

The Current Development of Flipped Classroom Research Publications in Indonesia: A Bibliometric Mapping

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ABSTRACT

Due to the rapid proliferation of flipped classroom studies in recent years, a literature study focusing on the trends and directions of this research has become crucial. This article aims to identify the current state and direction of Scopus-indexed publications related to the flipped classroom in Indonesia. Bibliometric analysis (Donthu et al., 2021) was employed to examine 53 papers extracted from the Scopus database, published from 2017 to 2023. The analyzed papers resulted from data filtering, which included eliminating duplicate data and excluding information lacking sufficient bibliometric details. Using Harzing's Publish or Perish and VOS viewer software, this study explored the trends and direction of flipped classroom publications, encompassing documents by year, citation structure, prolific author, most cited publications, document types, publication by source titles, and publication by the institution. Additionally, intellectual interactions, as illustrated by co-authorships and co-occurrence, were identified. The findings revealed a gradual increase in flipped classroom publications and a decrease in citations. Concerning intellectual interactions, it is noteworthy that the current focuses of flipped classroom studies include topics such as 'critical thinking', 'computer simulation', and 'elementary classrooms'. The study's findings serve as a cautionary note for researchers, urging them to consistently maintain and enhance publication productivity while exploring research topics and methodologies that remain unexplored.

1. Introduction

The rapid advancement in information, communication, and technology (ICT), coupled with the post-COVID era, has prompted higher education researchers to explore new and innovative instructional methodologies to enhance traditional didactic teaching. These efforts are aimed at ensuring that students and teachers have the best approaches and tools to facilitate the most effective teaching-learning interaction (Al-Samarraie et al., 2020). Effective teaching instruction occurs when it increases student engagement and learning motivation, reduces student withdrawals, and ultimately achieves a better learning experience and outcomes (Chen Hsieh et al., 2017; Garrison & Kanuka, 2004; O'Flaherty & Phillips, 2015). In light of this, the flipped classroom has emerged as an instructional method that purportedly meets the demands for an innovative and effective learning environment, receiving warm support from practitioners and academics alike (Bhagat & Spector, 2018; Turan & Akdag-Cimen, 2020).

Generally speaking, the primary purpose of flipped classrooms is to foster an active learning environment

for students (Bates et al., 2017; Kushairi & Ahmi, 2021). Its original concept is rooted in constructivism theory, which emphasizes student-centered learning. In contemporary educational discourse, the student-centered principle posits that learners are responsible for synthesizing, discovering, and creating knowledge, with lectures serving the role of facilitators and guides (Bates et al., 2017). The knowledge learners acquire in education is not solely derived from a lecture theatre but rather what they scrutinize and reflect upon.

Due to the growing interest and increasing reports on the flipped classroom (Bhagat & Spector, 2018; Rodrigues et al., 2022), the past couple of decades have seen a substantial number of updated investigations focusing on a qualitative systematic review study (Al-Samarraie et al., 2020; O'Flaherty & Phillips, 2015; Turan & Akdag-Cimen, 2020; Zou et al., 2020). Like the majority of researchers, we believe that a systematic review offers valuable contributions to research mapping, providing a summary and synthesis of existing findings, and guiding the identification of gaps (Arksey & O'Malley, 2005; Raynaud et al., 2021; Snyder, 2019; Xiao & Watson, 2019). However, we also recognize its limitations, including a narrow study

scope, heavy reliance on a qualitative approach that may lead to biased interpretations across different scholars' backgrounds, and time-consuming nature (Donthu et al., 2021; Hernández-Torrano & Ibrayeva, 2020). At this point, we find it crucial to introduce a methodological alternative and a new perspective on flipped classroom research mapping, specifically through bibliometric analysis (further description of bibliometric analysis will be discussed in the following sections).

It is important to note that flipped classroom is still in its early stage of development (Lundin et al., 2018; O'Flaherty & Phillips, 2015; Zou et al., 2020). As of now, there is no standard model, as it is widely employed across various disciplines and contexts, leading to a diversity of approaches and methods. This diversity results in a lack of a shared conceptual and practical framework for both implementing and evaluating the effectiveness of the model (Lundin et al., 2018). However, it is not mandatory for the present study to address this gap by presenting a model articulating an effective flipped classroom. By and large, the core idea of flipped classrooms is to reverse the roles of out-of-class and in-class activities (Chen Hsieh et al., 2017; Mehring, 2018). In the traditional teaching model, the learning process typically begins with face-to-face interaction in the classroom and continues at the students' own pace after the class. This conventional model encourages students to build knowledge by passively listening to lectures and elaborating through homework at home. In contrast, the flipped classroom model initiates the first step of acquiring information outside and before the class. During the class, students deepen their knowledge through discussion with fellow students and the lecturer. Simultaneously, the lecturer observes students' progress and provides corrective feedback. The flipped classroom is believed to be an educational method offering a more dynamic and interactive classroom learning atmosphere (Gao & Hew, 2022; O'Flaherty & Phillips, 2015; Turan & Akdag-Cimen, 2020; Zou et al., 2020), providing an opportunity for students to take ownership of their learning (Al-Samarraie et al., 2020; O'Flaherty & Phillips, 2015), and offering a solution to achieve a better quality of learning in the face of limited funding and staff resources (Reidsema et al., 2017).

While the flipped classroom may appear similar to student-centered pedagogical approaches, the significant progress and proliferation of technology, as mentioned earlier, have propelled the flipped classroom to new heights (Bates et al., 2017; Kushairi & Ahmi, 2021). The widespread access to communication and information in today's world allows students to engage in all aspects of their lives. Recent reports indicated that this technology-rich

environment motivates students to prefer active and collaborative online learning (Bates et al., 2017). Simultaneously, substantial investments by educational institutions in building information technology facilities have accelerated the adoption of the flipped classroom model. Moreover, the literature demonstrates a growing number of educators who frequently design and refine flipped classrooms using online digital tools to align with a student-centered approach and cater to students' preference for digital technology (Bates et al., 2017; Kushairi & Ahmi, 2021; Turan & Akdag-Cimen, 2020).

The present study employed bibliometric analysis (Donthu et al., 2021), which, in simple terms, is the statistical analysis of research publications. This method is by no means new, as its early discourse can be traced back half a century (Donthu et al., 2021; Thanuskodi, 2010). However, in recent years, bibliometric analysis has gained momentum due to the widespread availability of bibliometric software (e.g., VOSviewer, CiteSpace, Publish or Perish) and scholarly databases (e.g., Web of Science, Scopus), which have simplified the collection and examination of vast scientific data (Cosentino et al., 2022; Donthu et al., 2021). Bibliometric analysis utilizes the bibliometric dataset in scholarly databases to examine trends and developments in a specific scientific area. It is considered a valuable approach for uncovering the distribution of research constituents, including the most contributing authors, journals, countries, and institutions. Additionally, it facilitates the exploration of relationships or interactions between research constituents, encompassing 'citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis' (Donthu et al., 2021).

Based on our preliminary exploration, at the global level, we observed that bibliometric analysis has been extensively utilized for various purposes. It is applied to scrutinizing research trends and propose future research directions in diverse fields such as management (Chen et al., 2015; Hallinger & Wang, 2020). Foreign language teaching (M. R. A. Chen et al., 2021), and engineering (Su et al., 2021). Bibliometric analysis is also predominantly employed to explore the study and usage of technology-based interdisciplinary learning instructions (Hashim et al., 2018; Kushairi & Ahmi, 2021; Raman et al., 2021; Shen & Ho, 2020; Sudakova et al., 2022).

In Indonesia, there has been a growing recognition among academics regarding the advantages of bibliometric analysis. Studies have utilized bibliometric analysis to examine research outcomes across diverse disciplines, including business incubators (Hakim, 2020), geography (Royani & Tupan, 2019), instrumentation (Tupan et al., 2018),

digital curation (Azmir & Salim, 2022), digital learning and researching (Ahmar et al., 2018; Prasetyadi et al., 2022), agriculture (Tupan & Rachmawati, 2018), banking (Agustina et al., 2021), and applied mathematics (Karim & Soebagyo, 2021). However, our comprehensive examination of the literature revealed inadequate or even absence of bibliometric analysis related to the exploration of flipped classroom studies in Indonesia. Furthermore, as mentioned earlier, the extensive body of research dedicated to the analysis of literature using qualitative methods has prompted us to offer methodological options and novel perspectives for the study of literature.

Against this backdrop, the present study formulates two research questions (RQ) as follows:

- a. What are the trends in publication and citation data of flipped classroom research in Indonesia?

- b. What is the current state of intellectual interactions among flipped classroom research in Indonesia?

2. Method

We drew inspiration from the procedures outlined by (Donthu et al., 2021) and (Kushairi & Ahmi, 2021) to guide the bibliometric analysis process. With the aim and scope of our study already defined, this section emphasizes the critical procedure of data collection. The data used in bibliometric research form the foundation for achieving reliable and accurate results (Brika et al., 2021; Comarú et al., 2021). Subsequently, the section outlines the process of data extraction and analysis (Figure 1). The objective of this research is to explore the distribution and relationships among flipped classroom research in Indonesia.

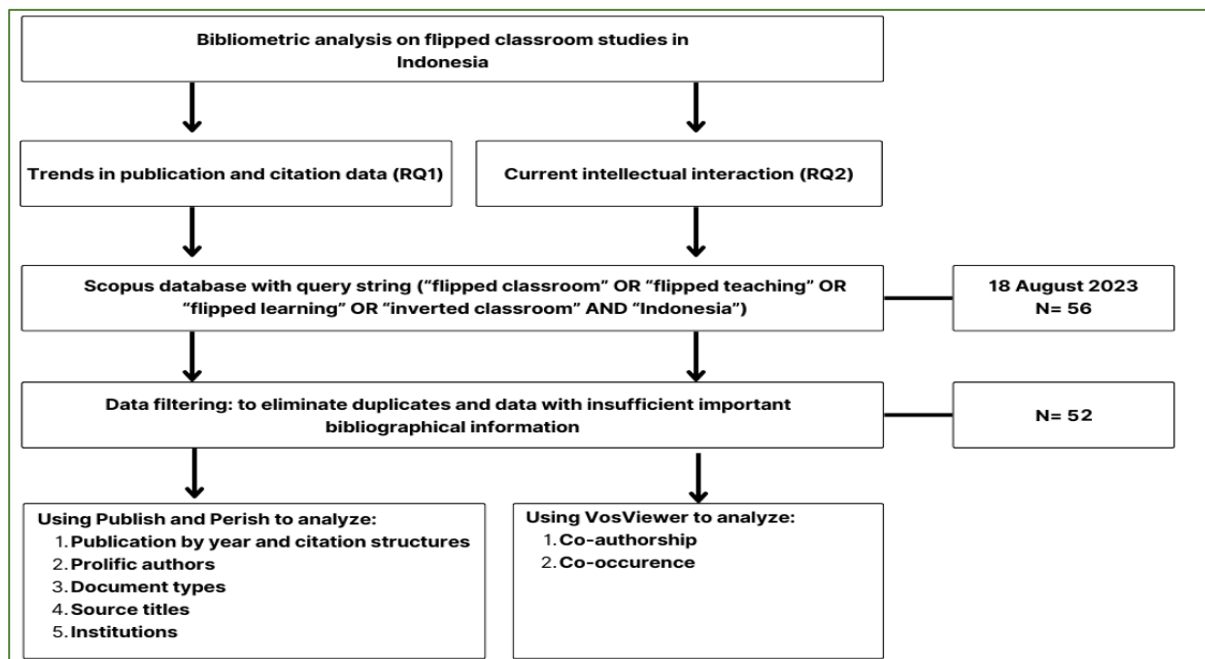


Figure 1. The Research Procedure

This research attempted to discover the distribution and relationships among flipped classroom research in Indonesia. We extracted data from the Scopus database covering the period from January 2017 to August 2023. The Scopus database was chosen as it is widely regarded as the largest and most finely curated scientific database currently available (Abbasi et al., 2011; Baas et al., 2020; Julia et al., 2020; Kushairi & Ahmi, 2021; Sudakova et al., 2022). To ensure effective and comprehensive data gathering, we formulated a query string based on the relevant flipped classroom terms combined with Boolean operators (“flipped classroom” OR “flipped teaching” OR “flipped learning” OR “inverted classroom” AND

“Indonesia”). The search for publications focused on article titles, abstracts, and keywords, without restrictions on the search field or date range. The query resulted in a total of 56 documents. All data information (e.g., authors, year, article title, source title, citations, keywords, abstract, affiliations, and countries) was then exported to a comma-separated value (.csv) file format, enabling us to conduct effective data filtering.

The purpose of data filtering is to remove duplicates or unnecessary data items. Data filtering plays a crucial role because these raw databases are not directly designed for bibliometric analysis, and errors in the

database if left untouched, may lead to inaccuracies and misrepresentation in data analysis (Donthu et al., 2021). During the filtering process, we identified several anomalous entries, such as a conference paper lacking sufficient bibliographical information and the absence of authors' identities. It was essential to mark and eliminate these entries to ensure the finest and most valid dataset. These steps revealed no duplicates and three incomplete documents, resulting in a total finalized dataset of 52 documents to proceed with the next analysis.

After identifying invalid data, we re-entered the same query string in the Scopus search, ensuring that

the invalid data were successfully excluded. Each category of bibliographical information (e.g., authors, year of publication, affiliation, etc) was exported into Research Information System (.ris) format. Harzing's Publish or Perish, along with Scopus' analyze search results, was employed to analyze the trends in the publication of flipped classroom research. This Analysis covered the distribution of documents by year of publication, citation structure, prolific authors, most cited publications, document types, publication by source titles, and publication by institution (RQ1). The appearance of Publish or Perish search results can be seen in Figure 2.

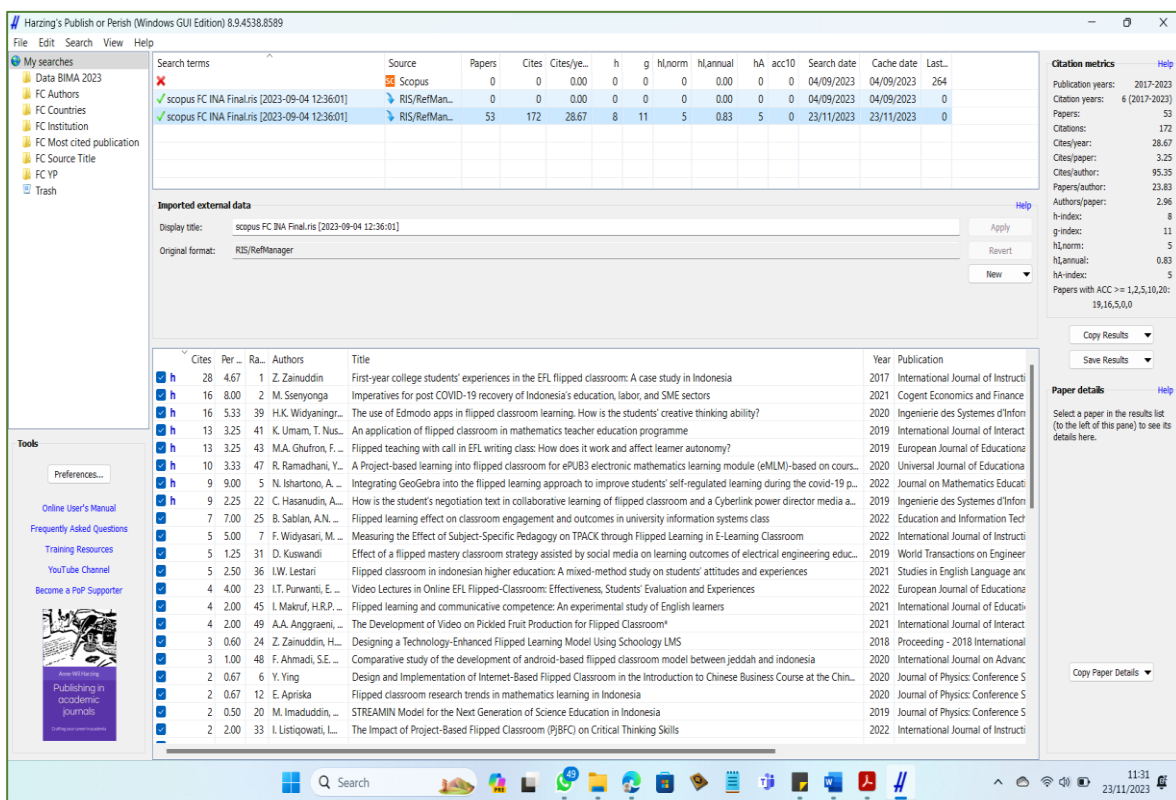


Figure 2. The Display of Publish or Perish Data Result

VOSviewer was employed to conduct a bibliometric analysis, addressing the current intellectual interactions among flipped classroom research in Indonesia including co-authorship and co-occurrence. We utilized VOSviewer version 1.6.18 (van Eck & Waltman, 2010), a freely available software, to construct and visualize bibliometric maps based on network data from flipped classroom publications. This software has been widely utilized in bibliometric studies across various disciplines (Brika et al., 2021). It graphically presents bibliometric maps based on nodal networks, in which each node represents an object of interest (e.g., author, article, institution, and country). The links connecting nodes

indicate co-occurrence between these objects. The size of nodes and the thickness of links reflect the significance and co-occurrence strength, respectively. The bibliometric maps also group highly related items, helping to identify thematic clusters.

3. Findings

This section is organized according to the formulated research questions. Firstly, it presents the results of trends in publication and citation data of flipped classroom research (RQ1). In addressing this research question, we analyzed various areas of scholarly publication, including the distribution of

documents by year of publication and citation structure, prolific authors, most cited publications, document types, publication by source titles, publication by country, and publication by institution. The majority of this section displays quantitative data results related to total publications (TP), total cumulative publications (TCumP), total cited publications (TCitP), total citations (TC), cites per publications (TC/TCumP), cites per cited publications (TC/TCitP) and h = h-index. Secondly, we explore the issue of intellectual interactions in flipped classroom research (RQ 2). By utilizing VOSviewer, visual maps were generated to identify co-authorships (authors and affiliations) and co-occurrence (keywords).

3.1 Trends in Publication and Citation Data

3.1.1 The distribution of documents by year of publication and citation structure

The reported distilled Scopus documents amount to a total cumulative of 52 publications (see Table 1, displaying the year publication and citation structure of flipped classroom studies in Indonesia). The first

publication occurred in 2017, marking the initiation of flipped classroom research in Indonesia. This suggests that Indonesian researchers were somewhat delayed in reporting the results compared to the inception of flipped classroom studies identified by (Kushairi & Ahmi, 2021), which date back to 2012. The inaugural flipped classroom paper in Indonesia was authored by Zainuddin (2017), garnering 28 citations. From 2017 to 2020, research productivity, reflected in total publications, increased exponentially with a notable decline in 2021. The highest number of publications occurred in 2022, totaling 14 documents. In 2019, citations reached a peak (see Figure 3), with an average citation per cited document being 7.33 times. Linear graphs for total publications of flipped classroom research showed a gradual increase from 2017 until 2023. Conversely, the linear graph for total citations exhibited a decline.

Table 1. Year Publication and Citation Structure of Flipped Classroom Studies in Indonesia

Year	TP	TCumP	TCitP	TC	TC/TCumP	TC/TCitP	H
2017	1	1	1	28	28.00	28.00	1
2018	4	5	2	4	0.80	2.00	1
2019	9	14	6	44	3.14	7.33	4
2020	12	26	8	37	1.42	4.63	3
2021	4	30	4	29	0.97	7.25	4
2022	14	45	6	29	0.64	4.83	4
2023	8	52	1	1	0.02	1.00	1

TP = Total Publications, TCumP = Total Cumulative Publications, TCitP = Total Cited Publications, TC = Total Citation, TC/TCumP = Cites per Publications, TC/TCitP = Cites per Cited Publications, h = h-index

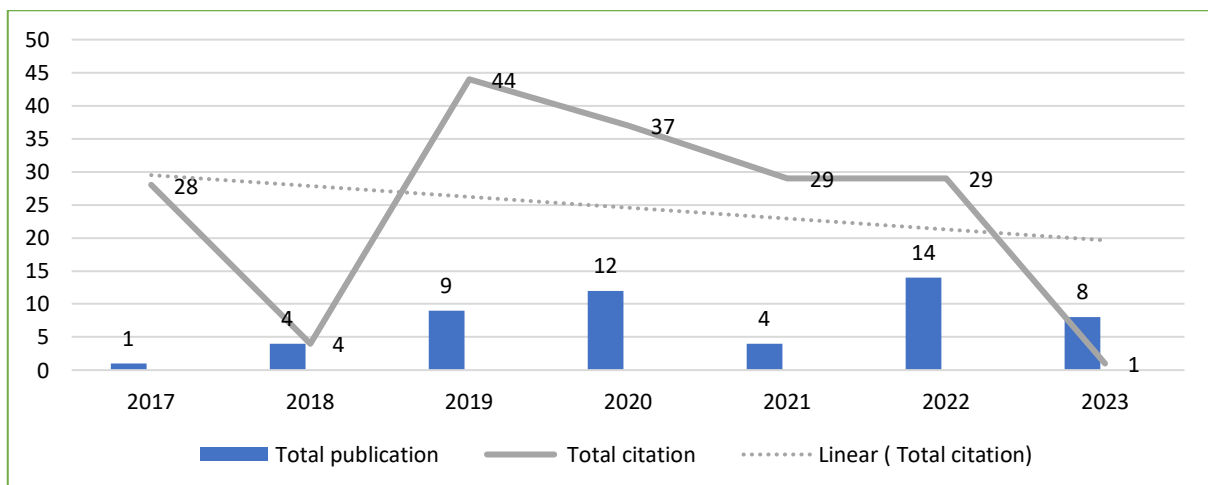


Figure 3. Total Publication and Citation Structure of Flipped Classroom Research

3.1.2 Prolific author

Zainuddin emerges as the most prolific author with 5 documents published. A closer look reveals that Fitrianingsih, A., Hasanudin, C., and Saddhono, K. share the same score in all analyzed aspects, each having 2 documents. This analysis highlights that total publication is not always directly proportional to the

number of citations. For instance, Umam, with 2 publications, had been cited 13 times, while Halili and Razak, each with 3 publications, received no citations (see Table 2, illustrating the 11 most productive authors of flipped classroom studies in Indonesia).

Table 2. Prolific Authors of Flipped Classroom Research in Indonesia

Author	TP	TCP	TC	TC/TP	TC/TCP	H	AY
Zainuddin, Z.	5	2	31	6.2	2.5	2	2017-2022
Fitrianingsih, A.	2	2	25	12.5	1	2	2019-2020
Hasanudin, C.	2	2	25	12.5	1	2	2019-2020
Saddhono, K.	2	2	25	12.5	1	2	2019-2020
Ishartono, N.	4	1	9	2.25	4	1	2022-2023
Hermawan, H.D.	3	1	3	1	3	1	2018-2019
Hanifah, M.	2	1	9	4.5	2	1	2022-2023
Nugroho, A.	2	1	4	2	2	1	2021-2023
Umam, K.	2	1	13	6.5	2	1	2019-2022
Halili, S.H.B.	3	0	0	0	0	0	2023-2023
Razak, R.B.A.	3	0	0	0	0	0	2023-2023

TP = Total Publications, TCP = Total Cited Publications, TC = Total Citation, TC/TP = Cites per Publications, TC/TCP = Cites per Cited Publications, h = h-index, AY = Active Years

3.1.3 Most cited publications

We present the flipped classroom research publications with the highest number of citations in Table 3. These publications encompass a range of formulated purposes and methodologies, including ‘backcasting approach’ literature studies (Ssenyonga, 2021), best-practice research (Umam et al., 2019; Widyaningrum et al., 2020), and perception studies (Lestari, 2021; Zainuddin, 2017).

Zainuddin’s (2017) article, First-year college students' experiences in the EFL flipped classroom: A

case study in Indonesia, not only marked the first published article indexed by Scopus but also emerged as the most cited publication with a total of 28 citations and an average of 4.67 citations per year. Through surveys, focus group discussions, individual interviews, and observation, the author examined freshmen college students’ learning experiences in the context of flipped classroom activities. The study concluded that students positively perceived the implementation of flipped classrooms, providing more opportunities for interaction with peers, preparation, and immediate feedback from teachers.

Table 3. Most cited publications between 2017-2023

Authors (Year)	Title	TC	TC/Y
Zainuddin (2017)	First-year college students' experiences in the EFL flipped classroom: A case study in Indonesia	28	4.67
Ssenyonga (2021)	Imperatives for post COVID-19 recovery of Indonesia's education, labor, and SME sectors	16	8.00
Widyaningrum et al. (2020)	The use of Edmodo apps in flipped classroom learning. How is the students' creative thinking ability?	16	5.33
Umam et al. (2019)	An application of flipped classroom in mathematics teacher education programme	13	3.25
Ghufron & Nurdianingsih (2019)	Flipped teaching with call in EFL writing class: How does it work and affect learner autonomy?	13	3.25
Ramadhani & Fitri (2020)	A Project-based learning into flipped classroom for ePUB3 electronic mathematics learning module (eMLM)-based on course design and implementation	10	3.33
Ishartono et al. (2022)	Integrating GeoGebra into the flipped learning approach to improve students' self-regulated learning during the covid-19 pandemic	9	9.00
Hasanudin et al. (2019)	How is the student's negotiation text in collaborative learning of flipped classroom and a Cyberlink power director media apps	9	2.25
Meyliana et al. (2022)	Flipped learning effect on classroom engagement and outcomes in university information systems class	7	7.00
Widyasari et al. (2022)	Measuring the Effect of Subject-Specific Pedagogy on TPACK through Flipped Learning in E-Learning Classroom	5	5.00
Kuswandi (2019)	Effect of a flipped mastery classroom strategy assisted by social media on learning outcomes of electrical engineering education students	5	1.25
Lestari (2021)	Flipped classroom in Indonesian higher education: A mixed-method study on students' attitudes and experiences	5	2.50
Purwanti et al. (2022)	Video Lectures in Online EFL Flipped-Classroom: Effectiveness, Students' Evaluation and Experiences	4	4.00
Makruf et al. (2021)	Flipped learning and communicative competence: An experimental study of English learners	4	2.00

TC = Total Citation, C/Y = Citations per Year

The data reveals that [Ssenyonga's \(2021\)](#) 'Imperatives for post-COVID-19 recovery of Indonesia's education, labor, and SME sectors' and [Widyaningrum et al.'s \(2020\)](#) 'The use of Edmodo apps in flipped classroom learning: How is the students' creative thinking ability?' each had been cited 16 times, making them the second most cited publications. Although [Ssenyonga \(2021\)](#) did not directly and precisely discuss flipped classrooms, it was included in the analysis since the term 'flipped classroom' can be found in the article's keywords. Ssenyonga's article primarily discussed the impact of

COVID-19 on the Indonesian economy and education, providing follow-up steps the country should consider. Among his suggestions, [Ssenyonga \(2021\)](#) encouraged policymakers and teachers to pay more attention to flipped classrooms, seeing them as an effective teaching method during such challenging times. In the other case, [Widyaningrum et al. \(2020\)](#) focused on investigating the influence of the use of flipped classroom learning on university students' creative thinking. The results of the experimental study showed that the use of flipped classrooms positively and significantly influences the predicted variable.

3.1.4. Document types

Table 4 illustrates that all flipped classroom publications in Indonesia were in the form of articles, conference papers, and reviews. More than half of all Scopus-indexed flipped classroom publications were

research articles, accounting for 73.08 % of the total. Additionally, 13 publications originated from conference papers. Notably, one publication took the form of a review.

Table 4. Document types of Flipped Classroom Research

Document Type	Total Publication	Percentage (%)
Article	38	73.08
Conference Paper	13	25.00
Review	1	1.92

3.1.5. Publication by source titles

Table 5 illustrates leading sources or publishers of the flipped classroom research. American Institute of Physics (AIP) Conference Proceeding contributed 4 publications and became the top productive source, followed by the Journal of Physics Conference Series and International Journal of Instruction with 3 publications each. In terms of the number of citations

and h-index, despite it has 4 published articles, the AIP conference only earned 1 h-index. This is not surprising, as 3 flipped classroom studies (i.e., Hanifah et al., 2023; Maharani et al., 2023; Pratiwi et al., 2023) published in the proceeding had not been cited. Only Rohyani and Huda’s (2020) work had a citation, albeit just once. (See Table 5, displaying the most productive sources of flipped classroom studies).

Table 5. Leading Sources of Flipped Classroom Research

Source Title	TP	TCP	TC	TC/TP	TC/TCP	
AIP Conference Proceedings	4	1	1	0.25	1.00	1
Journal of Physics Conference Series	3	3	6	2.00	2.00	2
International Journal of Instruction	3	3	35	11.67	11.67	2
European Journal of Educational Research	2	2	17	8.50	8.50	2
Ingenierie Des Systemes De Information	2	2	25	12.50	12.50	2
International Journal of Interactive Mobile Technologies	2	2	17	8.50	8.50	2
Studies In English Language and Education	2	1	5	2.50	5.00	1
Universal Journal of Educational Research	2	1	10	5.00	10.00	1

3.1.6 Publication by institution

Figure 4 ranks the top institutions according to the number of flipped classroom research publications. It is clear that Universitas Muhammadiyah Surakarta and Universitas Negeri Malang predominantly contribute to the list. With 10 publications, the two universities are at the forefront, followed by Universitas Seblas Maret (4), Bina Nusantara University (4), and Universiti Malaya (4). An interesting finding emerges

with two foreign institutions (i.e., Universiti Malaya and The University of Hong Kong) among the leading institutions. Given the affiliation of Zainuddin Zamzami, one the most productive and influential researchers in this field, being Universiti of Malaya, it is unsurprising that the university earned its high position.

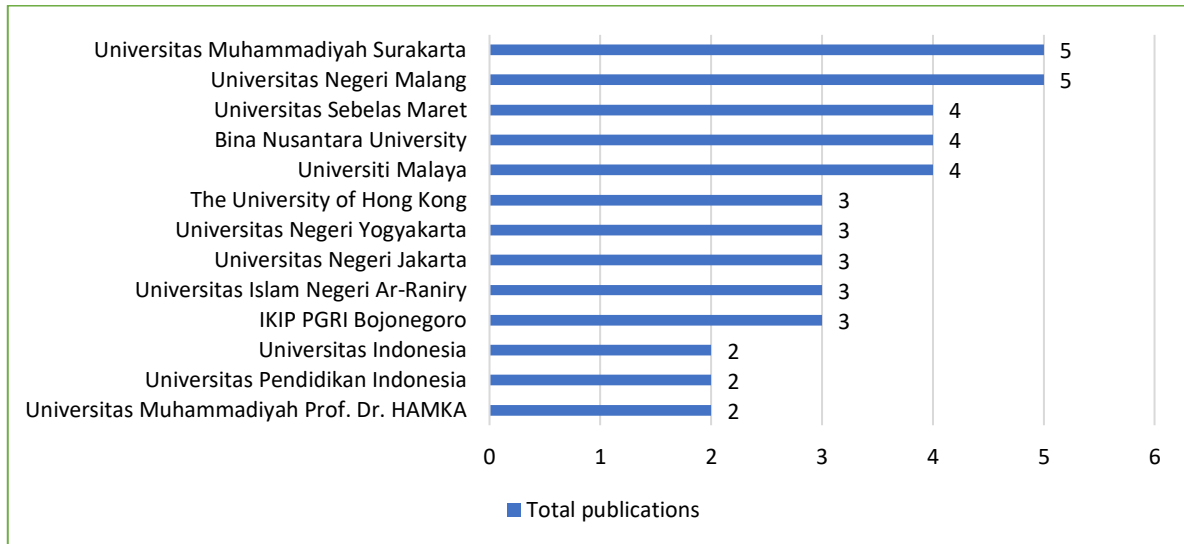


Figure 4. Leading Institutions of the Flipped Classroom Research in Indonesia

3.2. Current Intellectual Interactions among Flipped Classroom Research in Higher Education

3.2.1. Co-authorships

Co-authorship allows for the evaluation of relationships in scientific papers, particularly those between authors and nations, displaying interdisciplinary research that may result in creative scientific output and better research publications.

The co-authorship analysis examines authors who have co-authored at least 1 research paper. The analysis resulted in a total of 137 authors grouped under 43

clusters represented by different colors (Figure 5). In terms of the total link strength, which represents the strength of the co-authorship of a researcher with other researchers, Istihartono (15 documents, 15 total link strength) emerged as the most influential researcher, followed by Halili and Razak as each with 3 documents and 11 total link strength, and Zainuddin, Z. (5 documents and 9 total link strength). In terms of clusters, the red cluster appeared to be the largest one, consisting of several leading authors including Ishartono, Halili, and Razak. Another dominant cluster was in blue including Zainudin and Hermawan.

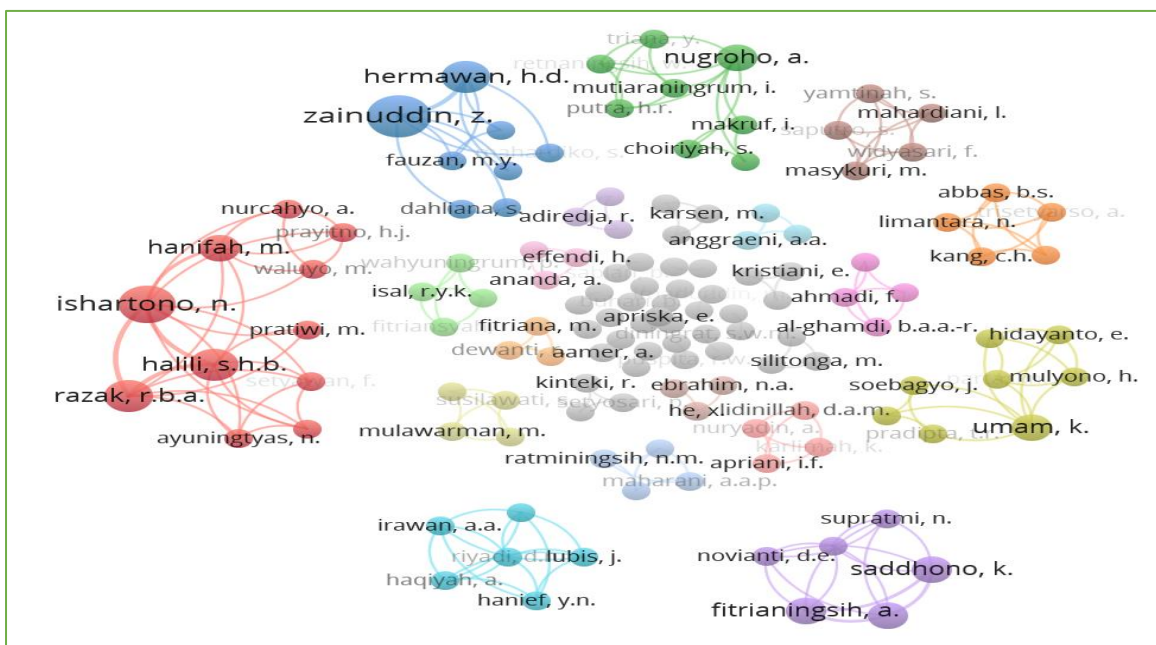


Figure 5. Bibliometric analysis of the co-authorship of authors

Figure 6 displays the co-authorships of flipped classroom studies related to countries. The figure illustrates that Indonesia plays a dominant role, indicating more significant collaborations among

Indonesian researchers than the collaboration between Indonesian and foreign researchers. Among foreign countries, Malaysia, Hong Kong, and Australia had the most interactions with Indonesian researchers.

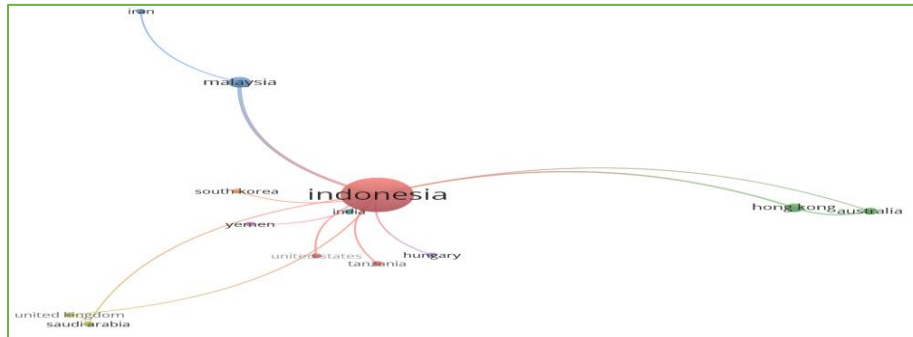


Figure 6. Bibliometric analysis of the co-authorship of countries

3.2.2. Co-occurrence

We used VOSviewer's keyword co-occurrence analysis to deconstruct the themes, demonstrating an interest in flipped classrooms. The basic assumption of this analysis is that keywords adequately characterize the article's subject matter. In total, 228 keywords underwent the present co-occurrence analysis. The network visualization presented in Figure 7 depicts the VOSviewer keywords, using virtual attributes such as color, circle size, text size, and line thickness to indicate the strength of interrelationships among the keywords (Kushairi & Ahmi, 2021). Keywords marked by the same color frequently co-occur. For instance, the

figure presented indicates a strong association and frequent co-occurrence between flipped classrooms, teaching, teacher education, classroom supervision, and other keywords highlighted in blue. There are 24 four clusters, with the largest ones identified as red, green, blue, yellow, orange, and light blue. The red cluster, consisting of 20 items, falls under the theme of a learning system. The green cluster, with 19 items, is the theme of blended learning. The blue cluster, containing 17 items, falls under the theme of teacher education. The yellow cluster comprising 16 items falls under the term perception. Finally, the orange cluster pertaining to 15 items falls under the term classroom management.

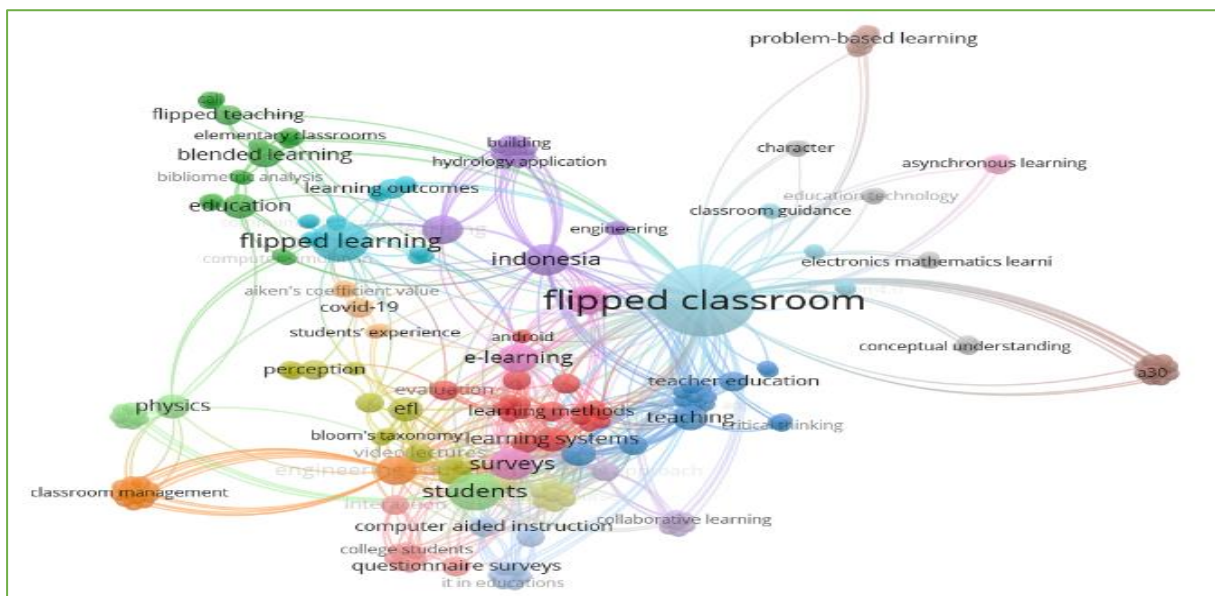


Figure 7. Co-occurrence analysis of keywords

The co-occurrence analysis also provides an understanding of topic development. In 2018, the dawn of flipped classroom studies in Indonesia, predominant topics included video lectures, learning management systems, and instructional design. Recently, from 2022 to 2023, studies have shifted towards exploring critical thinking, computer simulation, and elementary classrooms. Another finding showed that there was no clear depiction of the research methodology used, except quantitative approaches including surveys and bibliometric analysis.

4. Discussion

The bibliometric analysis involves the examination of statistical patterns across time in several aspects related to the creation and utilization of scientific information (Brika et al., 2021; Comarú et al., 2021; Donthu et al., 2021; Kushairi & Ahmi, 2021). In this study, we employed bibliometric analysis to investigate flipped classroom studies in Indonesia. The flipped classroom has evolved as a teaching technique that has garnered significant attention due to its provision of dynamic and interactive technology-based learning for teachers and students (Gao & Hew, 2022; O'Flaherty & Phillips, 2015; Turan & Akdag-Cimen, 2020; Zou et al., 2020). This bibliometric analysis covered the publication trends and citation data, and the intellectual interactions among researchers (Donthu et al., 2021). To address the former, we utilized a descriptive bibliometric analysis of various aspects of scholarly publication using Publish or Perish. This included examining the distribution of documents based on their year of publication and citation structure, identifying prolific authors and the most frequently cited publications, categorizing documents by type, and analyzing publication patterns across different source titles, countries, and institutions. As regards to latter, VOSviewer was deployed and employed to build visual maps that identified co-authorships, including authors and affiliations, and co-occurrence of keywords. By doing these rigorous steps of methodology, the present study facilitated the visualization of research progress and knowledge development in flipped classroom studies, enabling the identification of future areas of interest.

Regarding the first research objective, the analysis has revealed the trend of publication and citation data in several bibliometric indicators. We identified that the majority of bibliometric studies employ a similar approach to achieve their aims (Bhagat & Spector, 2018; Brika et al., 2021; Julia et al., 2020; Kushairi & Ahmi, 2021; Sudakova et al., 2022; just to name a few). In this study, this bibliometric descriptive analysis provided valuable insight into the distribution of documents based on the year of publication and

citation structure. Additionally, it offered information on prolific authors, highly referenced publications, document types, publication sources, and institutional affiliations. The significant findings showed the slow pace of total publications of flipped classroom research in Indonesia, starting from 2017 until 2023, and the decline in total citations. Zainuddin's (2017) study investigating English students' learning experiences in flipped classrooms marked the beginning of flipped classroom research in 2017. Ever since, the productivity of research that is manifested in total publications increased slowly until 2020, with a dramatic decline in 2021. As the COVID outbreak occurred during 2020-2021, this decline was unsurprising. This aligns with global reports indicating a substantial loss in the number of scientific publications during that period (Cosentino et al., 2022; Raynaud et al., 2021). While the global trend suggests a significant increase in flipped classroom publications over the years (Bhagat & Spector, 2018; Kushairi & Ahmi, 2021; Rodrigues et al., 2022), the direction at the Indonesian level appears to differ. Although Julia et al. (2020) mentioned that Indonesia is one of the prominent countries in flipped classroom research, these findings may become an alert for Indonesian researchers to maintain productivity on the subject. Other findings clearly showed some notable writers in the field of flipped classroom research include Zainudin, Ishartono, and Fitrianiingsih. The AIP Conference Proceedings, Journal of Physics Conference Series, and International Journal of Instruction have been recognized as the primary sources for publishing and distributing academic articles. The institutions that exhibited the highest volume of publications were affiliated with Universitas Muhammadiyah Surakarta and Universitas Negeri Malang. Consequently, this kind of analysis facilitated the identification of current and prospective patterns within this field (Donthu et al., 2021; Rodrigues et al., 2022).

Co-authorship analysis depicts the relationships in scientific works between authors across countries (Donthu et al., 2021; Kushairi & Ahmi, 2021). It allows visualizing the relations between interdisciplinary research that may lead to creative science and better research papers as researchers usually work together to write scientific articles, which improves their output. The current investigation highlights the prominent position of Indonesian authors, indicating robust partnerships among local researchers compared to collaborations with foreign scholars. The results of the co-authorship analysis could provide valuable insight to strengthen the existing co-authors and open up new collaboration (Abbasi et al., 2011; Comarú et al., 2021). Subsequently, new collaborations may create

new scientific knowledge, including new research questions, new research proposals, new theories, and new publications. Following this, the establishment of new collaborations has the potential to generate novel scientific knowledge, encompassing unexplored study inquiries, innovative research ideas, emerging theories, and publication (Abbasi et al., 2011). Therefore, Indonesian researchers are suggested not only to maintain partnerships with existing co-authors but also to explore collaborations with influential authors, particularly from other countries. This approach has the potential to not only enhance the quality of research output but also contribute to the generation of innovative scientific knowledge. An analysis of keywords co-occurrence enables the deconstruction of themes, indicating a keen interest in the study of flipped classrooms (Donthu et al., 2021). The fundamental premise of this analysis is that keywords effectively represent the article's topic content. The results of the co-occurrence analysis reveal that current studies of flipped classrooms focus on critical thinking, computer simulation, and elementary classrooms. Additionally, quantitative methods, such as surveys and bibliometric analysis, are predominantly emphasized. The results of occurrence analysis may help future researchers continue the exploration of the delicate and current area of the visual maps. Also, it is noted that there is limited discussion related to the research methodologies to investigate the practical use of flipped classrooms. Future research endeavors could be enriched by adopting a qualitative longitudinal approach, involving repeated and continuous observation of the implementation of flipped classrooms. These implications align with the conclusions provided by Gao and Hew (2022). After employing a short course on flipped classrooms for 'two hundred and forty-seven 4th graders,' they found a positive influence on students' computational thinking. They call for the upcoming studies to undertake a longitudinal investigation for a more comprehensive understanding of changes in both student achievement and attitudes.

Despite the fact the rigorous methodology performed by the present study, several limitations have been acknowledged. The outcomes of a bibliometric study might demonstrate variability based on the choice of the database as well as the incorporation of additional search keywords (Raman et al., 2021). Since the present study heavily relied upon the Scopus database, future investigations are encouraged to utilize other scholarly databases, for example, Web of Science and Google Scholar. We assume that Google Scholar could provide a much more extensive dataset on flipped classrooms in Indonesia compared to Scopus, given that Indonesian scholars tend to have a higher quantity of publications on Google Scholar (Ahmar et al., 2018). However,

more careful and rigid data filtering is essential, as Google Scholar may present more unstructured and insufficient information within a vast amount of data. Since the data in bibliometric research serve as the foundation for obtaining reliable and accurate findings (Brika et al., 2021; Comarú et al., 2021), future bibliometric studies may benefit from exploring additional search keywords combinations to get a broader selection of articles and current citations associated with the flipped classroom. Additionally, it is advisable to conduct bibliometric analysis in conjunction with systematic literature reviews to facilitate a more comprehensive investigation of the current body of literature. Regarding intellectual interaction, the visual map displayed here only illustrates the analysis of the authorship and co-occurrence. We recommend further research to expand the scope of analysis, incorporating aspects such as citation, bibliometric coupling, and co-citation for a more nuanced understanding.

5. Conclusions

The flipped classroom has undoubtedly emerged as a teaching approach that has received significant attention, offering educators and students dynamic and interactive technology-based learning. Employing bibliometric analysis through Publish or Perish and VOSviewer, the purpose of the current study was to determine the trends in publication and intellectual interactions among Scopus-indexed flipped classroom research in Indonesia. After data filtering, 53 publications were subjected to the investigation. This study revealed that the first flipped classroom Scopus-indexed report occurred in 2017, and publications have been gradually increasing since then. However, the citation structure seemed to decrease gradually. Frontline authors in flipped classroom research include Zainudin, Ishartono, and Fitrianiingsih. AIP Conference Proceedings, Journal of Physics Conference Series, and International Journal of Instruction were identified as the top sources for publishing and disseminating the papers. The institutions with the most publications were Universitas Muhammadiyah Surakarta and Universitas Negeri Malang. Related to the intellectual interactions between publications, the strongest authorships were found between Ishartono, Halili, and Razak, while another dominant authorship was between Zainudin and Hermawan. The results of the co-occurrence of 228 keywords showed that terms such as learning system, blended learning, teacher education, perception, and classroom management predominantly and frequently occurred in all papers. In conclusion, the slow increase in flipped classroom publications and the decrease in citations may be a caution for researchers to continuously maintain and boost productivity. The results of authorship and co-occurrence analysis

suggest authors maintain the strength of authorship and explore possibilities for establishing new collaborations. Future flipped classroom research is required to explore uncharted themes, especially in the area of research approach (e.g., longitudinal study). Regarding the bibliometric methodology, we suggest future researchers consider additional keyword terms, use other or combined scholarly databases (e.g., Web of Science or Google Scholar), and integrate quantitative bibliometric analysis with qualitative systemic literature review.

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