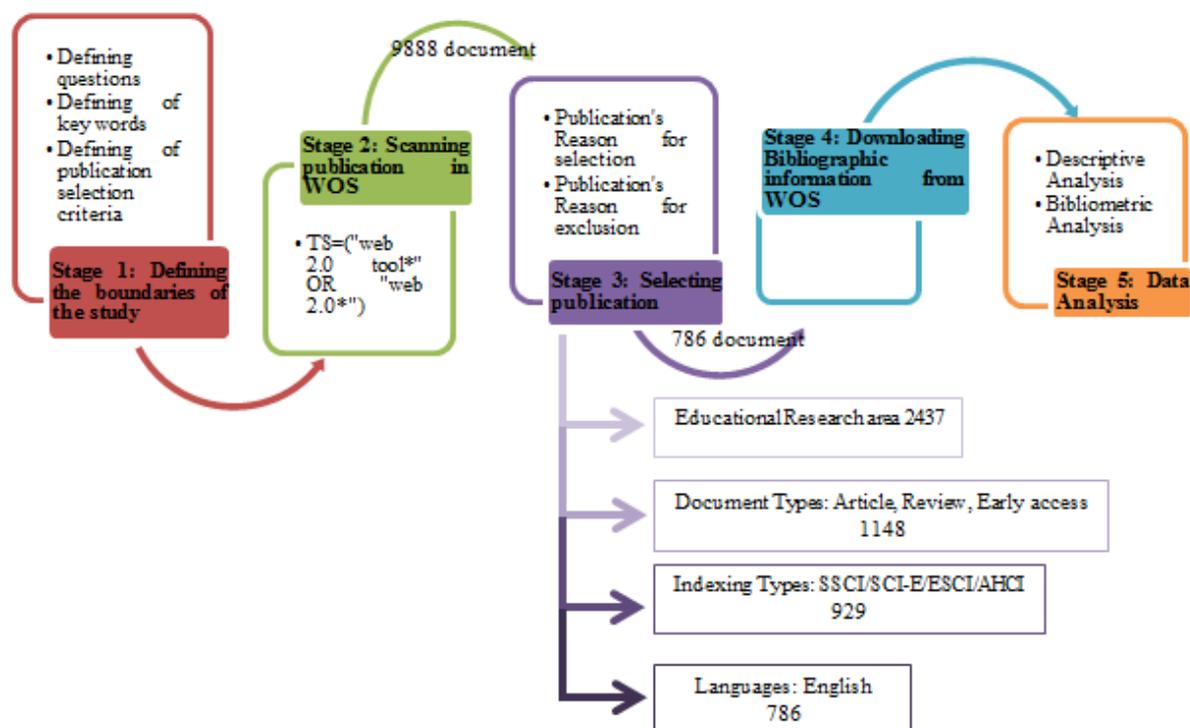

Figure 1. Research Process

2.1.1. Stage 1: Defining the boundaries of the study

The following steps were applied during the determination of the boundaries of the study:

- *Defining research questions:* In line with the purpose of the research, the research questions listed in Table 1 were defined in order to determine the current status, trends and bibliometric indicators of Web 2.0 technologies in educational research area.

Table 1. *Research Questions*

No	Research Question
1.	What are the year distributions of relevant publications and citation?
2.	What are the countries, journals, authors, and organizations distributions of relevant publications?
3.	What are the citation rankings of relevant publications, countries, journals, authors, and organizations?
4.	What pattern of co-citation author network has emerged?
5.	What pattern of co-word network has emerged?

- *Defining of search words:* General keywords to be used in searches to find basic studies in line with the purpose of the study; It is designated as "Web 2.0 tool" and "Web 2.0".

- *Defining of publication selection and exclusion criteria:* The selection and exclusion criteria defined in Table 2 were adopted in order for the studies to be included in the research to be suitable for the purpose of the research. If one of the inclusion criteria specified here is met, the study is added for review.

Table 2. *Selection and Exclusion Criteria*

Type	Criteria
Selection	Mention of Web 2.0 tool* or Web 2.0*
	The type of research area is educational research
	The types of document are articles, review or early access
	The types of indexing are SSCI, SCI-Expanded, ESCI and AHCI
	The language is English
Exclusion	The type of access is abstract

2.1.2. Stage 2: Scanning publication in WOS

On July 5th 2021, the 9888 raw document has been retrieved from the using the following advanced query:

TS=("Web 2.0 tool*" OR "web 2.0*")

2.1.3. Stage 3: Selecting publication

9102 documents removed from the data set with the help of WoS's filtering features. In the finally, on July 5th 2021, the 786 documents have been retrieved from the using the following advanced query, and are included in the analysis (see Figure 1).

TS=("Web 2.0 tool*" OR "web 2.0*")

Refined by: RESEARCH AREAS: (EDUCATION EDUCATIONAL RESEARCH) AND DOCUMENT TYPES: (REVIEW OR EARLY ACCESS OR ARTICLE) AND WEB OF SCIENCE INDEX: (WOS.SSCI OR WOS.SCI OR WOS.ESCI OR WOS.AHCI) AND LANGUAGES: (ENGLISH)

Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI.

2.1.4. Stage 4: Downloading Bibliographic information from WoS

In line with the research questions, results of the analysis were downloaded and full records and cited references were exported to file.

2.1.5. Stage 5: Data Analysis

In the analysis of the articles, descriptive analysis and bibliometric analysis methods, citation analysis, and co-word analysis were used. VOSviewer application was employed in order to facilitate conducting bibliometric analysis and visualize the results. The reason for using VOSviewer is its being pretty effective in analyzing big data sets and displaying some interesting visuals, analysis, and inquiries (Rafols et al, 2012; Van-Eck & Waltman, 2010). Additionally, VOSviewer can generate maps of publications, authors, or journals derived from networks of co-citation. It can also build maps of keywords from networks (Hundha et al, 2020).

3. Results

3.1. Descriptive Results

Descriptive analyses are presented distribution of publications and citation by years (Figure 2), countries (Figure 3), journals (Figure 4), authors (Figure 5), and organizations (Figure 6).

3.1.1. Distribution of publications and citation by years

In Figure 2, when the distribution of the relevant publications by years is examined, it is seen that Web 2.0 studies in the educational research area started to be studied in 2007. While there was a fluctuation in the number of studies between 2007 and 2021, it is seen that the number of studies reached the maximum level in 2015. Especially in 2015 and 2016, it is noteworthy that there is a serious intensity in the number of studies.

When the distribution of relevant publications citations by years, although the citations of Web 2.0 studies in the field of educational research decreased in 2018, it increased rapidly between 2007-2020.
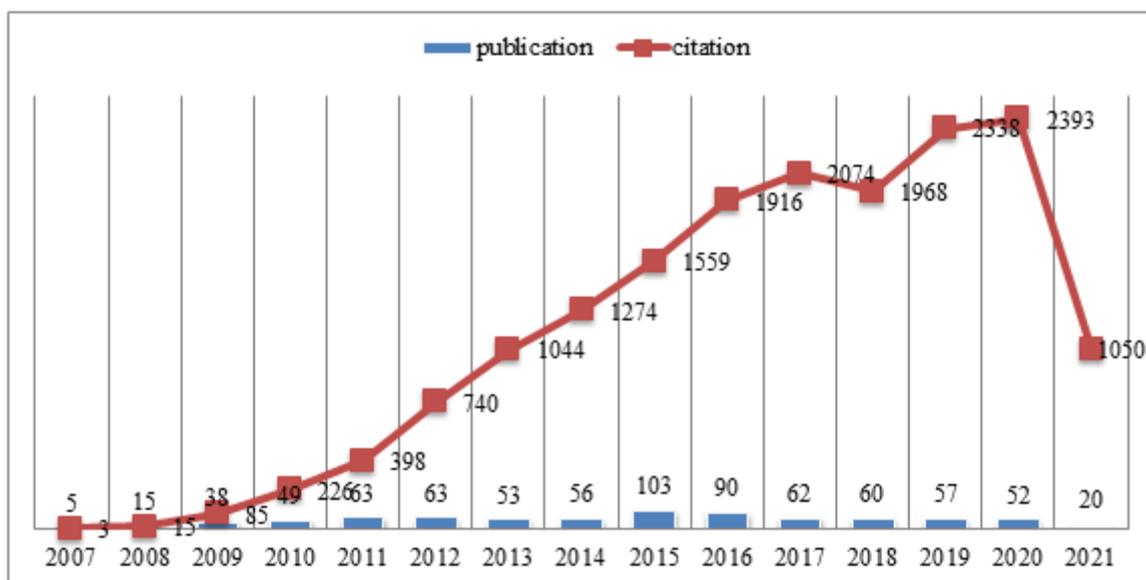

Figure 2. Distribution of publications and citation by years

3.1.2. Distribution of publications by countries, journals, authors, and organizations

When the distribution of the relevant publications by country is examined, it is seen that there are studied 81 countries on Web 2.0 in educational research area. Due to the large number of countries, countries with 15 or more publications are given in Figure 3.

In Figure 3, there are 183 articles in the United States of America and this number is considerably higher than the publications in other countries. This country is followed by the England with 92 articles, Spain with 79 articles, Australia with 62 articles, Taiwan with 52 articles, Turkey with 49 articles, China with 40 articles, Canada with 24 articles, Greece with 21 articles, Malaysia with 17 articles, and Finland with 15 articles.
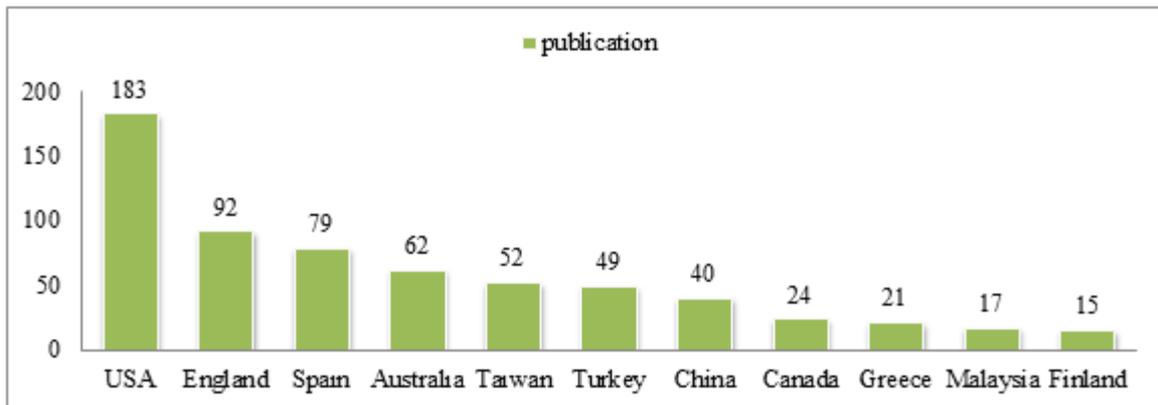

Figure 3. Distribution of publications by countries

When the distribution of the relevant publications by country is examined, it is seen that there are studied 222 journals on Web 2.0 in educational research area. Due to the large number of journals, journals with 10 or more publications are given in Figure 4.

In Figure 4, there are 48 articles were published in the "Computers and Education" journal. This journal is followed by "Australasian Journal of Educational Technology" journal with 39 articles, "Interactive Learning Environments" journal with 34 articles, and "Internet and Higher Education" journal with 31 articles.
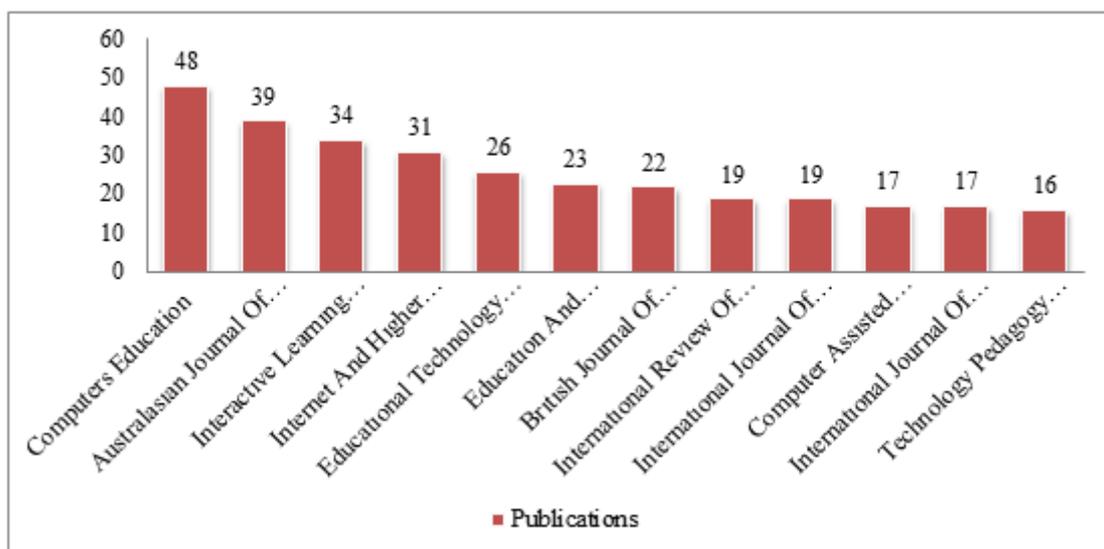

Figure 4. Distribution of publications by journals

In Figure 5, when the distribution of the relevant publications by author is examined, it is seen that there are 7 articles were published by Timothy J. Newby. This author is followed by "Kathleen Gray" with 6 articles, and "Peggy A. Ertmer, Yueh-Min Huang, John Sandars, Chin-Chung Tsai" with 5 articles, and ", Juan Asensio-Perez, Wen-Hao David Huang, Ugur Kale, Lina Lee, Chen-Chung Liu, Celia Thompson, Jenny Waycott" with 4 articles.
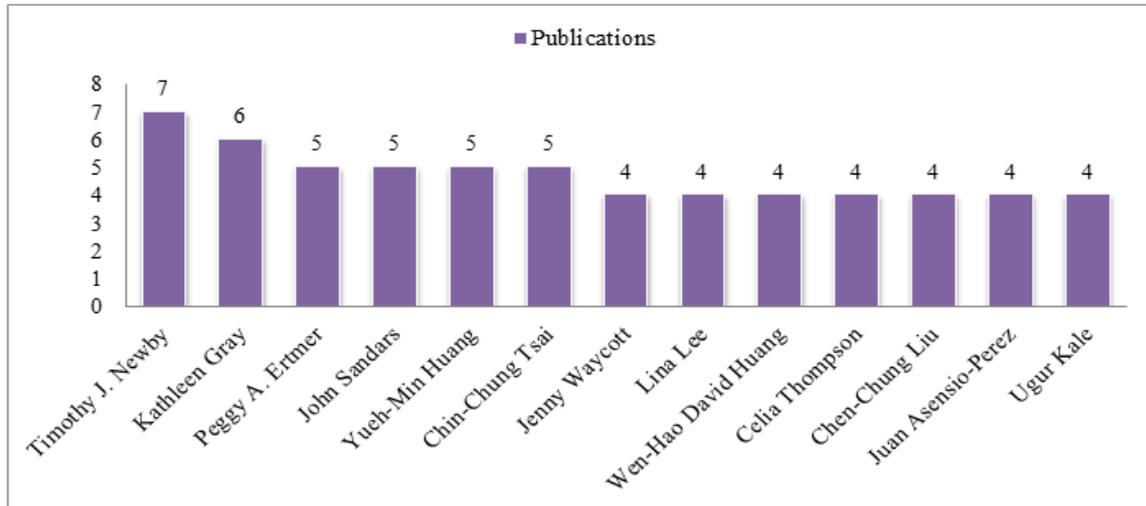

Figure 5. Distribution of publications by authors

In Figure 6, when the distribution of the relevant publications by organizations is examined, it is seen that there are 16 articles were published by Open University. This organization is followed by "University Hong-Kong" with 12 articles, and "University Melbourne, National Center University" with 11 articles, and "Nanyang Technological University" with 10 articles.
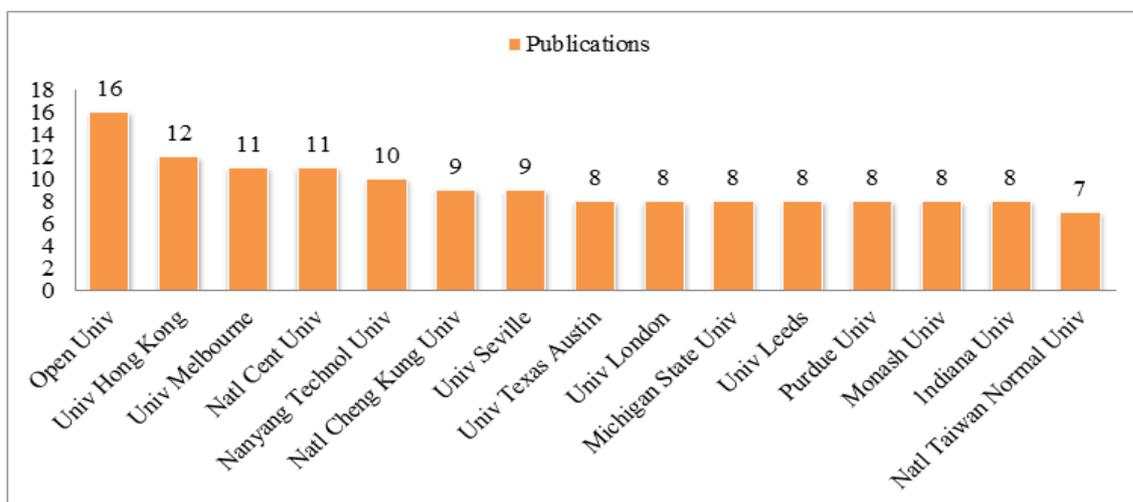
Figure 6. Distribution of publications by organizations

3.2. Bibliometric Results

Bibliometric analysis was started with traditionally frequently used citation analysis. So, citation analysis of country (Table 3), journals (Table 4), authors (Table 5), organizations (Table 6), and documents (Table 7) with the highest number of publications was conducted by citation rankings. Bibliometric analysis was continued with co-citation analysis and co-word analysis. Co-citation analysis for authors' cooperation was presented in Figure6. Co-word analysis was presented Figure7.

3.2.1. Citation analysis (Country, Journal, Author, Organizations and Document)

Table 3 shows the number of publications and citations of the most influential authors in educational research area. The first 20 countries with at least 200 citations in the relevant indexes are listed according to the number of citations. When the table is examined, it seems that USA with 6012 citations comes to the fore. This country is followed by England with 2251 citations, Australia with 1415 citations, Spain with 1372 citations, and Taiwan with 1083 citations.

Table 3. *Citation Ranking of Authors*

Country	Documents	Citations	Total Link Strength
USA	182	6012	572
England	91	2251	242
Australia	62	1415	233
Spain	79	1372	173
Taiwan	52	1083	147
China	39	813	125
Scotland	14	585	79
New Zealand	13	495	51
Germany	13	486	40
Turkey	49	401	136
Greece	20	389	68
Singapore	13	345	46
Switzerland	4	341	30
Finland	15	333	62
Netherlands	13	322	61
Austria	3	276	27
Italy	12	271	42
Malaysia	17	266	71
Canada	24	250	48
Pakistan	5	214	17

Table 4 shows the number of publications and citations of the most influential journal in educational research area. The first 21 countries with at least 100 citations in the relevant indexes are listed according to the number of citations. When the citations received by the publications in the mentioned journals are examined, it is seen that "Computers & Education" and "Internet and Higher Education" journals come to the fore. When the number of citations per article is examined, "Internet and Higher Education" journal comes to the fore. This journal is followed by "Journal of Computer Assisted Learning" and "Computers & Education".

Table 4. *Citation Ranking of Journals*

Source Titles	Documents	Citations	Total Link Strength	Number of Citations Per Research
Computers & Education	48	2549	142	53,10
Internet and Higher Education	31	2536	179	81,81
Australasian Journal of Educational Technology	39	1076	109	27,59
Computer Assisted Language Learning	17	738	38	43,41
Educatıonal Technology Society	26	722	47	27,77
Interactıve Learning Environments	34	664	59	19,53
International Review of Research In Open and Distributed Learning	19	648	35	34,11
Journal of Computer Assisted Learning	11	601	70	54,64
British Journal of Educational Technology	22	520	46	23,64
Learning Media and Technology	11	502	38	45,64
Medical Teacher	11	414	6	37,64
Journal of Computing In Higher Education	8	331	20	41,38
Comunicar	7	328	0	46,86
Educational Technology Research and Development	13	260	41	20,00
Turkısh Online Journal of Educational Technology	8	194	11	24,25
Innovations In Education and Teaching International	12	189	23	15,75
Education and Information Technologies	23	167	32	7,26
Technology Pedagogy and Education	16	157	36	9,81
International Journal of Educational Technology In Higher Education	10	123	26	12,30
Recall	6	122	19	20,33
Language Learning Technology	8	105	7	13,13

Table 5 shows the number of publications and citations of the most influential author in educational research area. The first 20 authors with at least 150 citations in the relevant indexes are listed according to the number of citations. When the citations received by the publications in the mentioned authors are examined, it is seen that "Christine Greenhow" and "Nada Dabbagh" come to the fore. These authors are followed by "Joan E. Hughes", "Mark J. W. Lee", and "Catherine Mcloughlin".

Table 5. *Citation Ranking of Authors*

Author	Documents	Citations	Total Link Strength
Christine Greenhow	3	669	41
Nada Dabbagh	3	645	26
Joan E. Hughes	2	512	36
Mark J. W. Lee	2	445	39
Catherine Mcloughlin	2	445	39
Jenny Waycott	4	334	64
Lina Lee	4	260	15
Stefania Manca	3	246	30
Gregor Kennedy	3	244	47
Maria Ranieri	2	242	27
Timothy J. Newby	7	197	93
Chun Lai	3	194	26
Peggy A. Ertmer	5	193	60
Shanton Chang	3	186	24
Stephen J. H. Yang	2	180	3
K. Logan	2	174	17
John Sandars	5	172	0
Suraya Hamid	2	159	19
Yueh-Min Huang	5	159	5
Sherah Kurnia	2	159	19

Table 6 shows the number of publications and citations of the most influential organizations in educational research area. The first 21 organizations with at least 200 citations in the relevant indexes are listed according to the number of citations. When the citations received by the publications in the mentioned organizations are examined, it is seen that "George Mason University ", "University Texas Austin", and "Charles Sturt University" come to the fore. These organizations are followed by "University Minnesota", "University Maryland", and "University Melbourne".

Table 6. *Citation Ranking of Organizations*

Organization	Documents	Citations	Total Link Strength
George Mason University	3	645	27
University Texas Austin	8	628	52
Charles Sturt University	4	614	67
University Minnesota	4	594	47
University Maryland	4	519	8
University Melbourne	11	505	72
Australian Catholic University	3	448	36
University N Carolina	4	395	56
University Hong Kong	12	386	50
Open University	16	342	28
University London	8	339	48
Michigan State University	8	330	28
Nanyang Technology University	10	292	30
National Center University	11	284	31
University Leeds	8	267	2
University Edinburgh	3	263	31
University New Hampshire	4	260	14
University Huelva	3	224	10
University llinois	6	204	13
National Cheng Kung University	9	203	16
University Nottingham	4	200	27

Table 7 contains the number of citations of the 12 most cited articles with at least 150 citations among the articles included in the review according to WoS data. When the most cited articles are examined, it is seen that " Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning." come to the fore.

Table 7. *Citation Ranking of Documents*

	Document	Citations	Links
1.	Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *Internet and Higher Education, 15*(1), 3-8.	637	37
2.	Greenhow, C., Robelia, B., & Hughes, J. E. (2009). Learning, teaching, and scholarship in a digital age: Web 2.0 and classroom research: What path should we take now?. *Educational Researcher*, *38*(4), 246-259.	509	68
3.	Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, *19*, 18-26.	482	9
4.	Ajjan, H., & Hartshorne, R. (2008). Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests. *The internet and higher education*, *11*(2), 71-80.	384	66
5.	McLoughlin, C., & Lee, M. J. (2010). Personalized and self-regulated learning in the Web 2.0 era: International exemplars of innovative pedagogy using social software. *Australasian Journal of Educational Technology*, *26*(1).	340	48
6.	Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2014). Technologies for foreign language learning: A review of technology types and their effectiveness. *Computer assisted language learning*, *27*(1), 70-105.	272	3
7.	Ebner, M., Lienhardt, C., Rohs, M., & Meyer, I. (2010). Microblogs in Higher Education–A chance to facilitate informal and process-oriented learning?. *Computers & Education*, *55*(1), 92-100.	264	21
8.	Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distributed Learning*, *13*(1), 56-71.	199	7
9.	Sánchez, R. A., Cortijo, V., & Javed, U. (2014). Students' perceptions of Facebook for academic purposes. *Computers & Education*, *70*, 138-149.	182	3
10.	Bennett, S., Bishop, A., Dalgarno, B., Waycott, J., & Kennedy, G. (2012). Implementing Web 2.0 technologies in higher education: A collective case study. *Computers & Education*, *59*(2), 524-534.	163	43
11.	Hemmi, A., Bayne, S., & Land, R. (2009). The appropriation and repurposing of social technologies in higher education. *Journal of computer assisted learning*, *25*(1), 19-30.	158	29
12.	Greenhow, C., & Lewin, C. (2016). Social media and education: Reconceptualizing the boundaries of formal and informal learning. *Learning, media and technology*, *41*(1), 6-30.	150	12

3.2.2. Co-citation analysis (Author)

When a co-citation analysis was conducted among the relevant publications, 18332 authors were found to be cited in the related field. When more than 20 citation criteria were set as the cut-off point, the number of authors was found 141 items / 6 clusters. Figure 7, the main research questions related to web 2.0 in educational research area co-occurrence map is shown. It is based on the information retrieved from WoS, which covers the publications from 2007 and 2021.
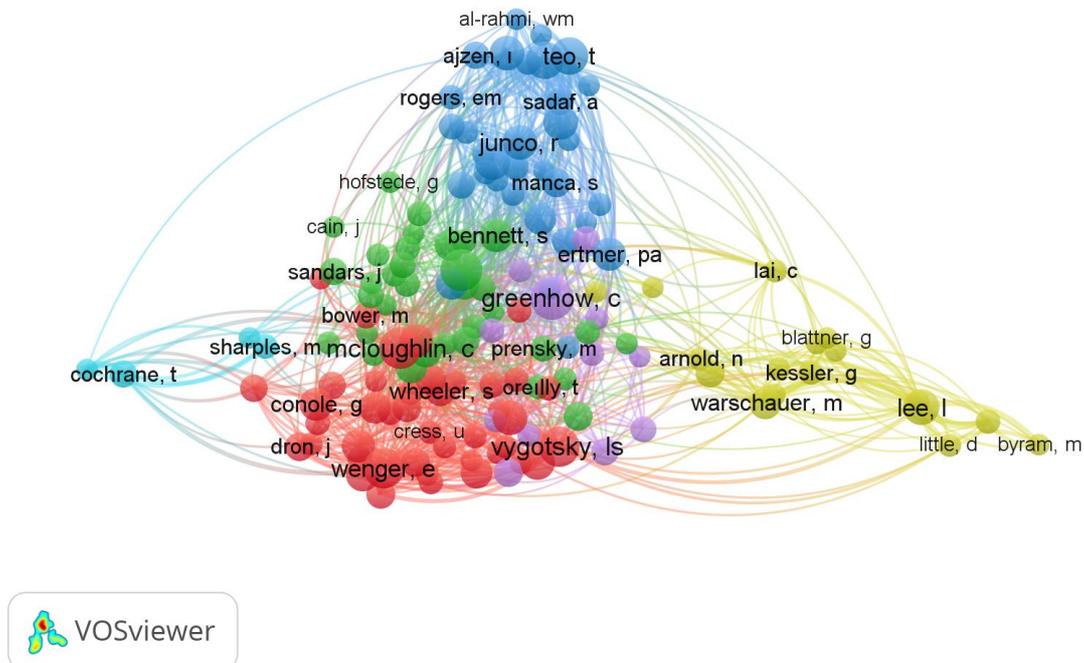

Figure 7. Co-citation (author) Network

As seen Figure 7, six clusters are formed on the map. Of these clusters, the red, green and blue clusters are larger and more distinctive than others. However, clusters seen as yellow, purple, and turquoise are observed to form less frequent and smaller clusters. When the entire map is examined, first, it seems that Catherine Mcloughlin, Vygotsky, Neil Selwyn, and Christine Greenhow are located at relatively central place and associated with many different clusters. This shows that Catherine Mcloughlin, Vygotsky, Neil Selwyn and Christine Greenhow were cited in many different studies.

When the red cluster, which is in the center of the map and one of the most intense clusters, is examined, it is found that academics Catherine Mcloughlin, Vygotsky, Étienne Wenger, and D. Randy Garrison are located at relatively central place. These academics work on educational psychology, and digital technology (outside Vygotsky).

When the green cluster is examined, it is found that persons Tim O'Reilly, Neil Selwyn, and Marc Prensky (In publications, Tim O'Reilly and Prensky are less highlighted on the map than Selwyn because they are named differently. However, looking at the detailed analysis, it was determined that Tim O'Reilly received more citations than Neil Selwyn with 121 citations) are located at relatively central place. O'Reilly is an author, and the founder of O'Reilly Media, popularizing the terms open source and Web 2.0. Selwyn is an academic working on integration of digital technology into schools, universities and adult learning. Prensky is an author who is best known for coining the terms "Digital Native" and "Digital Immigrant".

The blue cluster is seen to consist of academics Timothy Teo, and Viswanath Venkatesh being located at relatively central place. These academics work on technology adoption, and psychology. In addition, this cluster includes researchers known for their work on research methods, mainly in qualitative research (J.W. Creswell, L. Cohen, etc.).

When the yellow cluster, which is one of the relatively small clusters, it is found that academic In Lee working in Business Administration (Specialization: Information Systems). The second small cluster is the purple cluster which is found that academic Christine Greenhow. She works in Educational Psychology, and Educational Technology. The turquoise cluster, which is the last small cluster, is found that academic Thomas Cochrane working in Educational Technology.

3.2.3. Co-word analysis

When the repeating keywords in the publications are analyzed, it is found that 1861 different keywords are used. When "being used at least 5 times" was determined as the cut-off point, 87 frequently used words were reached. In Figure 8, it is observed that the most-used keywords in the articles tend towards such keywords as higher education, social media, collaborative learning, e-learning, and technology.
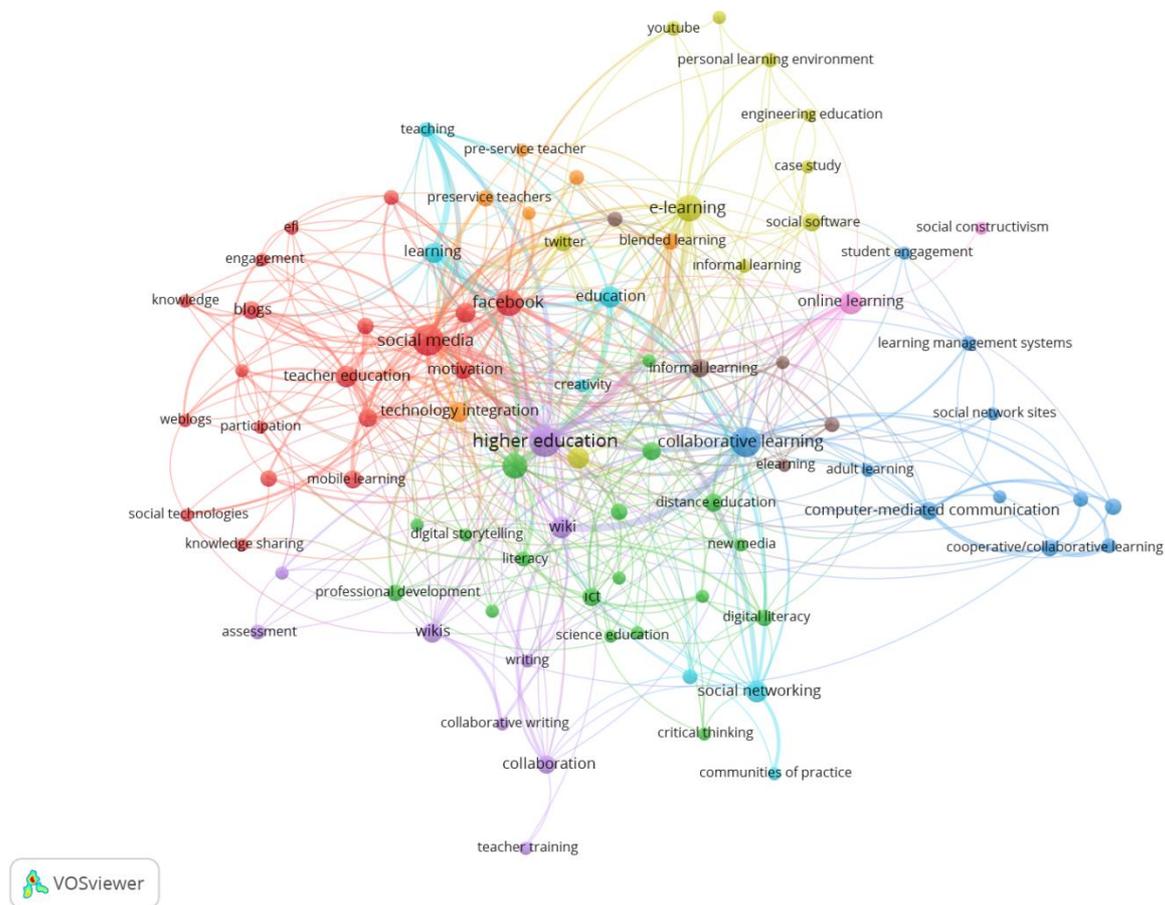

Figure 8. Analysis of Keywords

When the map is examined, it is seen that five main clusters (red, green, blue, yellow, and purple) and relatively smaller clusters are formed. It is understood that the red cluster, which is a very large cluster, focuses on social media. Concepts are frequently used in studies on social media that is seen that the focus is on issues such as teacher education, pedagogy, foreign language learning, and motivation. The second large cluster is the green cluster

focusing on technology (ict, distance education, pre-service teacher, professional development, digital literacy etc.). The blue cluster focuses on collaborative learning (computed-mediated communication, teaching/learning strategy, adult learning etc.). The yellow cluster focuses on e-learning (case study, engineering education, informal learning etc.). The purple cluster is the last large cluster focusing on higher education (wiki, assessment, project-based learning etc).

4. Discussion and Conclusions

In this present study, the trends of the articles in the field of educational research area published in international journals related to "Web 2.0" are revealed through descriptive and bibliometric analyzes. In the terms of the results of the research, it is seen that there was a rapid increase in the number of related publications, especially in 2015-2016, and in the number of citations in 2019-2020. This result indicates that the interest and tendency of education researchers to use Web 2.0 increased in 2015-2016. Soomro, Zai & Jafri (2020) draws attention to the increasing popularity of Web 2.0s in educational research area. Considering the increasing number of publications over the years and the tendencies of researchers, it is normal for the number of citations to reach the highest level in 2019-2020.

When the most popular countries are analyzed, USA and England have been the most published and cited country in education research area about Web 2.0. One of the countries with the most publications and citations in different bibliometric analysis studies on the use of technology-related topics in the field of education is "USA". (Amoozegar, Khodabandelou & Ale Ebrahim, 2018; Chen, Zou & Xie, 2020; Goksu, 2021; Khan & Gupta, 2021; Li & Wong, 2021; Lopes et al., 2017; Zawacki-Richter & Latchem, 2018). In addition, in Bozkurt's (2020) study on the field of educational technologies, it is revealed that USA is the country with the highest contribution of articles. Although it is interesting that the USA is in the first place in almost all of the studies carried out, it is not surprising. Because USA, both pioneered the traditions in technology (Bozkurt, 2020), adopted technology earlier (Rogers, 2003), and is the country located O'Reilly Media where the first to introduce the concept of Web 2.0.

When the most popular journals are analyzed, "Computers & Education" has been the most published and cited journal in educational research area about Web 2.0. "Australasian Journal of Educational Technology", "Interactive Learning Environments", and "Internet and Higher Education" are effective about numbers of publication. The most published and cited journal in different bibliometric analysis studies on the use of technology-related topics in the field of education is "Computers & Education" (Amoozegar, Khodabandelou & Ale Ebrahim, 2018; Goksu, 2021; Khan & Gupta, 2021; Lopes et al., 2017; Shen & Ho, 2020; Zawacki-Richter & Latchem, 2018). In addition, in Bozkurt's (2020) study on educational technologies, "Computers & Education" journal is determined as the journal with the highest article contribution. This journal is leading in its field, has a high h-index, is at Q1 level and is an important journal to identify current research topics. For this reason, it can be said that it is preferred more by researchers. In addition, SSCI-indexed journals, like "Computers & Education", tend to be preferred as target publications by countries where academic promotion is heavily decided on the basis of where the articles are indexed (Bozkurt, 2020). From this point of view, the result is normal considering the countries' forefront in the number of publications related to Web 2.0 and considering that these countries direct academic promotion. "Internet and Higher Education" journal leaves behind "Computers & Education" journal in terms of citations per article. Because "Internet and Higher Education" journal has higher link strength than "Computers & Education" journal. An interesting

situation in the order of citations per article is related to the number of publications and the "Journal of Computer Assisted Learning", which is not at the forefront in the number of citations. This journal, which has a very high number of citations per article, has very low link strength. In other words, the citation power of the journal with other journals is quite weak despite the high number of citations. Finally, "Australasian Journal of Educational Technology", which is one of the top three journals with the highest number of publications and link strength, is quite low in the number of citations per article.

Considering the ranking of the authors in terms of productivity, it is seen that the authors named "Timothy J. Newby", "Kathleen Gray", and "Peggy A. Ertmer" are in the top three. While two of these authors are in the field of educational sciences, Gray, who works in e-learning in the health field, is in second place. In the citation order, it is seen that the studies of "Christine Greenhow", "Nada Dabbagh", and "Joan E. Hughes" received more than 500 citations. It is seen that the authors who stand out in terms of productivity are not in the expected place in the citation order. Goksu (2021) emphasizes that productivity refers to the number of publications, but it is believed that it is more important for the researcher to produce effective and interesting publications. In this context, it is noteworthy that efficient authors studying "Web 2.0s" in the educational research area are not effective enough. It is thought that this may be related to the quality of the relevant publications or the study subjects. Although Timothy J. Newby has very high link strength, it is seen that he is not in the expected place in the citation ranking. In other words, although the author's co-citation power with other authors is quite high, he lagged behind in the citation ranking. Considering the order of citations per article, Joan E. Hughes ranks first. An interesting case in the citation ranking concerns Nada Dabbagh. This author, who has a very high number of citations, has very low link strength. In other words, the power of the author to be cited jointly with other authors is quite weak despite the high number of citations.

Considering the rankings of organizations in terms of productivity, it is seen that Open University, University Hong-Kong, University Melbourne, and National Center University are at the top of the list. In the citation ranking, it is seen that the studies in George Mason University, University Texas Austin, and Charles Sturt University received more than 600 citations. It is seen that the organizations that come to the fore in terms of productivity are not in the expected place in the citation ranking. The fact that the organizations in the first six have more than 500 citations reveals the effects of these organizations in terms of citations. The presence of organizations in different locations in the list can be seen as an important indicator in terms of the visibility and efficiency of these organizations.

When the most cited articles are analyzed, it is seen that most of them are related to higher education. In addition, when the authors of the most cited articles are examined, they overlap with the most influential authors. Three of the 12 most cited articles are published in Computers & Education, three articles in Internet and Higher Education, and the others in different journals. It is noteworthy that the other articles in the ranking are reviews, quantitative and qualitative studies in the context of research methods. This may be an indication that Web 2.0s, whose popularity in the field of education have increased over time, have been adapted to education by researchers with various research methods. It is important that new researchers on Web 2.0s in educational research area use these articles to form the theoretical framework for their thesis or other studies.

When the most co-citation analysis in term of authors is examined, Catherine Mcloughlin, Tim O'Reilly and Timothy Teo are the most cited authors. It is seen that Catherine Mcloughlin and other authors in the cluster study on subjects suitable for the information age, especially in the field of educational psychology. From this point of view, it can be said that

most of the studies that refer to this cluster are studies that focus on educational psychology and digital technology. Tim O'Reilly is not an academic. He is an author who founder of O'Reilly Media, popularizing the terms open source and Web 2.0. Since the publications examined are related to Web 2.0, it is thought that the citation behavior to the author who first used this concept is high. The interesting result about co-citation analysis in term of authors concerns Timothy Teo. This academic is not one of the prominent researchers in both productivity and effectively. However, the citation behavior of the researcher in the reviewed publications is quite high. For this reason, it can be said that most of the studies that refer to the cluster in which the author is included are studies that focus on technology acceptance and that they often use qualitative research methods.

The keywords such as Web 2.0s in educational research area, social media, technology, collaborative learning, e-learning, and higher education are the most-used keywords according to the co-occurrence analysis. This presents important findings with regards to determining the research subjects and trend research subjects that form the basis of the Web 2.0s in educational research area. The fact that the most prominent keywords are "social networks" may be due to the fact that social networks are the first Web 2.0s that come to mind. The use of social networks in education improves student satisfaction and engagement (Clarke & Kinne, 2012), writing skills (Hadjerrouit, 2014; Wheeler & Wheeler, 2009), collaboration (Preston et al., 2015), and academic skills (Lai & Ng, 2011; Wake & Modla, 2012). Similar to the results of this study, Iredale et al. (2020) concluded that the articles examined in their review study are mostly related to social media. The fact that the keyword "Technology" is the second most prominent word reveals that Web 2.0s are an important technology in the field of education. Other important words are collaborative learning, and e-learning. Web 2.0 technologies are structures that allow users to change, edit, share and comment on content through collaboration (Huang et al. 2013; Kale & Goh, 2014). The results of Magnuson's (2013) study confirmed that Web 2.0 can improve five information literacy standards, including information literacy related to collaboration and technology education. In addition, many studies point out that Web 2.0 technology encourages learners to participate more in the cooperative learning environment and mention the importance of the use of Web 2.0 technologies in cooperative learning environments (Barak et al., 2009; Chitanana, 2020; Ciampa & Revels, 2012; Deng, Li & Lu, 2018; Elgort et al., 2008; Huang, Jeng & Huang, 2009; Jones et al., 2010; Langset, Jacobsen & Haugsbakken, 2018; Mcloughlin & Lee, 2010; Seifert, 2020). The relationship between e-learning with Web 2.0 is thought to be more related to Web 2.0 Personal Learning Environments (PLEs). Because Web 2.0 PLEs have started to be a promising environments in e-learning (Rahimi, Berg & Veen, 2015). The last keyword such as Web 2.0s in education is "higher education". This finding is supported by the fact that Web 2.0s in educational research focuses on higher education and that the use of these technologies provides new ways to support and enhance the learning process in higher education (Ajjan & Hartshorne, 2008).

In conclusion, this study -as far as it is known, is the first bibliometric analysis study on this subject- aims to identify the changes and developments related to the use of Web 2.0 in the educational research area, to identify the connections between the studies and to provide a starting basis for revealing general trends. The increasing popularity of Web 2.0s, their positive effects on teaching-learning by enabling collaborative learning and interactive ways of acquiring knowledge, and their preference in higher education (Soomro, Zai & Jafri) are confirmed by the bibliometric findings obtained from this present study. In addition, this study reveals that the authors in the USA and European countries are mostly productive and effective in research on the use of Web 2.0s in educational research area. According to the results of this study, Web 2.0s are increasingly popular in educational research, studied

mostly by researchers of USA origin, published more in the journal "Computers & Education", attracting the attention of educational psychology and digital technology researchers, being more preferred in higher education, e-learning. It is an innovative technology that enables collaborative learning.

5. Limitations and Recommendations

There are some limitations to this present study. The first of these limitations is related to the subject of the research. This research is limited to studies about Web 2.0s in the educational research area. For this reason, it is recommended to conduct bibliometric studies on different subjects in educational research, taking into account the macro data revealed in the current study. Secondly, the publications examined in the study are limited to studies in English (article, review, early access) scanned in the SSCI, SCI-expanded, ESCI and AHCI indexes in the WoS database. Therefore, in order to increase the generalizability of the results obtained from the research, studies that include studies in different languages, scanned in different databases and using different indexes should be conducted. The last limitation is related to the time range of the publications examined in the study. The publications examined in this study are limited to the studies conducted in 2007-2021(June). Therefore, researchers are advised to include studies conducted after 2021-June.

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