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To cite this article:

Çakır, R., Sayın, V., & Bektaş, S. (2021). Bibliometric analysis of studies conducted between 2015-2019 on the flipped classroom model. *International Journal of Research in Education and Science (IJRES), 7*(1), 163-187. https://doi.org/10.46328/ijres.1126

International Journal of Research in Education and Science (IJRES) is affiliated with the
International Society for Technology, Education, and Science (ISTES): www.istes.org

IJRES International Journal of Research in Education and Science
2021, Vol. 7, No. 1, 163-187 https://doi.org/10.46328/ijres.1126

Bibliometric Analysis of Studies Conducted between 2015-2019 on the Flipped Classroom Model

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Article Info

Article History

Received:
18 April 2020
Accepted:
22 August 2020

Keywords

Flipped classroom
Educational technology
Bibliometric
VOSviewer

Abstract

One of the reflections of technology to education is the flipped classroom model. In The Flipped Classroom model, the lecture process on a subject is delivered at home, while the application process that is related to the subject is in the class. The purpose of this study is to examine the trends in recent years via bibliometric results of articles on the use of flipped classrooms in education. For this aim, we investigated a total of 2955 publications on the flipped classroom obtained from the Web of Science database. Then, a bibliometric analysis of the publications was carried out in this study of qualitative research method. The publications have been examined in terms of some bibliometric variables and are presented descriptively. We performed a content analysis using tables and the VOSviewer program. According to the results, the most commonly used keywords in the research are the "flipped classroom learning" and "active learning", and the publication language is generally English. The most common types of documents are papers and articles. Valencia Polytechnic University is the most contributing institution in its field of study. The most active countries in terms of the number of studies are the USA and China.

Introduction

Today, with the increase in the use of information and communication technologies, there have been innovations in education. Educators include information and communication technologies while designing educational processes. Innovations in education are regarded as the reflection of technology in the process of change to the main educational environments, methods and tools (Kara, 2016). While including technologies in the teaching process, attention has been paid to having processes that allow students to organize and design according to their learning situation, which is active and able to access materials and documents at intended any time and place (Bishop & Verleger, 2013). Therefore, there is a need for learning activities in which students can be active in the teaching process in schools. In this context, learning activities are created using educational software, game-based learning environments, web-based learning environments, e-learning contents that will contribute to teaching in the teaching process (Çelen, Çelik, & Seferoğlu, 2011). Depending on the rapidly changing technology, one of the educational models in which educators include information and communication technologies that make learning easier is the "Flipped classroom model" (Çakır, Adsay & Akgül-Uğur, 2019; Kara, 2016; Zainuddin et al., 2019).

Bergman and Sams (2012) recorded their lesson teachings as video. They showed their students how to access lesson videos and how to take notes while watching. Students were asked to watch the videos they uploaded to the web as homework before the lesson. They made changes in the videos according to the reactions from the students watching the videos. The students had the opportunity to solve the problems at the application level with their teachers in the classroom environment. It has become popular with the success provided by the application of the method throughout the year. The media brought up this method and referred to it as 'flipped classroom' (Bergman & Sams, 2012). The Flipped Classroom (FC) teaching model also attracts the attention of researchers, especially because it is a method of implementing active learning strategies by centering the student (Kim, et al., 2014).

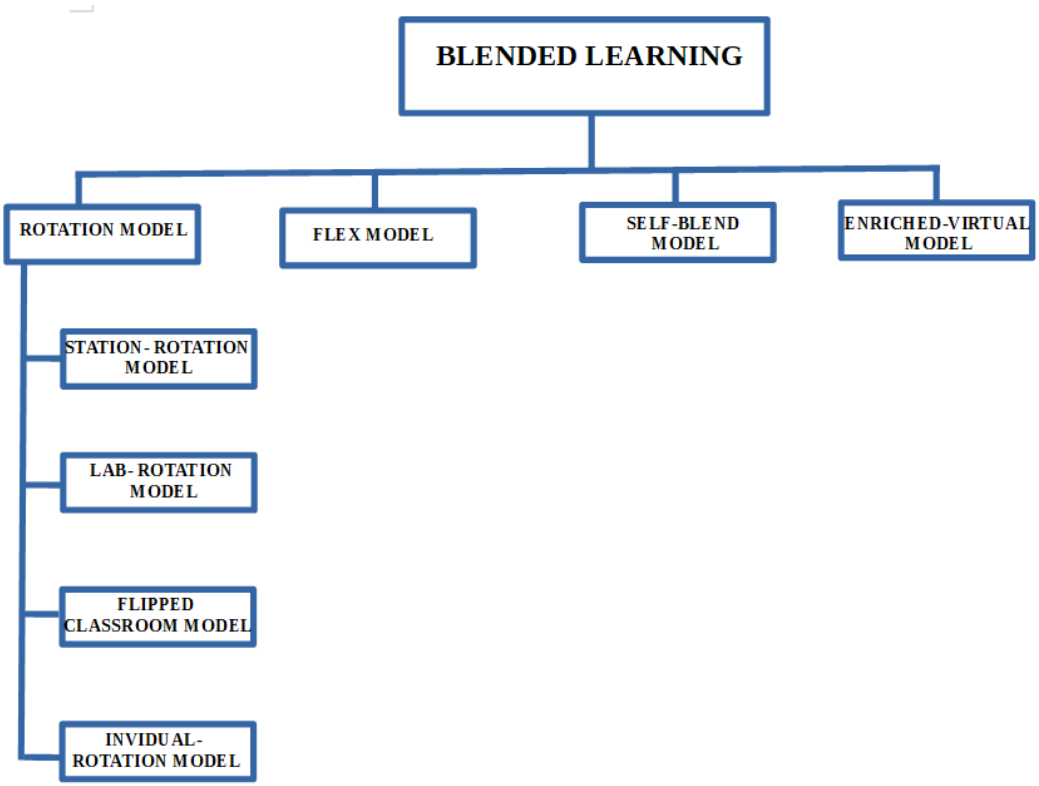

Figure 1. Blended Learning Method Types (Staker & Horn, 2012, p.8)

According to Barak and Shakhman (2008), while teachers stated that they want to ensure active participation of students, but see the lack of time as an obstacle for this situation. Baker (2000) stated that, according to the FC model, the teacher can move the lecture process out of the classroom to allow time for active learning in the classroom. Thus, the FC teaching model has become an advantageous teaching model that can be preferred in the teaching process by eliminating an important obstacle to students' learning as a result of their own experiences.

While Osguthorpe and Graham (2003) expressed blended learning as combined use of the advantageous aspects of the two different types of learning; face-to-face learning and online learning, Staker and Horn (2012) classified blended learning as appropriate learning for students by taking individual responsibility under four

titles. They referred to these titles as 'Rotation, Flexible, Self-Blended, Enriched Virtual Model'. The Rotation model is a model in which a transformation is applied between learning methods, at least one of which is online, according to the preference of the teacher within a certain program in the teaching of a class or subject. Other methods may include a small group or classroom education, group projects, individual teaching, and assignments. The Rotation model is divided into four in itself as station rotation, laboratory rotation, individual rotation and flipped class. The Station rotation model is a blended learning model that is performed on the condition that students visit both the e-learning, traditional lesson and all of the small group stations while in the classroom (Staker & Horn, 2012). According to this model, students follow a standard or daily schedule. With the most general application method, the students at the traditional class station are directed to the e-learning environment or small group study and the transition between stations has been done. When the station rotation model is examined, it is seen that the model increases teacher-student and student-student interaction, especially with small group study. It also has the potential to create stations for project-based studies (Christensen, Horn, & Staker, 2013). Laboratory Rotation Model is a blended learning model that is carried out in a way that students are exposed to different physical environments. According to this model, students follow a standard or daily schedule. Learning opportunities are presented not in just one classroom but also in different classes just like in the station rotation model (Staker & Horn, 2012). Therefore, although learning begins in the classroom with the teacher, it continues in an e-learning laboratory with assistants. While at least one of these areas is predominantly a learning lab for online learning, additional classes include other learning methods (Christensen, Horn, & Staker, 2013). The Lab-Rotation model differs from the Station-Rotation model because students alternate between locations on campus rather than staying in a single class for a blended class or subject. The Individual Rotation model is an individually customized model in which rotation is made for learning models of a particular course or topic within a program, at least one of which is online learning. An algorithm or teachers determine individual student programs (Staker & Horn, 2012). The individual rotation model is different from other rotation models because students do not have to return to each available station.

The FC method is also a subtitle of the "Rotation" model. This method is not new, since it is similar in that teachers ask their students to come prepared to the lesson and try to provide deeper learning on the preparatory study. But the reason why the model is seen as new is that developing technology is being used in a certain order (Strayer, 2012). Besides, O'Neil, Kelly, and Bone (2012) also referred to the FC model as a new model that provides an opportunity to directly engage in activities by using technological developments in education in the formation of a positive learning environment. In this model, instead of delivering the lesson directly in the classroom, the teacher records the lessons on video and shares them on the Internet so that they can be viewed before the lesson. With the displacement of activities in and out of the classroom, teachers take on the role of guide on the edge rather than the lead role on the stage, and students become active participants instead of passive listeners in the learning process (King, 1993). In the FC model in which students are active, individual learning has come to the fore with the help of various teaching technologies (Hamdan et al., 2013). In traditional educational environments, students spend their in-class time listening to the lesson and, if time remains, making researches on newly learned knowledge (Fulton, 2012).

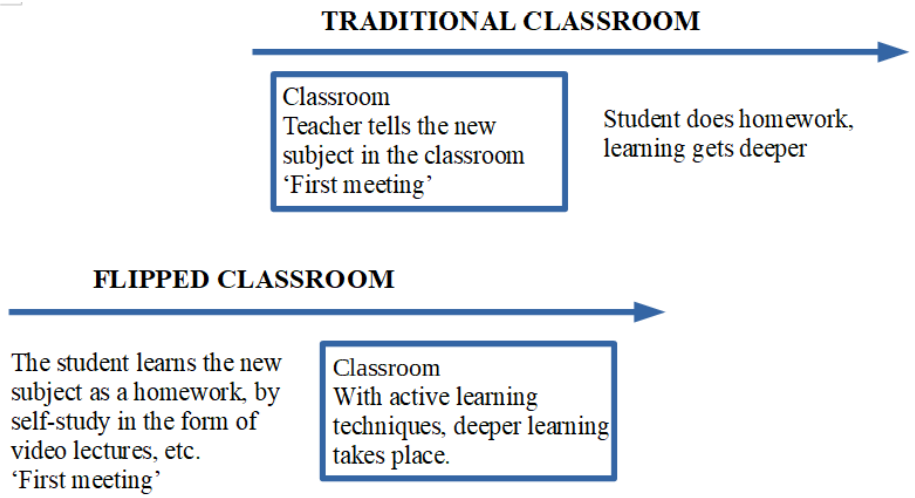

Figure 2. Comparison of Traditional Classroom and Flipped Classroom (Kara, 2016; Zownorega, 2013)

According to Figure 2, the FC model will give students an advantage over the traditional classroom model, since the students first encounter with the new subject before the classroom environment. Contrary to the traditional learning flow, the students learn the information that the teacher should teach in the classroom at home from materials recorded electronically. During the time which students spend in the classroom, they do exercises that will reinforce the topic by discussing in company with the teacher. Thus, with efficient time management, a detailed learning opportunity is provided instead of superficial learning.

According to Bergmann and Sams (2012), in the FC model, which emerged as an alternative to the traditional classroom, it provides the students the opportunity to learn the lesson concepts with online educational tools like film, video, and audio out of the classroom by flipping the paradigm of the traditional classroom and active learning like problem-solving and practical applications in the flow of time within the class are included. The advantages and disadvantages of the FC model in education, in general, are stated below (Alsancak Sırakaya, 2015; Bergmann & Sams, 2012; Fulton, 2012; Çakır, Adsay & Akgül-Uğur, 2019; Rutkowski & Moscinska, 2013; Turan, 2015; Zownorega, 2013):

Advantages of the FC Model	**Disadvantages of the FC Model**
• Students are active in understanding the subjects.	• Whether students have the internet or not affects access to course content negatively.
• Students come to the class with pre-learning.	• It can pose problems for students who can't motivate themselves to learn because they learn at their pace.
• It provides permanent learning as it provides the opportunity to repeat as many times as wanted.	• The expectation of learning the materials in a short time can adversely affect the quality of learning.
• It motivates by enabling students to gather their attention. It has a motivational effect.	• The fact that the situation of whether or not the students perform their learning outside the classroom cannot be brought under control affects

	negatively.
• It provides an opportunity to update by easily preparing the contents. • Students learn at their own pace and take on their learning responsibilities. • Time can be used more efficiently and creatively. • It allows students to access materials in their homes in case of absenteeism.	• The teacher's inability to prepare video content is a problem. • It is a negative situation that the videos are long and technical problems may be encountered while watching the video.

Generally, the FC model provides the opportunity to take individual responsibility in the learning process allowing them to be active. By performing their extracurricular learning in the appropriate time period for themselves, it provides a higher level of in-depth learning with collaborative learning in the classroom environment. Therefore, students will be able to use time efficiently to produce creative products and solve high-level problems. It can be said that the FC model is a method that can be used in education as it allows individual differences in situations where students' facilities are similar in terms of equipment and internet infrastructure. FC model continues to exist today as a popular approach that continues to be used in education. It is possible to find researches in different fields of education related to the FC model in the literature (Al-Harbi & Alshumaimeri, 2016; Çakır, Adsay & Akgül-Uğur, 2019; Johnston, 2017; Harun & Hussin, 2017; Naccarato & Karakok, 2015; Wang et al., 2018;).

Today, there are bibliometric analysis studies in different disciplines (Alkan, 2014; Arici et al., 2019; Karagöz & Şeref, 2019; Yang, Sun & Liu, 2017; Zan, 2013). As the use of Vosviewer software makes it easier to visually express data while conducting bibliometrics analysis, it is an important tool for researchers who will perform bibliometrics analysis. Furthermore, the greatest advantage of this analysis is that it analyzes numerous scientific publications written on any subject (Zhang et al., 2015). When the related literature was examined, it was seen that Yang, Sun, and Liu (2017) examined academic publications on "Flipped Classroom" in terms of bibliometric features. In their study, the publication types and languages, the countries, features of the journals and the frequency of the keywords, of the 149 studies related to the flipped class model in SCI / SSCI for the period 2000-2015, were analyzed using bibliometric methods.

In this study, a current and wider perspective on FC was tried to be revealed by including 2955 studies conducted between 2015-2019. In the data analysis part, the data were visualized by creating bibliometric maps with the help of the Vosviewer program. Also in this current study, in addition to the research of Yang, Sun, and Liu (2017), the most cited publication, the type of publication by years, the features of the most cited authors were examined, and it was aimed to guide the researchers to conduct new studies. The answers of the following questions were sought in this study as it is thought to be important in guiding future studies on FC:

1. What is the numerical distribution of academic publications related to the Flipped Classroom by year, distribution of publication language, and publication type?

2. What are the organizations and research areas that stand out in academic publications related to the Flipped Classroom?
3. Which are the most publishing countries in academic researches related to the Flipped Classroom and the top 10 most referred publications?
4. What are the keywords that stand out in the academic publications about the Flipped Classroom and their analysis by year?
5. How is the network structure and distribution of the words used most in the abstract section of the academic publications related to the Flipped Classroom?
6. How is the network structure of the most cited authors in academic publications related to the Flipped Classroom and the network structure of the authors working together by the countries?
7. How is the network structure of the most cited sources in the academic publications related to the Flipped Classroom and the network structure of the sources most cited together?

Method

Research Model

This study is a case study as a pattern with a qualitative approach in nature. The aim of the case study is to produce in-depth results related to a particular situation (Yildirim & Simsek, 2011). The study was patterned with the case study approach as it was intended to examine the academic publications about the FC in terms of bibliographic variables and reveal the current situation.

Data Collection

In educational research, databases such as Web of Science, Scopus, and Google Scholar are widely used bibliometric databases. In this study, the Web of Science database was used for data collection. The main factor in choosing this database is that it can easily compile the data needed for bibliometric analysis. It is also an accepted and highly preferred database in the scientific literature (Braun, Schubert, & Kostoff, 2000; Yang et al., 2013). In this context, an online search of the Web of Science was conducted on November 2019, and publication information was obtained.

First, the “Search” option was accessed on the Web of Science search page. For the search, the word “*flipped classroom*” was written in the search record. “Topic” was selected as the search feature. The last five-year timeframe as 2015-2019 years was covered as the scope or research to make up-to-date comments. As a result of the access to the publications process, the number of publications included in the research was 2955. Since it is not possible to examine these 2955 studies one by one; it was downloaded as a full record with the extension ".txt" in 6 Win (tab-delimited) file format with 500, and then uploaded to the Vosviewer package program and analyzed so that visual network maps were obtained. In order to create the charts, after 2955 studies were listed in the Web of Science, the data in the "Analyze Results" menu were used. Among the bibliographic indicators, “the number of publications per years”, “the language of publications”, “document type”, “most publishing organizations” “most publishing countries” “first 10 most cited publications”, “research areas”, “analysis of

keywords based on the number of citations", "keywords mostly used in the publication abstracts", "analysis of the keywords mostly used in the publication abstracts by years", "the most cited authors", "the most cited sources", "network of co-citation of the sources" and "the network structure of the authors working together by their country" were preferred in the research for data analysis.

Data Analysis

The use of bibliometrics is preferred as a data analysis technique in the research. Bibliometrics refers to the mathematical and statistical analysis of models that appear in publications and document types as meaning (Diodato, 1994). In bibliometrics, the documents in the scientific communication string are analyzed using numerical and statistical techniques. Moreover, "Bibliometrics deals with the statistical examination of data such as the author, subject, cited author, cited sources, and make it possible to determine the general structure of a particular discipline in line with the obtained statistical results" (Zan, 2012:15).

In the research, the bibliometric variables related to the flipped classroom; "number of publications per years", "the language of publications", "document type", "most publishing organizations" "most publishing countries", "first 10 most cited publications", "research areas", "analysis of keywords based on the number of citations", "keywords mostly used in the publication abstracts", "analysis of the keywords mostly used in the publication abstracts by years", "the most cited authors", "the most cited sources", "network of co-citation of the sources" and "the network structure of the authors working together by their countries" were analyzed in a descriptively. Moreover; "Analysis of keywords by the number of citations", "analysis of keywords by years", "words mostly used in publication abstracts", "analysis of words mostly used in publication abstracts by years", "most-cited authors", "most cited sources", "network of collective citation of the sources", "the network structure of the authors working together by their countries" were also analyzed in a descriptively. Descriptive analyzes were performed using tables and VOSviewer (Version 1.6.9) package program. VOSviewer is a free-to-use computer program for creating and viewing bibliometric maps (Van Eck & Waltman, 2009).

Findings

In this section, the findings obtained in terms of 15 variables are presented in the studies related to FC. Co-occurrence analysis and then author keywords were selected to create a map of the keywords that authors use the most. The number of repetitions of a keyword is set to be a minimum of 5. It was observed according to the obtained map that there are 15 clusters in total and based on the number of repetitions obtained the keywords that the authors preferred mostly are flipped classroom (f=1399), active learning (f=217), blended learning (f=192), flipped learning (f=152) higher education (f=129), e-learning (f=82), MOOC (f=80), teaching mode (f=64), instructional model (f=59), gamification (f=44). Accordingly, the most focused keywords of the authors; are flipped classroom, blended learning, flipped learning, higher education, e-learning, MOOC, teaching mode, teaching model, gamification. According to the map, the cluster grows as the frequency of use of the keywords preferred by the authors increases (see Figure 3).

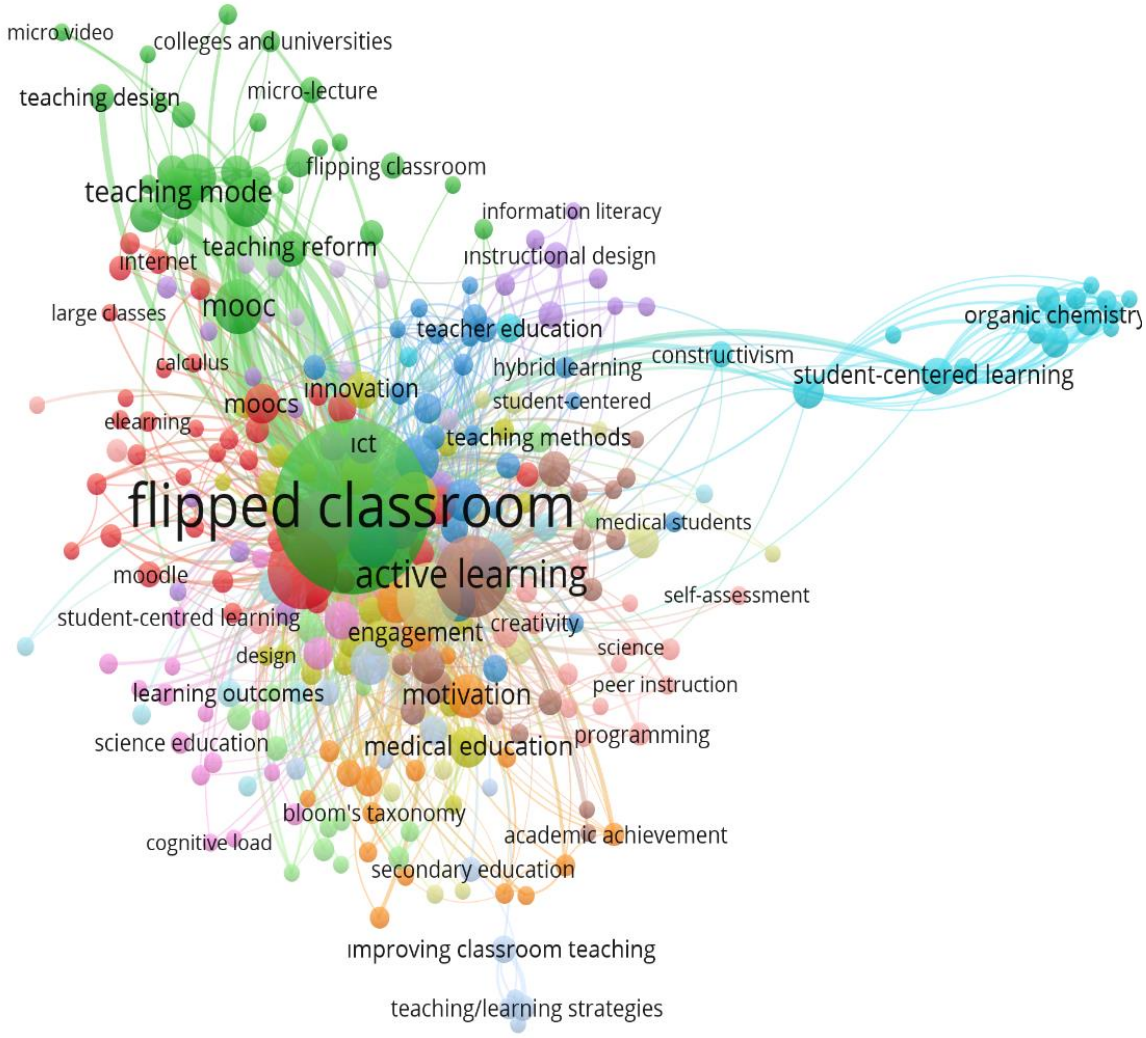

Figure 3. Keywords Preferred By Authors in Studies Related to the Flipped Classroom

In the analysis of the distribution of the number of articles by years using the keyword; co-occurrence analysis and then author keywords are selected, then 'overlay visualization' menu is selected and 'avg. pub. year' from the 'scores' field is selected. According to the map obtained; it is observed that "flipped classroom" studies started to increase rapidly since the 2000s, but the first study on FC in Web of science was conducted in 1992. It is observed that the number of conducted studies increases as the color turns yellow on the year scale. When the analysis of keywords by years was examined; it was observed that yellow color clusters were focused on in the studies made, and in the recent studies the focus was on academic achievement, teaching/learning strategies, in which classroom level the FC model is applied in higher education (first-second year undergraduate), teaching technologies used (Moodle, MOOC), in which field education the FC model is applied (medical education, engineering education, etc.), learning components (feedback, motivation, etc.) the used learning approaches (constructivism) (see Figure 4).

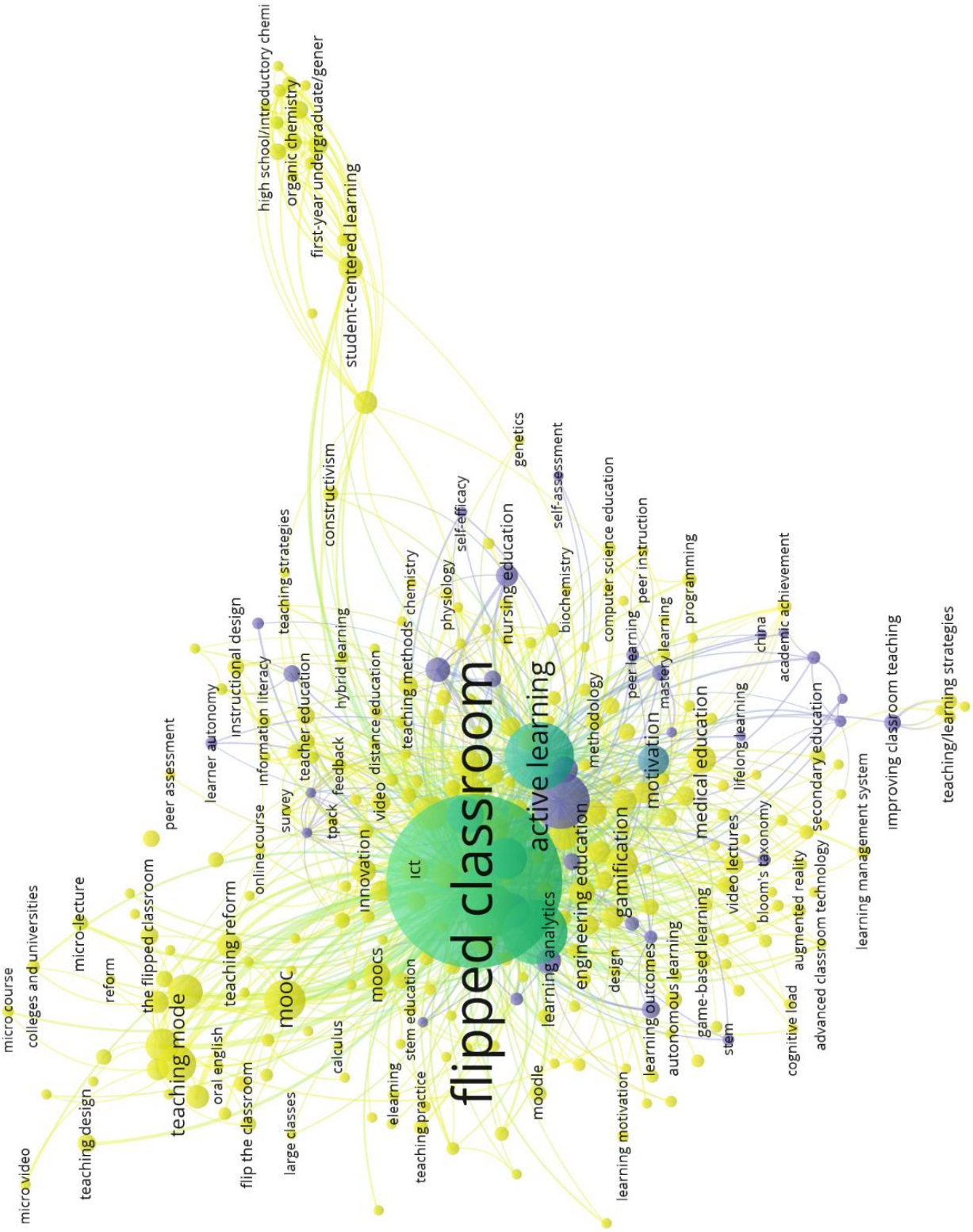

Figure 4. Distribution of the Number of Articles Using Keyword by Years

For the analysis of the word mostly used in the abstract parts of the studies conducted related to the "Flipped Classroom", web of science bibliographic database is loaded into the system and then ‘text data’ method is selected. After the abstract and binary counting methods are selected, the minimum number of repeats is set as 10 and then continued. According to the obtained map, it is seen that there are 3 clusters in the abstract parts.

Accordingly, it is observed that based on the number of repetitions obtained the most commonly used words in the summaries are teaching (f=789), development (f=463), lecture (f=372), performance (F=303). In the abstract sections of the studies on flipped learning, it is observed that the focused subjects are the content of teaching, the technologies used in the teaching environment and their impact on learning performance (see Figure 5).

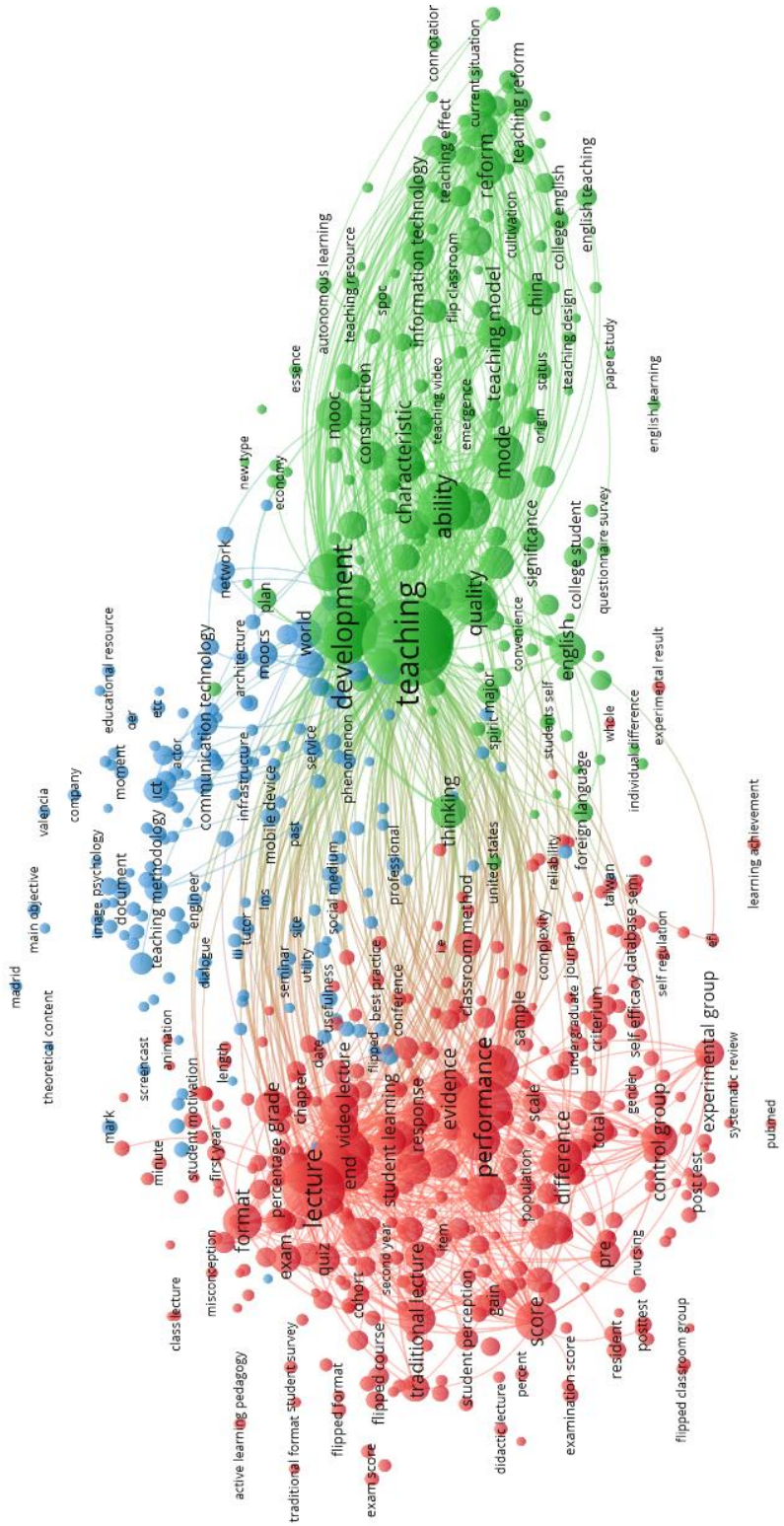

Figure 5. The Most Commonly Used Words in the Abstract Parts of the Studies about the Flipped Classroom

In the analysis of the words mostly used in the abstract of the studies conducted on the "Flipped Classroom" by the years, "avg. pub. year" is selected in the scores area from "the overlay visualization" menu. When the obtained map is examined, based on the number of repetitions, it is observed that the new studies focus mostly on experimental group, self-efficacy, score differences between experimental and control groups, and the source of teaching. According to these data, it was revealed that there was a tendency towards issues like the impact of flipped learning on student success in the abstracts of the new studies (see Figure 6)

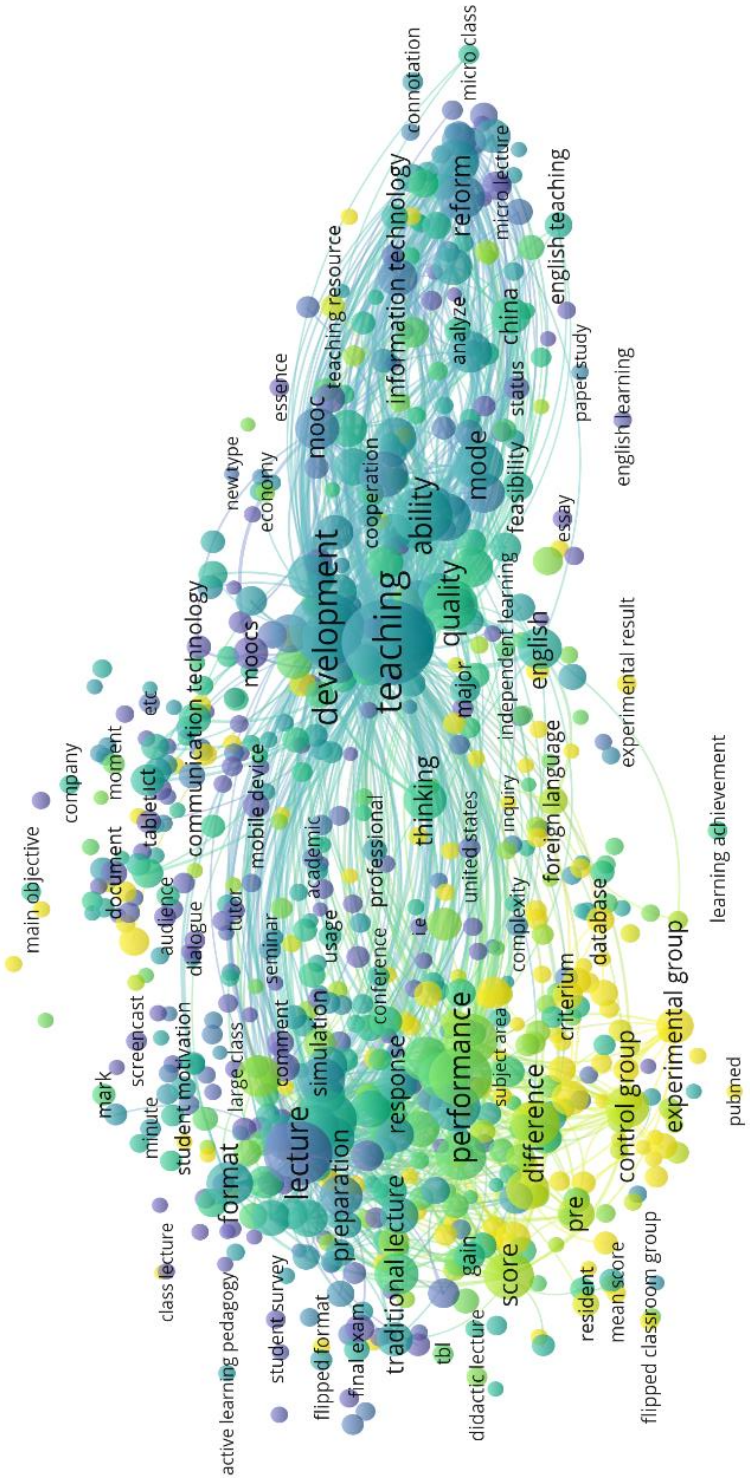

Figure 6. Distribution of the Most Commonly Used Words in Article Abstracts by Years

"Citation analysis" and "author" are selected for the most cited author analysis. The minimum number of studies of an author is determined as 3 and the minimum number of citations is 10. Accordingly, O'flaherty Jacqueline & Philips Craig (394 citations), Hwang Gwo-Jen (228 citations), Lai Chiu Lin (197 citations) and Hung Hisui Ting (154 citations) were the most cited authors in this field. Consequently, the study of the most cited authors (394 citations) was "The use of flipped classrooms in higher education: a scoping review" as given in Figure 7.

Figure 7. Most Cited Authors

To analyze the most cited sources, first "citation analysis" and then "sources" are selected (see Figure 8). The minimum number of documents is selected as 3 and the minimum number of citations is selected as 3 in the drop-down menu. According to the obtained map, the most cited magazines are; the internet and higher education (458 citations, 6 documents), computer & education (429 citations 28 documents), journal of chemical education (367 citations, 35 documents), educational technology & society (274 citations, 24 documents), chemistry education research and practice (243 citations, 12 documents).

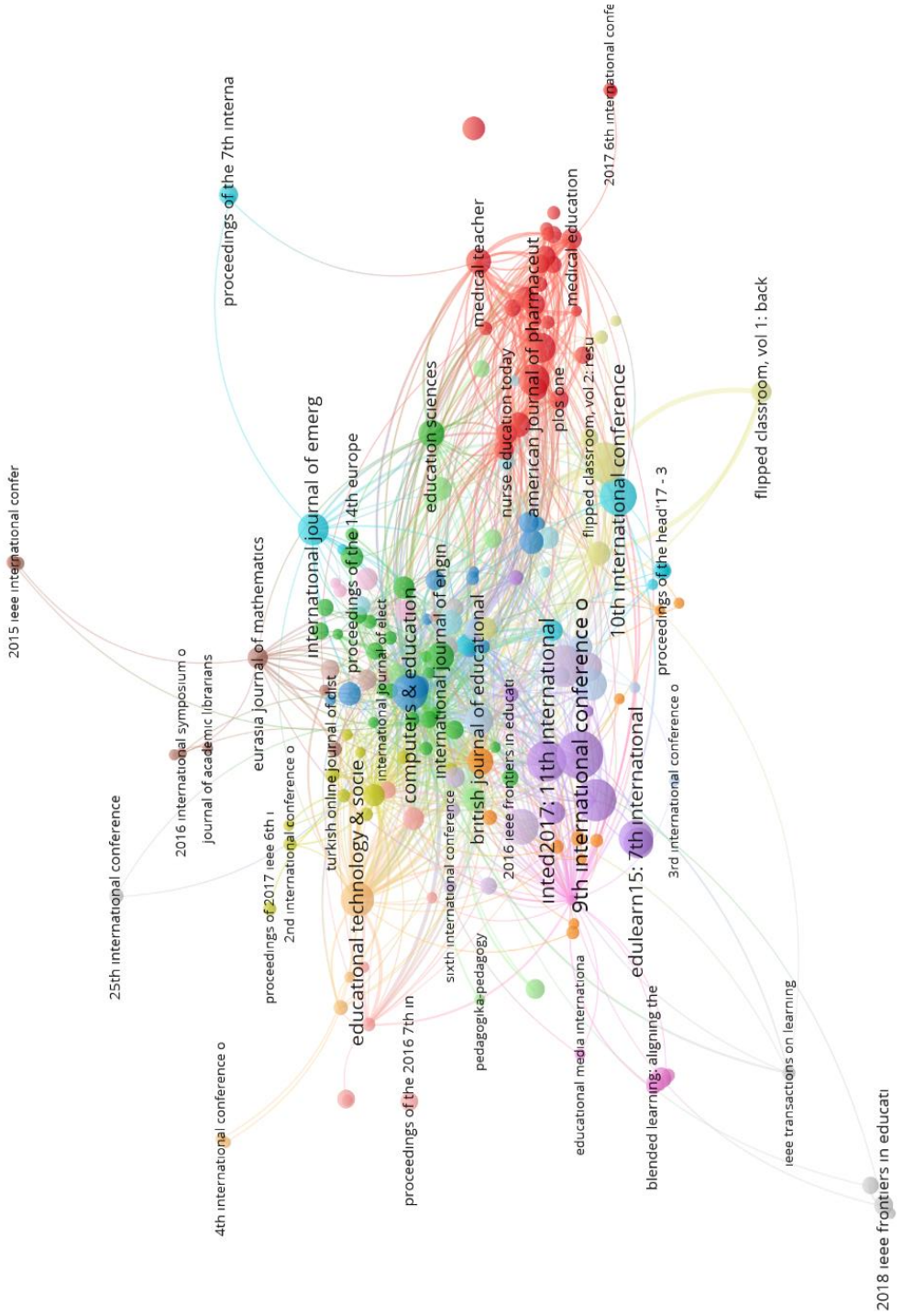

Figure 8. The Most Cited Resources

"Co-citation analysis" and "cited sources" are selected while forming the network of co-citation of the sources (see Figure 9). The minimum number of citations of a source was set at 20 when the map was created. The most cited sources are journal of computer and education (1778 common citations), j chemical education (826 common citations), am j pharmacy education (817 common citations), internet and higher education (756 common citations).

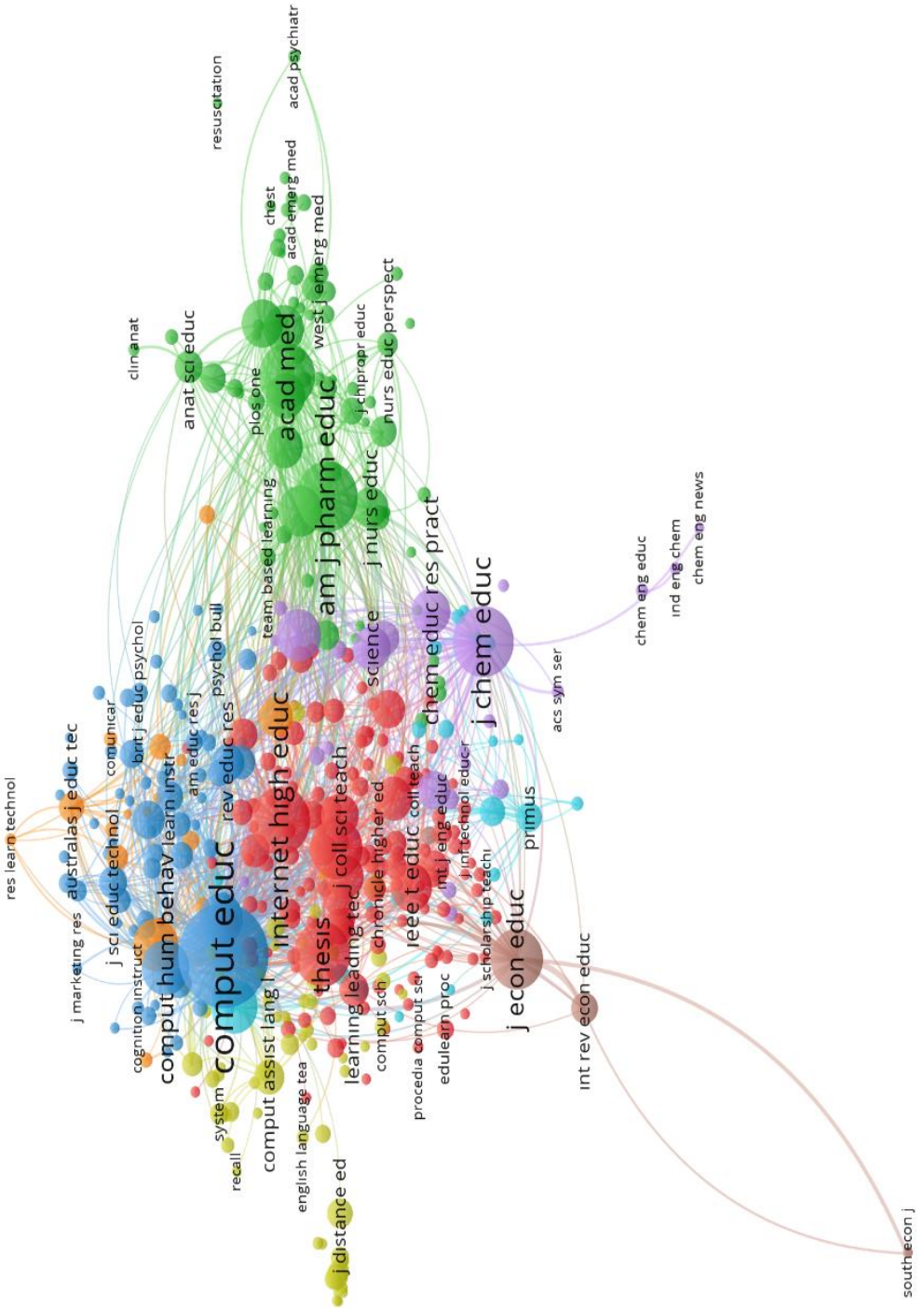

Figure 9. A Network of Co-Citation of Sources

"Co-authorship analysis" and "countries" are selected when creating a network structure based on the countries of the authors working together (see Figure 10). When creating the map, the minimum number of countries is

selected as 3 and the minimum number of citations as 3. Accordingly, the number of citations and documents according to the countries of the authors working together; USA (3823 citations, 825 documents), Australia (1257 citations, 122 documents), Taiwan (962 citations, 129 documents), China (590 citations, 762 documents), UK (188 citations, 100 documents).

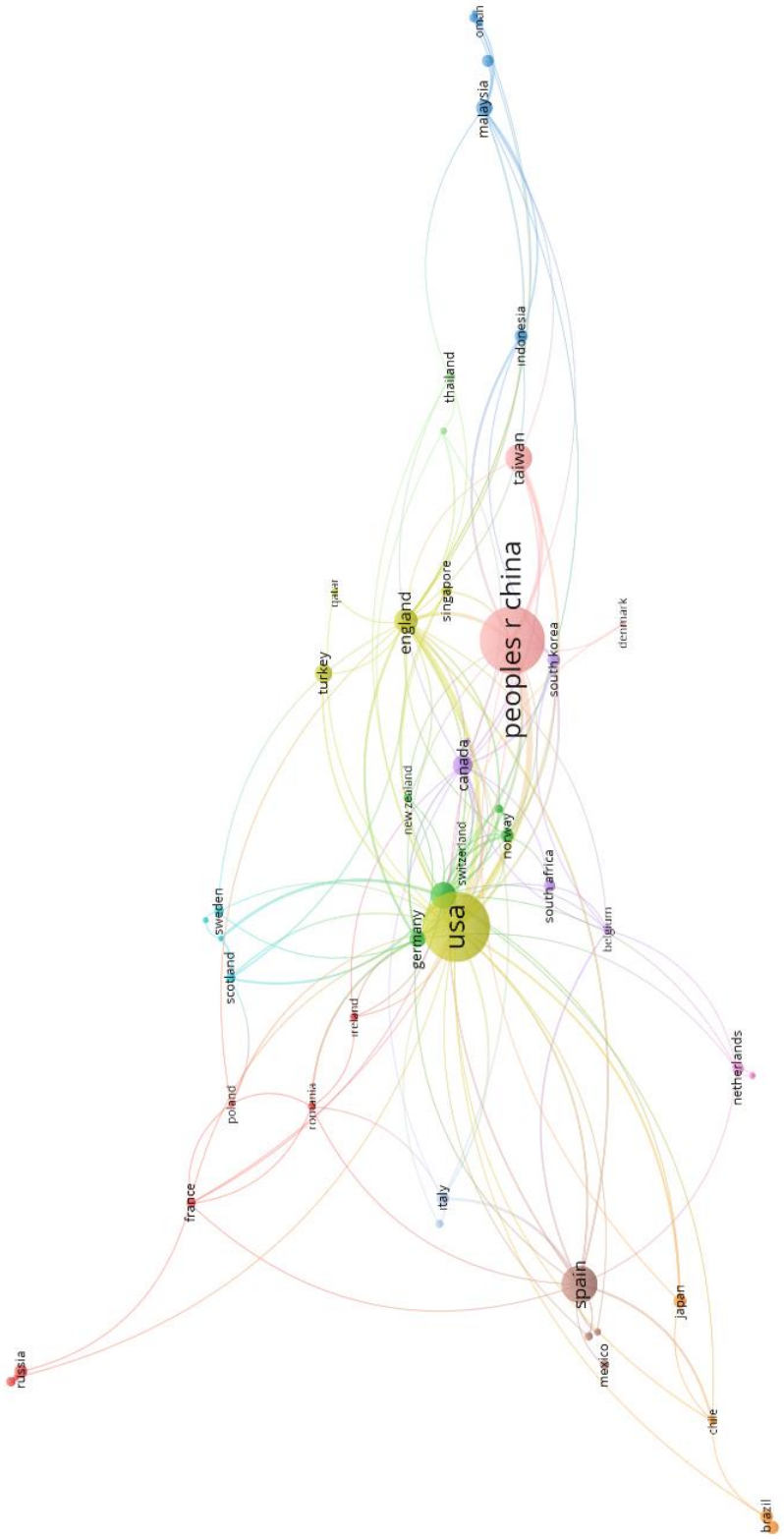

Figure 10. Network Structure of Co-Authors by Their Countries

The data were obtained from "the web of science core collection" by selecting "document types" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". According to the data obtained in the last 5 years, the studies related to flipped learning were mostly made on papers followed by articles, meeting summaries, book sections, review articles, discussion articles, pre-release articles, manuscripts, book views and new studies (see Table 1).

Table 1. Document Types in Researches on Flipped Classroom

TYPE	**TOTAL**
Proceedings Book	1406
Article	1310
Meeting Summary	116
Book Chapter	70
Review	55
Editorial material	50
Early Access	32
Letter	9
Book Review	8
New items	4

The data were obtained from "web of science core collection" by selecting "organizations" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". According to the table above, the organization that does the most work on flipped learning is “Valencia Politecnic University”. It is followed by “Hong Kong University”, “Carolina University”, “Madrid Polytechnic University”, “National Taiwan University of Science and Technology”, “Bohai University”, “Michigan University”, “Monash University”, “Zaragoza University” and “National Taiwan Normal University” respectively (see Table 2).

Table 2. Organizations That Do the Most Work On Flipped Classroom

Organization	**Number of Studies**
Valencia Politecnic University	26
Hong Kong University	22
Carolina University	21
Madrid Polytechnic University	21
National Taiwan University of Science And Technology	20
Bohai University	19
Michigan University	19
Monash University	18
Zaragoza University	18
National Taiwan Normal University	17

The data were obtained from "web of science core collection" by selecting "languages" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". Accordingly, the English language was preferred most (95.48%) in the studies on flipped learning. It is followed by Spanish, Chinese, Portuguese, Russian, German, Korean, Bulgarian and Turkish languages respectively (see Table 3).

Table 3. Top 10 Most Used Publication Languages in Studies on Flipped Classroom

Language	Total	Rate
English	2791	95.48%
Spanish	88	2.97%
Chinese	43	1.45%
Portuguese	12	0.40%
Russian	6	0.20%
Germany	4	0.13%
Korean	3	0.10%
French	3	0.10%
Bulgarian	2	0.06%
Turkish	2	0.06%

The data were obtained from "web of science core collection" by selecting "countries/regions" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". According to the data obtained, the United States (with the a of 34.27%) has the most publications on flipped learning. It i s followed by China, Spain, Taiwan, Australia, England, Canada, Turkey, Germany, Malaysia respectively (see Table 4).

Table 4. Top 10 Countries with the Most Streaming of Flipped Classroom

Countries	Number of Studies	Rate
USA	825	95.48%
China	763	2.97%
Spain	233	1.45%
Taiwan	129	0.40%
Australia	122	0.20%
England	100	0.13%
Canada	76	0.10
Turkey	56	0.10%
Germany	52	0.06%
Malaysia	51	0.06%

The data were obtained from "web of science core collection" by selecting "research areas" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". According

to the data obtained, "educational research" (with the rate of 44.38%) was the area on which the studies related to flipped learning were made. This is followed by education, scientific disciplines, interdisciplinary social sciences, computer science, interdisciplinary applications, computer science theory, management, electrical engineering, computer science, information systems, and multidisciplinary chemistry, multidisciplinary engineering fields respectively (see Table 5).

Table 5. Top 10 Research Areas About Flipped Classroom

Research Areas	Number of Studies	Rate
Education, Educational Research	1539	44.38%
Education Scientific Disciplines	629	18.14%
Social Sciences Interdisciplinary	306	8.82%
Computer Science Interdisciplinary Applications	227	6.54%
Computer Science Theory Methods	204	5.88%
Management	146	4.21%
Engineering Electrical Electronic	142	4.09%
Computer Science Information Systems	96	2.76%
Chemistry Multidisciplinary	91	2.62%
Engineering Multidisciplinary	87	2.50%

The data were obtained from "web of science core collection" by selecting "publication years" from the "analyze results" menu after listing the "topic" search covering the last 5 years related to "flipped classroom". Accordingly, the year in which the most publications were made in the last 5-year period related to flipped learning is 2017. It was followed by the years 2018, 2016, 2015 and 2019 respectively (see Figure 11).

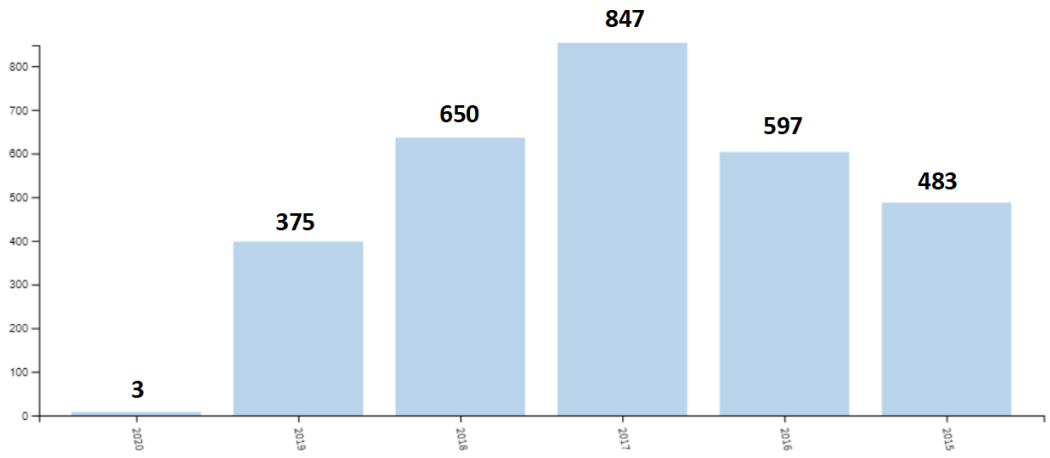

Figure 11. The Number of Publications by Years Related to Flipped Classroom

The data was obtained from "web of science core collection" by selecting "create citation report" after listing the "topic" search covering the last 5 years related to "flipped classroom". Accordingly, the top 10 publications with the most citations in the table above are ranked according to the number of citations received. The maximum number of citations received for the time being is 394 for one publication (see Table 6).

Table 6. Top 10 Most Cited Publications Related to the Flipped Classroom

No	Publication Name	Total Citation
1	The use of flipped classrooms in higher education: A scoping review	394
2	Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research	298
3	Enhancing Student Engagement Using the Flipped Classroom	178
4	Improvements from a Flipped Classroom May Simply Be the Fruits of Active Learning	171
5	Flipping the classroom for English language learners to foster active learning	131
6	The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education	104
7	A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course	90
8	Flipping for success: evaluating the effectiveness of a novel teaching approach in a graduate level setting	86
9	Seamless flipped learning: a mobile technology-enhanced flipped classroom with effective learning strategies	84
10	Twelve tips for "flipping" the classroom	76

Discussion

In this study, a total of 2955 studies published between 2015 and 2019 in the “web of science” database, based on the FC model, were analyzed in a descriptively. These analyzes were performed using tables and the VOSviewer (Version 1.6.9) package program. As a result of the examination, findings related to the “number of publications per years”, “the language of publications”, “document type”, “most publishing organizations” “most publishing countries” “first 10 most cited publications”, “research areas”, “analysis of keywords based on the number of citations”, "keywords mostly used in the publication abstracts”, "analysis of the keywords mostly used in the publication abstracts by years”, “the most cited authors”, “the most cited resources”, “network of collective citation of the sources” and “the network structure of the authors working together by their country" were preferred in the research for data analysis.

In the studies conducted on the FC model; based on the number of repetitions of the most used keywords, it was observed that most of the keywords used and, thus, the focused subjects were FC, active learning, blended learning, flipped learning, higher education, e-learning, mooc, teaching modes, teaching model and gamification. Yang, Sun, and Liu (2017) reached a similar conclusion in their study to reveal the trends in 149

articles published on flipped learning between 2000 and 2015, and found that the most used keywords were active learning and blended learning. When the distribution of the keywords by years was examined; it was concluded that in the recent studies the focus was on the subjects like academic achievement, teaching/learning strategies, in which classroom level the FC model is applied in higher education (first-second year undergraduate), teaching technologies used (moodle, MOOC), in which field education the FC model is is applied (medical education, engineering education, etc.), learning components (feedback, motivation, etc.) the used learning approaches (constructivism). Zainuddin et. al (2019) found a similar result in the content analysis they made concerning the studies published on the flipped classroom between the years 2017-2018, and they found that the most frequently used keywords in these studies were; the flipped classroom, teaching/learning strategies, pedagogical subjects, blended learning, active learning, higher education, and learning performance. "Constructivism", which emerged in the analysis of keywords by years, shows that the approach adopted in recent studies is constructivism.

Similarly, Aydin and Demirer (2016) found in their content analysis related to flipped learning that constructivist and social constructivist approaches were mostly used in the studies. In this sense, it is seen that our study matches the literature. When we look at the words used most in the abstract parts of the studies about the FC, it is seen that these are teaching, development, lesson and performance. From this point of view, it is understood that the subjects focused on in the abstract are the teaching environments, student performance, the way the lesson is thought. When it is examined the distribution of these words by year, it is seen that the recent studies have mostly focused on the differences in learning performance and the source of teaching, which the FC model creates against the traditional class model.

The most cited authors on the FC model were O'flaherty Jacqueline & Philips Craig (394 citations), Hwang Gwo-Jen (228 citations), Lai Chiu Lin (197 citations) and Hung Hisui Ting (154 citations). Accordingly, the authors most cited were O'flaherty Jacqueline and Philips Craig (394 citations) with their study "The use of flipped classrooms in higher education: A scoping review". According to the results, the most cited sources for the flipped classroom were Internet and Higher Education, Computer & Education, Journal of Chemical Education, Educational Technology & Society, Chemistry Education Research and Practice, British Journal of Education. Zainuddin et. al (2019) obtained a similar result in their content analysis of the studies published on the flipped classroom from 2017-2018, finding that the most cited sources are Computer & Education, Journal Educational Technology and Society, Educational Technology, British Journal of Educational Technology. It is thought that there are differentiations due to the fact that the year intervals are not the same.

When examining the co-citation network of the sources, Computer and Education, Journal of Chemical Education, Journal of Pharmacy Education, Internet and Higher Education journals came to the fore. When we examined the network structure according to the countries of the authors working together on the FC model in the last five years, it was seen that countries like the USA, Australia, Taiwan, China and the UK were the first ones respectively. Accordingly, the most co-working authors were in the United States. When the statistical analysis of the document types in the studies related to the FC is examined, it is observed that the most of the studies are on papers. Besides, they are followed by the article, summary of the meeting, and the book sections

respectively. In the content analysis of the studies conducted by Aydın and Demirer (2016) about the FC between 2011-2015, they concluded that the types of documents studied were in the type of articles and thesis. This mismatch with the literature is thought to be due to the fact that the current year range is different from each other. “Valencia Polytechnic University” took the first place when the organizations that do the most study on the flipped classroom were examined. It is followed by "Hong Kong University" and "Carolina University" respectively.

The most widely used publication language in the study on the flipped classroom was English with a ratio of 95%. It is followed by Spanish and Chinese respectively. When the countries conducting the most publications on the FC were examined, it was seen that the USA had the most publications, followed by China and Spain, respectively. When examining the current literature; Uzunboylu and Karagözlu (2017) found that the most publishing country was the USA, and it was followed by Malaysia and Jamaica respectively according to the results obtained in the content analysis of the studies published on flipped classroom between 2010-2015. Moreover, in the content analysis of the studies published on FC between 2017-2018, Zainuddin et. al (2019) concluded that Taiwan was the most publishing country, followed by the USA and Turkey respectively. It was seen that the results differentiated as the current year intervals were different, though the United States as a partner country came to the fore in all 3 studies.

Upon examination of the most studied areas of research related to the flipped classroom, it was concluded that educational research took the first place, followed by educational scientific disciplines and interdisciplinary social sciences. It was observed that although there are studies on disciplines in the literature, they have not been compiled under a general title. Yang, Sun, and Liu (2017) found in their study that the most studied disciplines are education, chemistry and medicine. For example, Uzunboylu and Karagözlu (2017) found that most studies were done in educational research in the field of health, followed by computer science and other social sciences. In their study, Aydin and Demirer (2016) again found that FC was used mostly in educational research, followed by other social sciences. In their study, Zainuddin et al (2019) concluded that most studies were done in the field of computer science, followed by educational research and other social sciences. In this sense, it is seen that the result is compatible with the existing literature. Upon the examination of the number of publications related to the flipped classroom by years, it was concluded that most publications were made in 2017. In their study, Uzunboylu and Karagözlü (2017) found that the year in which most publications were made was 2015. It is seen that the inconsistency with the literature is due to the difference in the year intervals of the studies. When the top 10 publications with the most citations on the flipped classroom were examined, it was observed that a study reached a maximum of 394 citations for the time being.

Conclusions

In conclusion, it is seen that the studies on the FC model are increasing day by day (Kozikoglu, 2019). Trends were examined in terms of a total of 15 variables in this study which was conducted to reveal trends related to the flipped classroom between 2015-2019. These are; “number of publications per years”, “the language of publications”, “document type”, “organizations” “most publishing countries” “first 10 most cited publications”,

"research areas", "analysis of keywords based on the number of citations", "keywords mostly used in the publication abstracts", "analysis of the keywords mostly used in the publication abstracts by years", "the most cited authors", "the most cited sources", "network of co-citation of the sources" and "the network structure of the authors working together by their countries". Although there are similar studies in the current literature regarding FC, it is thought that there is no such detailed and current study in terms of scope and findings, therefore it is thought to contribute to the literature.

The FC model, which is popular in recent years with the development of technology, has a positive impact on students' cognitive and affective goals (Kozikoglu, 2019). The FC model, which offers an autonomous studying environment to the individual, increases the individual's internal motivation and ensures him/her advance at his/her own pace (Zainuddin et al, 2019). In this sense, the use of the FC model in learning environments is recommended as it improves learning performance and provides an effective learning environment. It is considered that this study, in which the data obtained in the light of the conducted studies are compared and interpreted with the existing literature, will contribute to literature. New studies using different methods are recommended to provide a more in-depth analysis of the FC model.

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