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Review Article

Trends in Flipped Classroom of Higher Education: Bibliometric Analysis (2012–2022)

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Abstract
The "flipped classroom" learning model in higher education requires the preparation of technological and pedagogical knowledge in Higher Education. This study was viewed bibliometrically from 2012-2022 using data collection techniques from Microsoft Excel and VOS Viewer. The purpose of this study is to explain the flipped classroom trend in higher education. This document is taken from the collection of Scopus articles. The keyword used was "flipped classroom" with a total of 2821 documents, but 2054 were selected for bibliometric analysis with certain criteria. The results showed that the United States of America was the document publication with the highest number of citations. This study presents data from Scopus as many as 2054 published data. In 2015 the article belonged to O'Flaherty J., Phillips achieved the most citations, namely 1011 other authors. While in 2017-2021 the number of citations is as much as19902 and is expected to continue to increase in 2022 (currently n=121 Scopus documents, citations of 289 articles). Another finding is that the trend of flipped classrooms continues to increase in Higher Education to hone 21st-century skills.

Keywords: Bibliometric Analysis, Flipped Classroom, Higher Education, VOSViewer

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1. INTRODUCTION

In recent years, the idea of flipped classrooms is "flipping the class" to make class time more interesting and learner-centered (Smith JD, 2013). Early in the 20th century, the flipped classroom model was first developed. The flipped classroom gained popularity among educators in 2009 (Awidi and Paynter, 2019). The main reason is that the flipped classroom model tends to have a very positive effect on student performance. In addition, this model is recognized and applied worldwide in various disciplines at various levels of education (Albahuoth, 2020).

The Flipped Classroom model is an alternative approach in higher education that flips the traditional classroom upside down. This includes the latest methodology in learning (Cheng et al., 2019). In line with Abeysekera and Dawson (2015), recognizing that Flip Classroom requires pedagogical knowledge as a form of learning outside the classroom. Flipped learning is using technology to learn. Voogt and Roblin (2012), who identified technology-based learning as a common component in all twenty-first-century learning frameworks, further support this.

Technology can be used to enhance critical thinking, creative and inventive thinking, and real-world problem solving as a cognitive, metacognitive, and epistemic tool. ISTE (2007) states that a lot of focus is put on using technology to assist pedagogical progress. In addition, it can develop 21st century competencies in higher education. Therefore, Voogt and Roblin (2012) revealed that technology-based learning supports the 21st century learning framework. Technology can be utilized as a cognitive, metacognitive, and epistemic tool to enhance genuine problem-solving, critical thinking, and creative and original thinking.

1.1 Literature Review

Several studies such as Bergmann and Sam (2012) have provided evidence that the flipped classroom is an innovative pedagogical approach in higher education student-centered by reversing the learning system. This method has many benefits according to McLaughlin et al (2014), such as students becoming open and positive, independent, and creative knowledge and more critical in addressing 21st-century problems. Additionally, compared to traditional classes (where students are required to complete assignments outside of class and the teacher explains everything in class), students' levels of academic motivation, satisfaction, and performance significantly improved (Roehl et al., 2013; Gilboy et al., 2015; Hung, 2015; O'Flaherty and Phillips, 2015). Flipped classroom is a clear alternative in the field of education. Apart from requiring teachers pedagogical knowledge, technological knowledge is no less important. Technology is needed to be able to innovate well in learning at the higher education level. Higher education learning innovation leads to learning to improve skills such as critical thinking, collaboration, communication, creativity, and communication. This will be a challenge because the global lockdown of education due to the COVID-19 pandemic has made the flipped classroom very important for students in higher education. This is because education must continue despite the pandemic. Higher educators need knowledge and technology transformation to implement a flipped classroom. The flipped classroom is useful in higher education because in higher education contains material concepts that require deeper reasoning, so that when using the flipped classroom students gain prior understanding through literacy for abstract concepts. The use of flipped classes can make it easier for students to learn abstract concepts in chemistry (Donnell and Hernández 2018; Robert, Lewis, Oueini, and Mapugay, A. 2016)

Numerous studies have shown that when compared to regular classrooms, using a flipped classroom can greatly improve student motivation, contentment, and performance (Roehl et al., 2013; Gilboy et al., 2015). Other studies demonstrate the flipped classroom model as a clear option in the field of education since it incorporates technology, which offers students creative and dynamic learning opportunities (Forsey et al., 2013). From the teacher's perspective, a flipped classroom can challenge students' memory to become growing (Sánchez et al., 2020). Another interesting thing is that the flipped classroom can show how the reverse approach is considered a cost-effective formula for serving students in a more individualized way in the classroom.

1.2 Purpose of the Study

Based on the problems above, the researcher wants to analyze bibliometrics in the use of flipped classrooms with 2054 Scopus documents which were analyzed with Microsoft Excel and VoS Viewers. In contrast to previous research, this bibliometric study examined 2054 Scopus articles from 2012 to 2022. This can be an overview of the world of education in terms of annual country publications and

citations, frequently cited documents, author keywords, sources, and institutions. It is significant that there are no bibliometric studies discussing flipped classrooms in vulnerable higher education 2012-2022. Therefore, the current review addresses the following research questions (RQs):
RQ1 : How is the development of the trend of flipped classrooms in higher education during 2012-2022?
RQ2 : How do references to flipped classrooms of high education in publication and citation trends?
RQ3: How many journals are in a flipped classroom?
RQ4 : What are the keywords in flipped classrooms?

2. METHODS

2.1 Research Design

This study aims to analyze the trend of flipped classrooms, document publications, citations, authors, journals, institutions, countries, and keywords using the bibliometric mapping method from a global perspective from 2012-2022. In addition, the flipped classroom is observed in the development of technological and pedagogical knowledge globally. In recent years, the bibliometric analysis technique has gained a lot of traction. The term “bibliometric analysis” refers to a numerical examination of the publications created by individuals or organizations over a specific time period in a specific locale as well as the connections between these publications (Ulakbim, 2021). In this way, bibliometric analysis provides the reader with projections among complex data as well as a visual map of studies in a specific subject in the literature.

This research is a case study with a qualitative approach. The publication of articles related to flipped classroom learning which is applied in chemistry learning reveals the current situation. The selected research database is Scopus with a total of 1054 documents. The search for the results of the flipped classroom research uses the keyword “flipped classroom” in Scopus. The inclusion and execution criteria used by the author are as follows.

Table 1. Inclusion and Exclusion Criteria

Inclusion
1. Keyword searches are limited to document titles, abstracts, and keywords
2. Documents are written in English
3. Documents focus on Flipped Classroom
4. All Publication dates
5. Has been cited by other authors
Exclusion
1. Documents published in non-English
2. Documents are not associated with Flipped Classroom
3. The document focuses on Flipped Classroom at the high school level

In carrying out the process of analyzing the data, researchers did not take all the articles that were on Scopus from 2012 to 2022, but had to sort out the criteria. The criteria themselves are divided into inclusion and exclusion criteria. This inclusion criteria is used as a source for further analysis of bibliometric dataKeyword searches are limited to document titles, abstracts, and keywords, documents are written in English, documents focus on Flipped Classroom, all publication dates and have been cited by other authors. While the exclusion criteria are criteria that make

the reason for researchers to examine a document, including documents published in non-English. This is due to the difficulty of researchers in analyzing articles using languages from other countries such as France, China, and Germany. Then the second criterion is that the document is not related to the Flipped Classroom. Unrelated data regarding flipped classrooms should be reduced by researchers. Furthermore, Documents focuses on Flipped Classroom at the intermediate level.

In recent years, the idea of flipped classrooms is "flipping the class" to make class time more interesting and learner-centered (Smith JD, 2013). Early in the 20th century, the flipped classroom model was first developed. The flipped classroom gained popularity among educators in 2009 (Awidi and Paynter, 2019). The main reason is that the flipped classroom model tends to have a very positive effect on student performance. In addition, this model is recognized and applied worldwide in various disciplines at various levels of education (Albahuoth, 2020).

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2.2 Data Collection and Analysis

2.2.1. Scopus Document

Scopus database collected via www.scopus.com. Scopus is the world's largest abstracting and indexing database. Scopus offers a wide range of disciplines relevant to the internationalization of higher education. The search for Scopus data begins with determining the bibliometric research topic. This bibliometric takes the topic Flipped Classroom because it has been cited 43255 by other authors or has an average citation of 15.33 per document. The documents that the researchers found were 2,821 articles from 2012 to 2022. However, after being reduced based on the inclusion data, there were 2,054 data that were used as sources for bibliometric analysis. The choice of data collection using Scopus is because the scope of scientific databases is wider than the others. The following are the steps in Scopus data collection, namely the keyword "flipped classroom" is used to search for published documents related to the title and scope of the study. The Scopus documents obtained were then reduced based on inclusion criteria and then continued with data processing using Microsoft Excel and Vos Viewers.

2.2.2. VosViewer

Starting in October 2022, people can read this paper by conducting an online search and utilizing the VOS Viewer app to learn more about the flipped classroom. The distance-based "Visualization of Similarity" bibliometric network is mapped to keywords using the VOSviewer application, resulting in grouping. In this regard, the

relationship between nations, organizations, investigators, and sources is seen using the VOS Viewer and denoted by nodes and colors. In order for clusters to form, these nodes are connected to one another. The node also displays the number of things.

In order to display and study the network map, the researcher must first download the data from the Scopus database as a comma-separated file (.csv) and import it into the VOSwiever application. Researchers can view the data using the VOSViewer tool, which does bibliometric mapping analysis for the "most frequently used keywords in papers," "most frequently discussed phrases in abstracts," "most cited authors," and "most cited journals."

2.3 Procedure

The procedure that researchers use is using prism flow. Prisma flow is a form of bibliometric research framework that makes it easier for researchers to carry out the data analysis process. The data search process in this study refers to the Prisma Flow framework, presented in Figure 1.

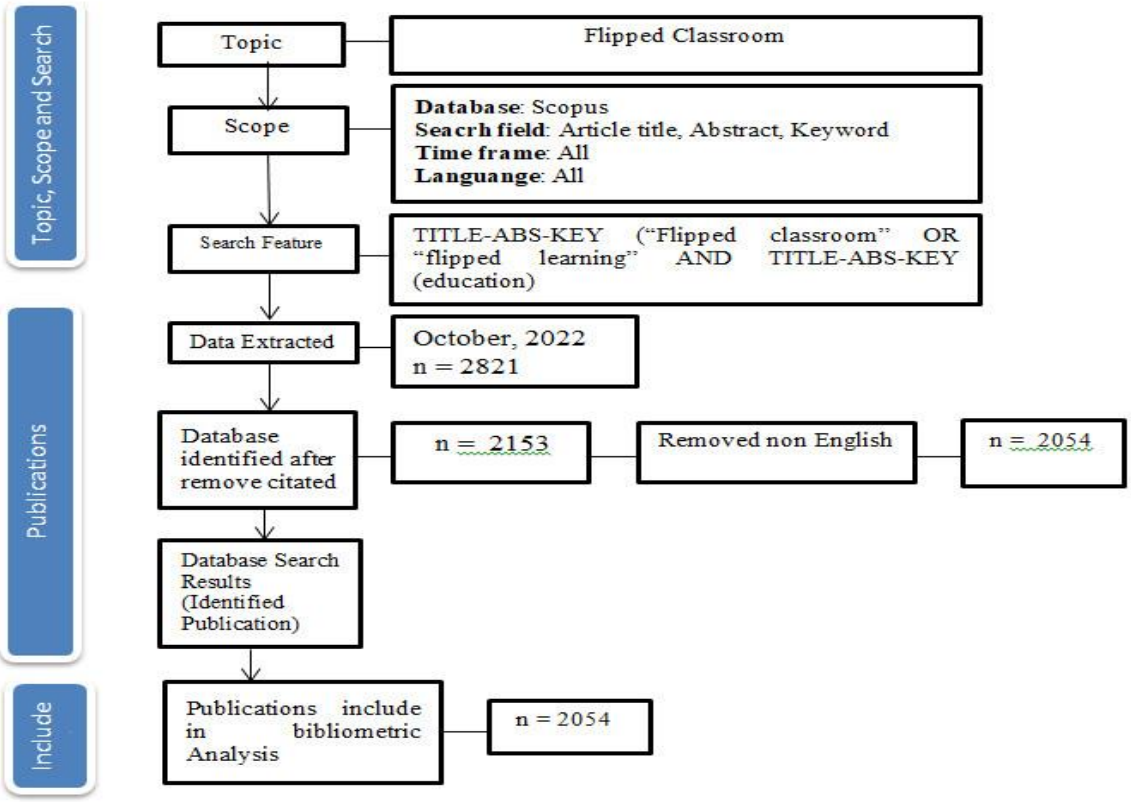


Figure 1. Schematic of the Prima Flow Flipped Classroom

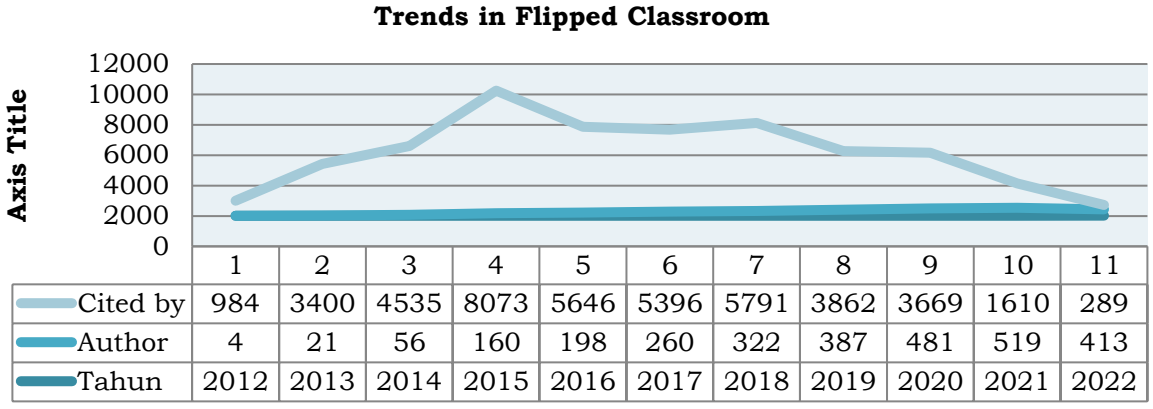
3. RESULTS

Flipped classroom studies in school learning began in 2012 and The number of publications in the first five years (2012-2016) and the subsequent five years has significantly increased (2017-2021), then in 2022, there is also an increase in scientific publications about flipped classrooms. Therefore, researchers examined the track record of publishing scientific articles in flipped classrooms because they experienced a significant increase in flipped classroom topics. The flipped classroom is useful in higher education because in higher education contains material concepts

that require deeper reasoning, so that when using the flipped classroom students gain prior understanding through literacy for abstract concepts.

3.1 Trends in Flipped Classrooms Before Reduction of Exclusion

Following are the findings of Scopus articles in the overall trend picture from 2012 to 2022.



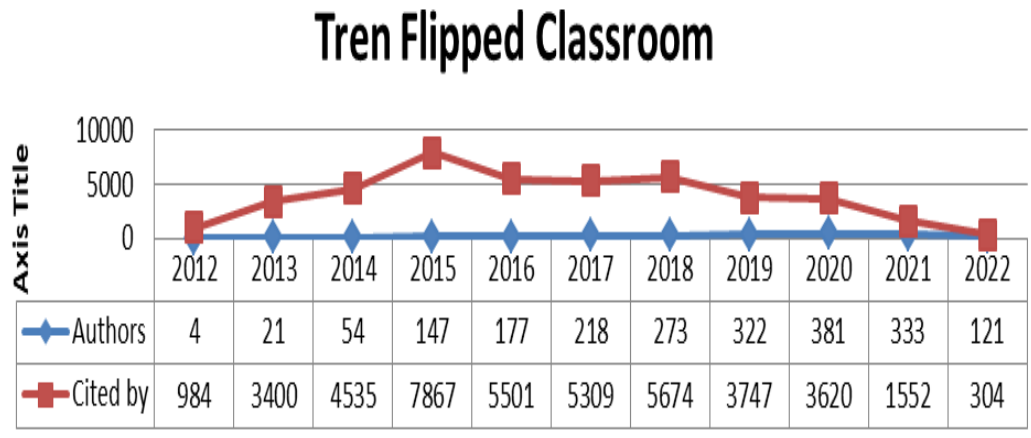
	1	2	3	4	5	6	7	8	9	10	11
Cited by	984	3400	4535	8073	5646	5396	5791	3862	3669	1610	289
Author	4	21	56	160	198	260	322	387	481	519	413
Tahun	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022

Figure 2. Trends in All Flipped Classroom Data

The following is a track record of the development of the flipped classroom from 2012 to 2022 before there was a data reduction of exclusion. After the reduction of exclusion data, data track records obtained 2153 data (after deleting data that was not cited by others). And after paying close attention, there is data that use languages other than English, namely French, Korean, and Chinese. After being observed, the data must be deleted to make it easier for the author to analyze and describe the data so that the database has a total of 2054 data.

3.2 Publication Trends and Citations

The search results indicate that a total of 2054 documents have been issued during the 2012-2022 period. Figure 2 illustrates the number of annual publications and citations.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Authors	4	21	54	147	177	218	273	322	381	333	121
Cited by	984	3400	4535	7867	5501	5309	5674	3747	3620	1552	304

Figure 3. Trend of Flipped Classroom

The first flipped classroom publication appeared in 2012 with 4 documents with a total of 984 citations. In 2013 there was an increase in publications of 21 authors, so the difference between authors in 2013-2012 was 17 authors, an increase in citations of 2416 citations. In 2014 there were 5 authors published, in 2015 there were 147 authors and in 2016 there were 177 authors. This proves that in the first 5 years (2012-2016) there was an increase in publications. In addition to an increase in publications, the first 5 years also saw a very significant increase in citations, namely in 2015 there were 7867 articles. If the data analysis process is carried out, most of the quotations come from the United States. with a total of 403 documents. A significant increase occurred in 2015 with a total of 7867 citations. This is because in 2015 many authors cited O'Flaherty J., Phillips C.'s article entitled The use of flipped classrooms in higher education: A scoping review, with a total of 1011 citations out of 7867 citations in 2015. this is unique for researchers to explore further regarding flipped classrooms in secondary education. In addition, the track record of flipped classroom publications seems to always be increasing. For the following 5-year period (2017-2021) the number of publications was 1527 authors, and the citations obtained were 19902, so the average flipped classroom publication data with citations was 13%. In 2022 there will be 304 citations and 121 Scopus articles published. So far, a total of 42,493 citations or the equivalent of 20 718 citations per author from 2012-2022. This development shows that flipped classrooms in higher education content are increasingly attracting the attention of researchers.

In 2012-2022 many documents were cited throughout the year. The documents we examined were Scopus articles, this is because articles are one of the strongest sources that writers often use to make a quote.

Quotations quoted by other authors usually have to be paraphrased to avoid plagiarism. Data similarities may also occur by two people who legally quote from the same source, this results in plagiarism because similarities in forms that are still considered plagiarism will be forwarded to the stage of further investigation (Culwin, 2001). Authors can make a quote but must meet certain conditions so that plagiarism does not occur. According to Culwin (2001), 4 processes of detecting plagiarism in higher education are collection, detection, confirmation, and investigation. One of the tools to check the quotation is VAST (Culwin, 2000). Misuse of citations so that plagiarism occurs is often done by students in higher education.

Table 2. Authors and Titles of Popular Documents Cited

Author	Year	Document Title	Source	C	C/A
Strayer JF	2012	How learning in an inverted classroom influences cooperation, innovation and task orientation	LER	791	246
Mason GS, Shuman TR, Cook KE	2013	Comparing the effectiveness of an inverted classroom to a traditional classroom in an upper-division engineering course	IEEE TE	602	161.90
McLaughlin JE et al.	2014	The flipped classroom: A course redesign to foster learning and engagement in a health professions school	AM	695	83.98
O'Flaherty J., Phillips C.	2015	The use of flipped classrooms in higher education: A scoping review	IHE	1011	58,51

Author	Year	Document Title	Source	C	C/A
Lai C.-L., Hwang G.-J.	2016	A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course	CE	339	31.07
Chen Hsieh JS , Wu W.-CV, Marek MW	2017	Using the flipped classroom to enhance EFL learning	CALL	242	24.35
Aktayr G., Aktayr M.	2018	The flipped classroom: A review of its advantages and challenges	CE	359	20.78
Awidi IT, Paynter M.	2019	The impact of a flipped classroom approach on student learning experience	CE	155	11.63
Tang T. et al.	2020	Efficiency of flipped classroom with online-based teaching under COVID-19	ILE	77	95.50
Iglesias-Pradas S. et al.	2021	Emergency remote teaching and students? academic performance in higher education during the COVID-19 pandemic: A case study	CHB	137	4.66
Jia C., Hew KF, Bai S., Huang W.	2022	Adaptation of a conventional flipped course to an online flipped format during the Covid-19 pandemic: Student learning performance and engagement	JRTE	15	2.51

Note: LER = Learning Environments Research; IEEE TE = IEEE Transactions on Education; AM = Academic Medicine; IHE = Internet and Higher Education; CE = Computers and Education; CALL = Computer Assisted Language Learning; ILE = Interactive Learning Environments; CHB = Computers in Human Behavior; JRTE = Journal of Research on Technology in Education

In this bibliometric discussion, we present the most cited journal sources and article documents annually from 2012 to 2022. In terms of the highest number of citations (C) and the average number of citations in total publications per author (C/A) each year.

3.3 Journal Sources, Documents, and Citations

Based on the SCOPUS data owned by the researcher, from 2054 data, journal sources, documents, and citations can be analyzed based on VOS Viewers with the results shown in Table 3 below.

Table 3. Sources, Documents, and Citations

Source	N	Citations	TLS
Educational Technology and Society	7	456	5
Journal of Chemical Education	12	283	3
British Journal of Education Technology	5	37	4
Journal of Physics; Conference Series	13	23	2
ACM International Conference Proceedings	7	21	1

From the table above, it can be said that the source of journals, documents, and citations is based on total link strength (TLS) with a limit of 5 link strength. The Journal of Chemical Education contains 12 documents with 283 citations with a total of LS 3, British Journal of Education Technology sources with a total of 5 documents, 37 citations with LS 4, and Journal of Physics sources; Conference Series with a total of 13 documents, 23 citations and 2 LS, and ACM International Conference Proceeding with a total of 7 documents, 21 citations and 1 LS.

3.4 Publication Analysis

From a total of 2054 documents found, the most publications that published flipped classroom journals over 100 published documents are listed in Table 4 below.

Table 4. Publication Analysis

Publishers	Publications	Percentage
Springer	200	10
Routledge	169	8
Elsevier	158	8
Taylor and Francis	110	5

The Flipped Classroom model is a topic of interest to several writers. The author publishes in various places. The top position for popular publications with more than 100 publications is Springer, followed by Routledge, Elsevier, and Taylor and Francis.

Table 5. Article Titles Based on Popular Journals

Authors	Article Title	Publisher
Kong SC	An experience of a three-year study on the development of critical thinking skills in flipped secondary classrooms with pedagogical and technological support	Elsevier Ltd
O'Flaherty J., Phillips C.	The use of flipped classrooms in higher education: A scoping review	Elsevier Ltd
Fraga LM, Harmon J.	The Flipped Classroom Model of Learning in Higher Education: An Investigation of Preservice Teachers? Perspectives and Achievements	Routledge
McLaughlin JE, White PJ, Khanova J., Yuriev E.	Flipped Classroom Implementation: A Case Report of Two Higher Education Institutions in the United States and Australia	Routledge
Al-Samarraie H., Shamsuddin A., Alzahrani AI	A flipped classroom model in higher education: a review of the evidence across disciplines	Springer
Florence EA, Kolski T.	Investigating the Flipped Classroom Model in a High School Writing Course: Action Research to Impact Student Writing Achievement and Engagement	Springer
Kuiper SR, Carver RH, Posner MA, Everson MG	Four perspectives on flipping the statistics classroom: Changing pedagogy to enhance student-centered learning	Taylor and Francis Inc.
Khanova J., Roth MT, Rodgers JE, Mclaughlin	Student experiences across multiple flipped courses in a single curriculum	Taylor and Francis Inc.

One of Kong's (2015) articles published by Elsevier discusses how well students did when pedagogical and technical support was included in subject-matter education in terms of enhancing their critical thinking abilities. The flipped classroom method was used to engage students in online pre-lesson learning preparation, in-class group discussions inside a digital classroom, and after-class extended study using a social learning platform. Knowledge of pedagogy and technology can develop students' mindsets because by using various online applications, students construct ways to be able to understand the use of these technologies in a learning activity.

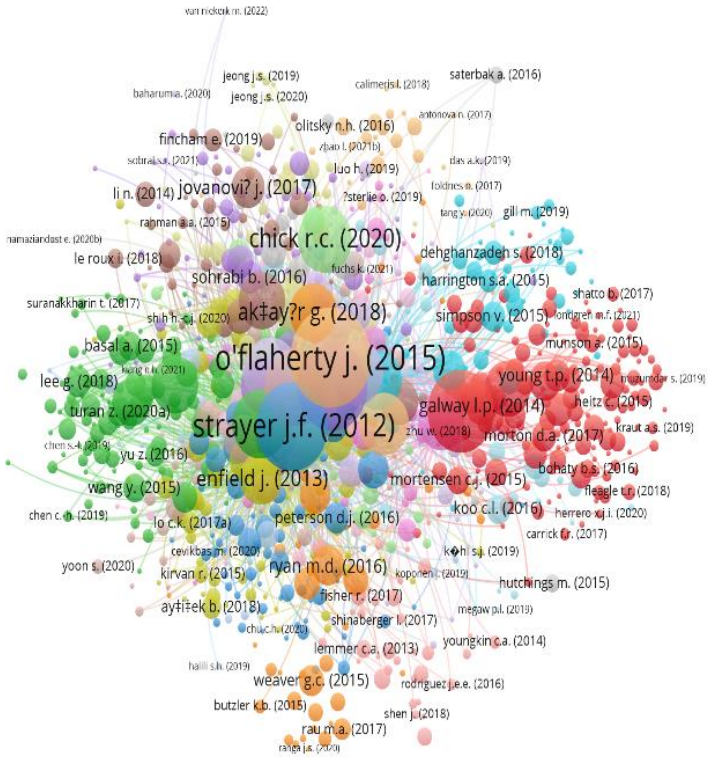


Figure 4. Most-cited Authors

Another author's publication, namely O Flaherty., Phillips C (2015) reveals that Higher education institutions are under increasing pressure to change since education is thought to need to adapt in order to satisfy the conceptual needs of our day. This is reflected in the rise of the inverted or flipped classroom. The results show that while there is a growing body of indirect evidence that the flipped approach improves academic performance and student and staff satisfaction, there isn't enough proof to say that it also fosters the development of lifelong learning and other 21st-century skills in undergraduate and graduate education. So, using a flipped classroom is a means to learn in a novel way (Cheng et al., 2019). The teacher guides learning in class and then adjusts the conventional use of the classroom to be transformed through the use of a flipped classroom. As a result, key concepts are acquired before entering the classroom. Students take on joint responsibility and take charge of their own education in this way (Lai & Hwang, 2016).

3.5 Popular Document Citations

This visualization reveals his search for the most-cited popular 2012-2022 documents. The largest node shows the author with the most citation documents, 1011 citations O'Flaherty (2015), Strayer's (2012) citations total 791 citations. These two authors lead with the highest number of citations. Then followed by other authors with a varying number of citations starting from 767 citations belonging to Abeysekera (2015), 489 citations belonging to Davies (2013), 489 citations belonging to Kim mk (2014), 469 citations belonging to Mclaughin je (2014), and 694 citations belonging to Mason (2013). The large number of citations owned by the authors shows that they are actively writing with flip-classroom articles that are interesting to quote again. Figure 4 is the result of the visualization using vos Viewers.

The most published Scopus documents belong to O'Flaherty J (2015) with Internet and high education article sources. The most cited articles on the topic of flipped classrooms discussed the findings of the flipped classroom approach in higher education and its use of literacy skills. It presents findings from a pilot study of student learning and student perceptions related to literacy using a flipped classroom. The results showed that the survey conducted indicated that the majority of students preferred the flipped classroom approach.

3.6 Trends of 15 Influential Countries in Articles

Based on the Scopus bibliometric study, it was found that 15 countries were interconnected and influential in the flipped classroom study.

In terms of document issuance by country, it was found that the United States was the country that issued the most documents and citations. Several countries have cooperated with the United States. Every country that is established, collaborates to write flipped classroom study articles with various and various disciplines. Based on previous literature reviews, the United States is the pioneer of flipped classrooms in the world and continues to expand to other countries.

Table 6. Top 15 Countries with the Most Papers Published

Country	Documents	C	TLS	C/A
United States	683	19308	5221	28,27
Taiwan	133	4202	2111	31.59
Australia	112	4347	1905	38,81
China	188	1787	1414	9.51
turkey	78	2268	1315	29.05
Hong Kong	65	2070	1170	31.85
Spain	126	1328	927	10.54
United Kingdom	88	805	738	9,15
Malaysia	61	1336	566	21,9
Canada	49	515	562	10.51
Indonesia	54	654	535	12,11
Saudi Arabia	37	344	492	9.30
Iran	31	461	380	14.87
South Korea	35	632	319	18.06
Norwegian	30	394	313	13,13

In this study, the United States is also seen to be cooperating with other Western countries such as Germany and the United Kingdom followed by countries from the Asian Continent such as China, Taiwan, Singapore, Malaysia, and Indonesia. From this collaboration, it was found that the United States has a very strong cooperation based on the thickness of the node. According to Birgili (2021),

the continent of Asia is the latest in research related to the current Flipped Classroom approach. This shows that there is good cooperation between countries to study flipped classrooms.

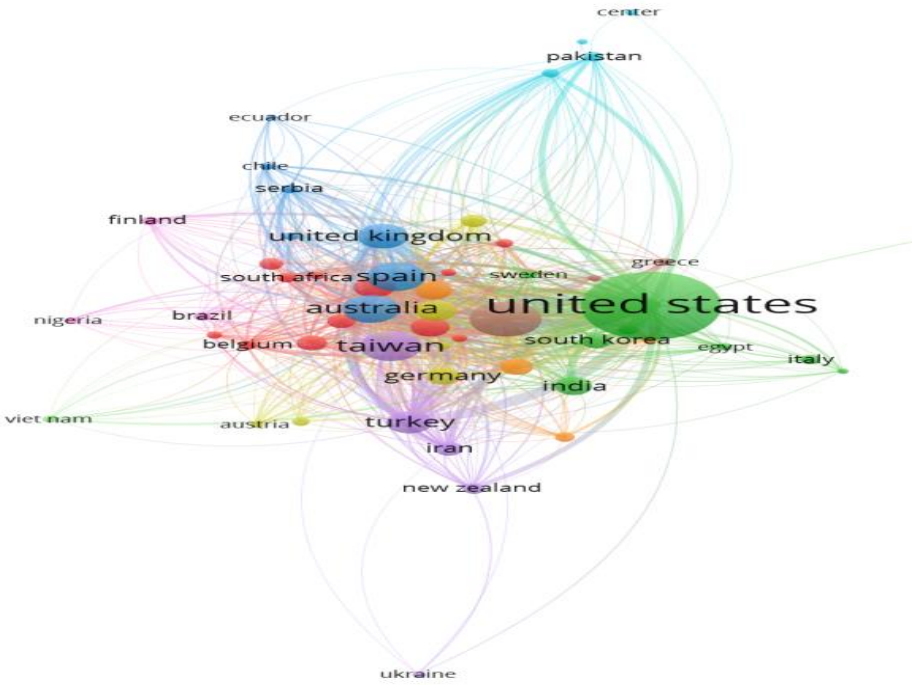


Figure 5. Visualization of Influential Countries in Articles

The majority of publications originating from the United States are indicated by the green visualization with the highest total publication of 683 documents with 199308 citations and LS 5221. Then followed by Taiwan 133 documents with 4202 citations and LS 2111. Taiwan 133 documents with 4202 citations and LS 2111. The table also states that Indonesia has an influence on flipped classroom research, which ranks 11th among several countries that are members of various flipped classroom studies. This strengthens Indonesia to continue to improve flipped classroom research in higher education in a wider scope because flipped classrooms are one of the developments in technology and pedagogy that must be mastered.

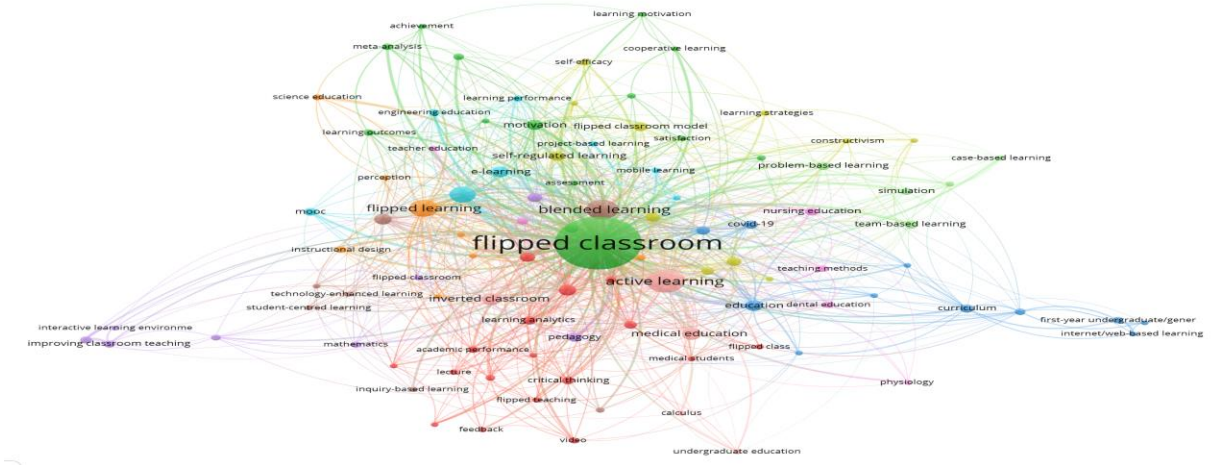


Figure 6. Visualization of Keywords That Are Often Used Together

3.7 Author Keyword Co-Occurrence

Visualization maps can show the most used words in titles, keywords, and abstracts. Then choose keyword analysis with the author. We get this data by using the Vos Viewer. Co-occurrence analysis represents the occurrence of the author's keywords in a particular article (Van Eck and Waltman. 2021). The minimum keyword that is set is 5 while the threshold that appears is 100 keywords. The visualization map is shown in Figure 6.

The visualization is shown by connected nodes and various colors. The blue color indicates the keyword flipped classroom, which shows the largest node, indicating the main keyword of this shared event in a cluster. in the pursuit of this study. The aspects that are often studied that relate to the main keywords of flipped classrooms include active learning, blended learning, higher education, education, online learning, motivation, collaborative learning, self-regulated learning, and pedagogy. In particular, the one most found in the flipped classroom is the flipped classroom (1128,948). Active learning (222,214), Blended learning (158, 154), Higher education (107, 243), Education (50, 129).

Table 7. The Occurrence of Keywords

Keyword	OC	TLS
Flipped classroom	1128	948
Active learning	222	214
Blended learning	158	154
Higher education	107	243
Education	50	129
Online learning	48	119
motivation	48	110
Collaborative learning	47	101
Self regulated learning	38	87
Pedagogy	33	76

3.8 Bibliographic Coupling of Organizations

Visual Bibliographic coupling map of Organizations with a minimum number of documents of an organization 5. Out of 4055 organizations, 4 meet the thresholds. From the 4 organizations, the total strength of the bibliographical coupling links with other organizations will be calculated. The organizations with the greatest total link strength will be selected, number of organizations to be selected 4. shown in the image below

Table 8. Bibliographic Coupling of Organizations

Organization	D	C	TLS	C/A
Faculty of Education, The University of Hongkong	7	347	136	49.6
Graduate Institute of Digital Learning and Education, National Taiwan University of Science	5	179	93	35.8
Harvard Medical School, Boston, MA, United States	5	36	83	7.2
The University of Hong Kong	5	81	4	16.2

From the bibliographical analysis of the documents, it was found that the organization Faculty of Education, the University of Hong Kong (7 documents, 347 citations), the Graduate Institute of Digital Learning and Education, National Taiwan University of Science (5,179), Harvard Medical School, Boston, MA, United States (3, 36), and The University of Hong Kong (5, 81).

4. DISCUSSION AND CONCLUSION

This study examines research trends related to Flipped Classroom in the context of higher education from 2012-2022 through bibliometric analysis. There are 2054 documents retrieved from the Scopus database and then used by VOSviewer software for further analysis. From 2012 to 2022, flipped classroom articles increased sharply with the highest publication in 2022. The most cited document, O'Flaherty's, comes from the United States. This is of concern to the researchers because the number of citations is also very much quoted by other researchers, namely a number of 1011. So it can be said that the development of the flipped trend of higher education throughout 2012-2022 has increased. In addition, the references used by various authors vary greatly in terms of publication and citation. Influential countries that have the most cooperation with other countries are surpassed by the United States and Taiwan.

During the first 5 years (2012-2016) there was a significant increase in publications when O'Flaherty wrote an article with the title Use of flipped classrooms in higher education: A scoping review. However, unfortunately, the strongest organization in this flipped classroom trend comes from the Faculty of Education, at the University Of Hongkong. The first most citations in 2012 belong to Strayer with Learning Environments sources. This shows that since 2012 the author has been very interested in flipped classroom articles, the author comes from the United States. The most widely used publisher is Springer. The keyword most used by the writer is Flipped Classroom. There was a significant increase in flipped classroom research during the COVID-19 pandemic because flipped classrooms are a very important and useful learning model to use in higher education when online learning and blended learning. This is proven by the number of publications increasing by 13% from the period before Covid-19. In 2022 there will also be an increase in flipped classroom research, namely 304 citations with 121 authors. This development shows that flipped classrooms in higher education content are increasingly attracting the attention of researchers.

Conflict of Interest

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REFERENCES

Abeysekera L & Dawson P. (2015). Motivation and Cognitive Load in the flipped Classroom: Definition, Rationale and a Call for Research. *Higher Education Research and Development*, *34*:1–14.

Albahuoth H. (2020). The effectiveness of the flipped classroom in developing the Arabic grammatical competence of class XI students. *Interactive Learning Environments*. doi: 10.1080/10494820.2020.1821714

Awidi IT & Paynter M. (2019). The impact of the flipped classroom approach on student learning experience. *Computer Education*, 128,: 269-283

Bergmann, J & Sams A. (2012). *Flip your classroom: How to reach every student in every class every day*. Washington, DC: International Society for Technology in Education.

Cheng L, Ritzhaupt, & Antonenko P. (2019). The effect of flipped classroom learning strategies on student learning outcomes: a meta-analysis. *Educational Technology Research and Development*, 67: 793–82.

Culwin F & Lancaster T. (2001). Plagiarism issues for higher education. *Vine*, 31 no.2.: 36–41.

Culwin F & Lancaster T. (2000).Visualizing IntraCorpal Plagiarism. Accepted for IEEE Information Visualization, 25-27 July, London, UK, available from South Bank University, London. *Proceedings Fifth International Conference on Information Visualisation.* 10.1109/IV.2001.942072

Donnelly J & Hernández FE. (2018). Fusing a reversed and informal learning scheme and space: student perceptions of active learning in physical chemistry. *Chemistry Education Research and Practice*, 19, no.2: 520-532.

Forsey M, Low M & Glance D. (2013). Flipping the sociology classroom: towards a practice of online pedagogy. *Journal of Sociology,* 49, 471–485.

Gilboy MB, Heinerichs S, & Pazzaglia G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior*. doi: 10.1016/j.jneb.2014.08.008

Hung, H. (2015). Flipping the classroom for English language learners to foster active learning. *Computer Assisted Language Learning* . doi: 10.1080/09588221.2014.967701

ISTE. (2007). *The national educational technology standards and performance indicators for students*. Eugene, OR: International Society for Technology. in Education. https://www.pobschools.org/cms/lib/NY01001456/Centricity/Domain/45/Ed%20Tech%20Resources/ISTENETS.pdf

Kong, S.C. (2015). An Experience of a Three-Year Study on the Development of Critical Thinking Skills in Flipped Secondary Classrooms with Pedagogical and Technological Support. *Computer and Education* 89,: 16–31.

Lai C L, & Hwang, G.-J. (2016). A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course. *Computers & Education* 100, 126-140.

McLaughlin JE, Roth MT, Glatt DM. (2014). The flipped classroom: a course redesign to foster learning and engagement in a health professions school. *Acadamic medicine* 89 no.2, 236-243.

NJ van Eck & L. Waltman. (2021). *VOSviewer manual*," Leiden University.

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, 25, 85-95.

Robert, J., Lewis, SE, Oueini, R., & Mapugay, A. (2016). Coordinated implementation and evaluation of flipped classes and peer-led team learning in general chemistry. *Journal of Chemical Education* 93 no.12 1993-1998.

Roehl, A., Reddy, S L, and Shannon, G J. (2013). The flipped classroom: an opportunity to engage millennial students through active learning strategies. J. *Family Consum. Sci.* 105, 44–49

Sánchez, SP, Belmonte, JL, Guerrero, AJM, and Hinojo-Lucena, FJ. (2020). Flipped learning and digital competence: Use the actual educational experience. *Revista Electrónica Interuniversitaria de Formación del Professorado,* 23,127–141.

Smith J & Greene H. (2020). Pre-Service Teachers Use E-learning Technologies to Enhance 105 Their Learning. *Journal of Information Technology Education*12, 121-140. doi: 10.28945/1790

Ulakbim. (2021). *Bibliyometrik analiz sıkça sorulan sorular*. https://cabim.ulakbim.gov.tr/bibliyometrikanaliz/bibliyometrik-analiz-sikcasorulan-sorular/.

Voogt J & Roblin N P. (2013). A comparative analysis of international frameworks for twenty first century competences: implications for national curriculum policies. *Journal of Curriculum Studies* 44, no.3, 299-321.