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Scientific Mapping of Research on Self-regulated Learning in Flipped Classrooms

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<p>Article History</p> <p>Article Submission 30 September 2022</p> <p>Revised Submission 09 November 2022</p> <p>Article Accepted 28 November 2022</p>	<p style="text-align: center;">Abstract</p> <p>Due to the COVID-19 global pandemic crisis, the flipped classroom mode was introduced in education, and students are required to use other self-regulated learning skills in their learning process in flipped classrooms. Therefore, this review study aims to provide a bibliometric mapping analysis of research on self-regulated learning in flipped classrooms in the Scopus database. The study selection process resulted in the selection of 107 studies to be analyzed. It used the VOS viewer program and excel for the bibliometric analysis to determine the publication trajectory, country contributions, most influential authors, journals, articles, corresponding research methodology, topical foci, and underexplored research areas in the studies. As a result of the study, there has been an increasing trend in overall publication production from 2015 to 2020, reaching its peak in 2020 during the pandemic, with 29 articles being published. There has been a significant contribution to the publication of studies by China and the United States. Apart from that, Computers and Education was the most influential journal, and Hwang was identified as the most-cited author in this research field. Research foci and underexplored themes were confirmed by co-occurrence analysis. Researchers in this domain may benefit from the findings presented here, which offer a holistic understanding of the current state of the research in this area and contribute to the burgeoning body of literature, as well as orient new entrants to identify the research priorities that will guide future studies in the field of self-regulated learning in flipped classrooms.</p> <p>Keywords: Bibliometric Mapping Analysis; Self-regulated Learning; Flipped Classrooms; Publication; Topical Foci</p>
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Introduction

As a result of the effects of the COVID-19 global pandemic crisis on education, it is imperative to raise awareness of the potential of virtual learning opportunities (Khodaei et al., 2022). Therefore, several online learning methods were introduced during the COVID-19 pandemic as appropriate educational strategies (Basilaia & Kvavadze, 2020; Tri et al., 2022). One of the online learning models that are growing in popularity is the flipped classroom, a pedagogical approach (Stöhr et al., 2020) that emphasizes student-centered learning (Gilboy et al., 2015) and has become widely known to be one of the leading innovations in the field of practical education (Hessler, 2016). This method was among the most popular while the epidemic was in full swing, and it is considered a promising alternative to teaching theoretical courses during the epidemic (Guraya, 2020).

While the flipped classroom idea is not new, it has gained considerable attention in educational research (Bergmann & Sams, 2012). Rather than teachers teaching the class during lesson time and students writing or doing homework after the class is over, the flipped classroom model flips that process (Bergmann & Sams, 2012), which results in a more active, student-centered approach in the class that aims to increase the quality of time spent by the students (Nolan et al., 2021), and facilitates active learning by providing structured and dynamic learning opportunities (Strelan et al., 2020). It is important to note that flipped classrooms are much more than simply flipping homework assignments and lecture topics (Burke & Fedorek, 2017). As a result, they are holistic learning environments in which learning takes place beyond the classroom setting (Burke & Fedorek, 2017). The purpose of classroom time is used for problem-solving, thus providing meaningful learning experiences, supporting student inquiries and reflections, and dealing with participation and practicality among students (Burke & Fedorek, 2017; Mengual-Andrés et al., 2020).

Although researchers contend that flipped classrooms have existed for a long time in education, the pre-class work students do before classes is slightly different with the help of the Internet, and computer-based technology (Sun et al., 2018), specifically concerning the content design and the content is usually presented in a video format (Zainuddin, 2018). This kind of lecture is considered capable of engaging learners in a self-learning experience (Hwang et al., 2015). It has been found that to succeed in flipped classrooms' online learning, students need to possess a sufficient level of active, self-disciplined, and self-regulated learning skills (Zhu & Liu, 2020), especially since, in flipped classrooms, students are required to learn both video lectures as well as a lot of information outside the school in a pre-class session (Lestari, 2021; Ng, 2018; Shih et al., 2018; Yoon et al., 2021). It is, therefore, clear that the emergence of flipped classrooms raises the need for new types of support for self-regulated learning to facilitate this process (Broadbent & Poon, 2015), which is crucial for the development of knowledge and performance in all human situations (Shyr & Chen, 2017). In this respect, self-regulation is critical to the success of flipped classrooms, as the students have to take responsibility for their learning (Roach, 2014).

As a result of the different features of the pre-class learning activities and the in-class learning activities in flipped classrooms, students are required to use other self-regulated learning skills in their learning process (Shih et al., 2018). One of the most serious concerns is that students often are not able to self-regulate or can't control their emotions, thoughts, and behaviors (Shyr & Chen, 2017). Attention has been directed to this research area. A good number of studies indicate that flipping classrooms can result in teachers developing the capacity to promote critical and independent thinking in their students, thus equipping them with the ability to self-regulate their learning and participate in lifelong learning, which will prepare them for their future work environments (He et al., 2016; O'Flaherty et al., 2015).

However, despite the importance of research on self-regulated learning in flipped classrooms, there has been little effort to collect statistics on the global scientific research output as a whole. Bibliometric analyses of self-regulated learning in flipped classrooms have not yet been conducted comprehensively. In the context of the sparse effort on bibliometric analysis of research that has been conducted on self-regulated learning in flipped classrooms, this study aims to fill this gap of knowledge and provide a bibliometric mapping analysis of research on self-regulated learning in flipped classrooms based on the Scopus database. This study offered a holistic understanding of

the current state of the research area of self-regulated learning in flipped classrooms and contribute to the burgeoning body of literature. It also involves the following research questions:

RQ 1. What are the publication trajectory and country contributions of research on self-regulated learning in flipped classrooms?

RQ 2. What are the most influential authors, journals, articles, and corresponding research methodologies contributing to self-regulated learning in flipped classroom research?

RQ 3. What topical foci have attracted the greatest attention and underexplored research areas in self-regulated learning in flipped classroom research?

Literature Review

In an online or flipped environment, learners' self-regulated learning plays a significant role in their effective learning (Lee & Tsai, 2011). There are lots of studies on self-reported attitudes toward flipped classrooms (O'Flaherty & Phillips, 2015). In flipped classrooms, students are expected to show proactive attitudes, finish online tasks ahead of time, monitor what they do not understand about the online tasks, and take part in activities in the classroom based on previous studies (Lai & Hwang, 2016). Since the flipped classroom is a student-centered pedagogy that emphasizes on self-regulated learning, it needs students to have a strong foundation of self-regulated learning abilities (Michalsky & Schechter, 2013). It is considered to have the possibility to change the traditional classroom by promoting self-regulated learning and making the classroom more motivating and attractive (O'Flaherty & Phillips, 2015).

Methodology

The work is a descriptive study with a bibliometric analysis to examine meta-data and content associated with research on self-regulated learning in flipped classrooms through the Scopus databases in all years. Bibliometric analysis refers to the graphical analysis of clearly defined bodies of knowledge using quantitative statistics (Van Eck & Waltman, 2020; Zupic & Čater, 2015). It is a form of analysis that is crucial for understanding the state of research and its trends, along with helping to determine the scientific accomplishments and academic progress made by the research community (Glänzel, 2012). Even though bibliometric analysis, also known as science mapping, has been widely applied to many other areas of research (e.g., Punnakitikashem, P., & Hallinger, 2019), there has only been a recent emergence of its use in the area of educational research (e.g., Moreno-Guerrero et al., 2020; Yang et al., 2017).

Specifically, the Scopus database was chosen because it has been widely cited as the largest and most comprehensive abstract and indexing database for peer-reviewed scientific literature; for example, it indexes over 14,000 journal articles and social science titles from 4000 publishers (Ballew, 2009). Currently, it has the most comprehensive list of documents and abstracts available for searching citations and abstracts (Ahmi et al., 2019; Falagas et al., 2008). Furthermore, Scopus possesses a vast array of products compared to other repositories, and it has 70% more publications when compared to the Web of Science (Shareefa et al., 2020). Hitherto, Scopus has been widely used to create databases for review research (Mongeon & Paul-Hus, 2016).

Search Criteria

As a part of the process of retrieving records and the creation of the working dataset, the search Boolean expression was used as follows: TITLE-ABS-KEY (("self-regulation" OR "self-regulated learning") AND ("flipped classroom" OR "flipped learning" OR "flipped course" OR "flipped model" OR "flipped approach" OR "flipped environment" OR "flipped teaching" OR "flipped instruction" OR "inverted classroom")). The keyword search was designed to identify as many relevant articles as possible regarding studies that have been conducted on self-regulated learning in flipped classrooms as possible and attempt to locate all relevant evidence on an issue to minimize the impact of bias on review results (Booth et al., 2016).

This query yielded 166 documents without any time limit (July 20, 2022). It only considered those publications that were published in the English language. This reduced the corpus to a

hybrid set of 161 documents. The search criteria were delimited to journal articles and excluded books, book chapters, and conference papers due to the belief that relying on such an extensive repository of peer-reviewed journal articles would provide a more consistent result. This resulted in 107 publications being eligible to appear in the database. Table 1 demonstrates the inclusion and exclusion criteria.

Table 1. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
1. A full-text article in the English language 2. Journal articles	1. Articles in other languages 2. Books, book chapters, and conference papers

This review study was aligned with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) 2020 checklist. The details are summarized from the search process using the PRISMA flow chart in Figure 1.

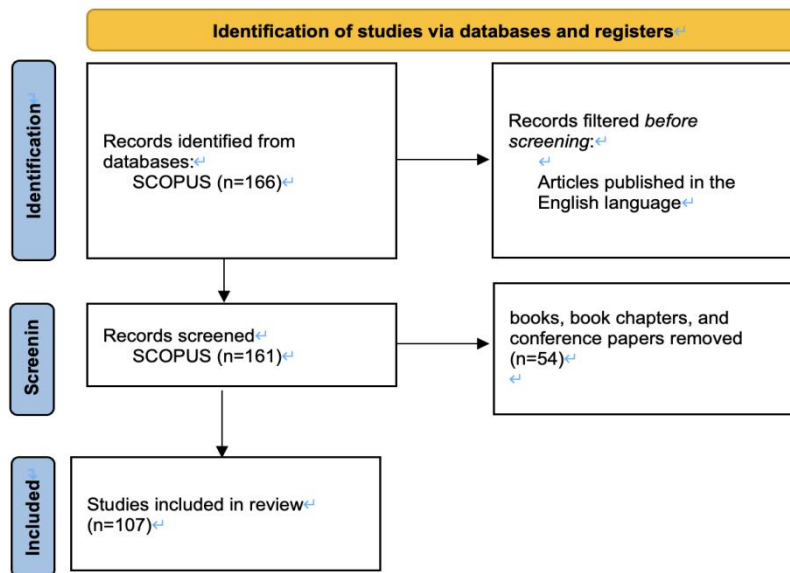


Figure 1. Flow Diagram for Reviews (adapted from Page et al., 2021).

The data gathered from the Scopus database was then converted into a comma-separated values (.csv) file, which was saved in excel to be analyzed descriptively. Data from the stored data provides information regarding the publication's date, the author's name, affiliation, country, publisher, article title, author keywords, abstracts, and citations for the publications.

Microsoft Excel and VOS viewer software were used for data analysis and visualization (Hudha et al., 2020). VOS viewer is designed to work efficiently with massive amounts of data and is designed to provide a wide range of different visualizations, analyses, and observations based on the data included in the system (Van Eck & Waltman 2020). In addition, VOS viewer allows users to create maps of publications, authors, or journals based on platforms of co-citations or maps of keywords centered on distribution channels based on a distribution map of co-citations (Hudha et al., 2020).

Results

To answer the research questions developed in the previous section, the following results offer

a descriptive view of the 107 published journal articles with bibliometric methodology.

Publication trajectory and country contributions

The first research question aims to demonstrate the publication trajectory and country contributions of research on self-regulated learning in flipped classrooms. Figure 2 summarizes the publication trends over the years. According to Figure 2 below, no publication related to self-regulated learning in flipped classrooms until 2015. The earliest paper was written by Talbert R. (with 20 citations) about student acquisition of “socio-mathematical norms” and self-regulated learning strategies in flipped classrooms. Then in the next two years, there has been no noticeable growth trend until 2018.

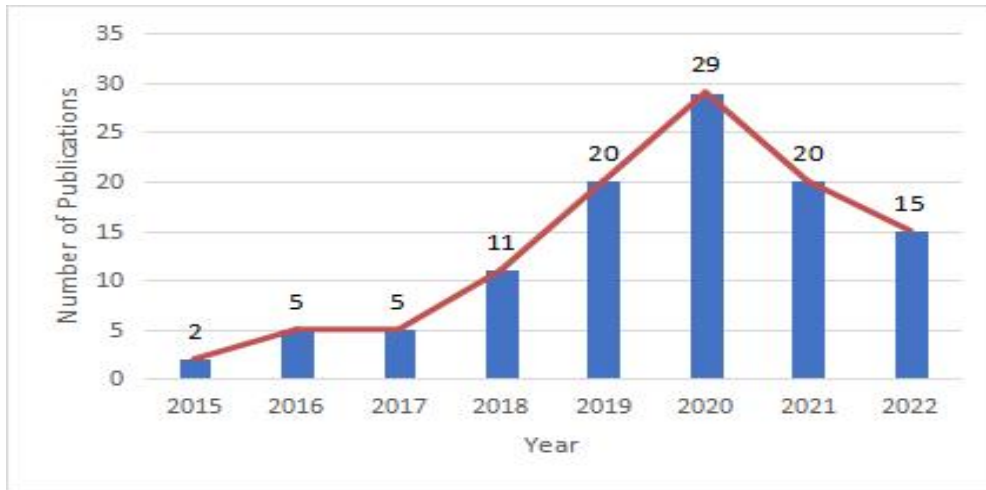


Figure 2. Publication Trajectory

As for country contributions, hitherto, 33 countries have published research on self-regulated learning in flipped classrooms, which confirms the global interest in this research area. Figure 3 shows the top 10 countries’ contributions to the highly cited articles and the number of articles published by the respective country. The citation attribute displays the number of citations that have been attributed to papers published by a particular source, author, organization, or country (Van Eck & Waltman 2020). Among them, China, the United States, and Turkey have the highest number of citations and publications.

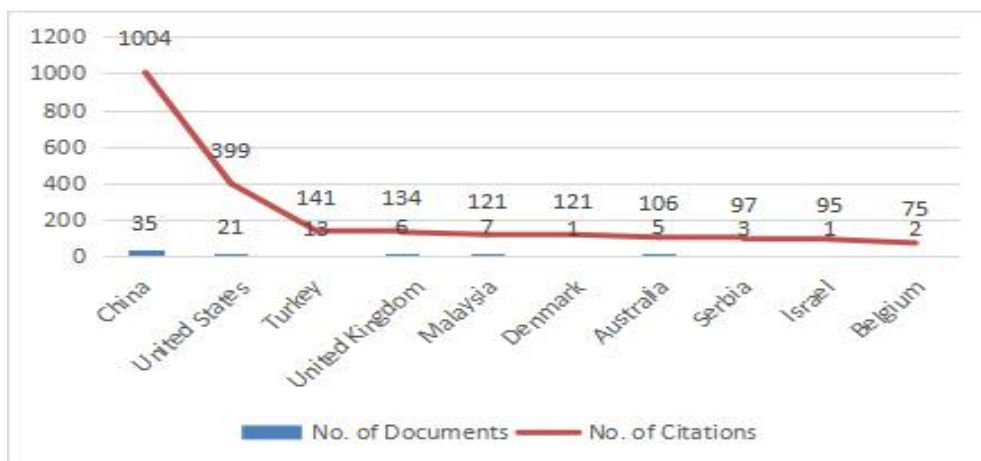


Figure 3. Country Contributions (Top 10)

Compared with other countries, Chinese researchers have made the most significant contribution in this field, with a 23% proportion of articles (35 articles) and the number of

citations accounting for 35.8% (1004 times), followed by the United States, with 14% proportion of articles (21 articles) and the number of citations accounting for 14.2% (399 times). A total of more than 1/3 of the knowledge base of this review is derived from these two countries.

As a matter of interest, it is worth noting that Britain and Malaysia, ranked fourth and fifth respectively, both account for slightly less than half of the number of articles in Turkey, but they have more significant citations, accounting for 134 and 121 citations respectively. In addition to that, there is only one document in Denmark that has received 121 citations. Therefore, it is undeniable that the research field has also been greatly influenced by Britain, Malaysia, and Denmark, with their contributions unwavering.

Most influential journals, authors, articles, and corresponding research methodology

The second research question was intended to explore the most influential authors, journals, articles, and the corresponding research methodology on self-regulated learning in flipped classrooms. A visualization map was produced using the VOS viewer program to display co-authorship and authors to identify the most influential authors. The least number of documents of an author was put to two, and then 26 authors met the thresholds among the total 304 authors. However, some of the 26 authors in the Vos viewer are not connected. The most extensive set of connected authors consists of 7 authors, so Figure 4 shows this set of authors instead of all authors.

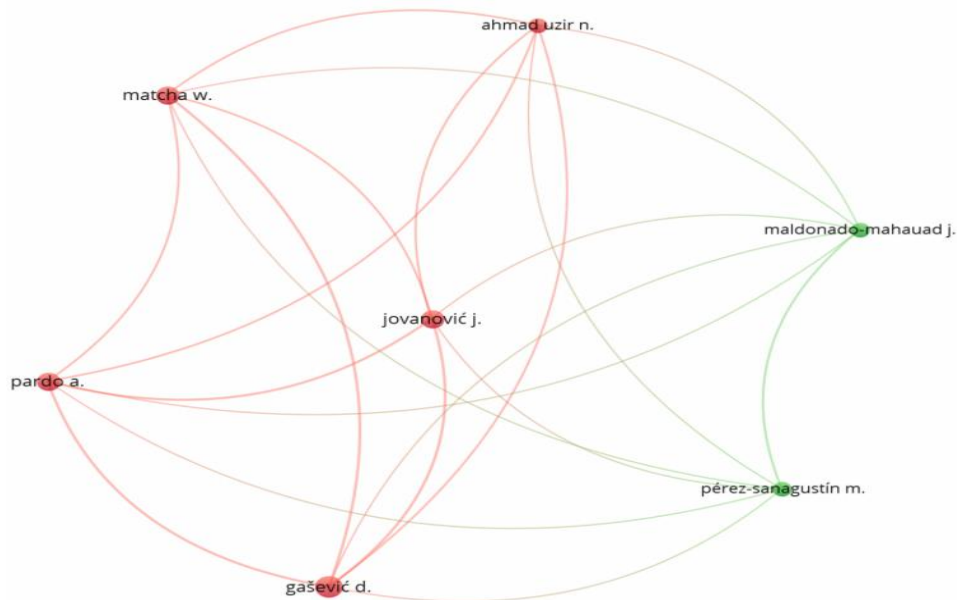


Figure 4. Set of Authors with More Than 1 Publication

It can be seen from Table 2 that the number of publications each of these 12 authors has published is almost the same. The data presented that Hwang g.-j. was the most-cited author in this field with 349 citations, followed by Lai c.-l. with 336 citations. The top 2 most-cited authors are from Taiwan, and their two published articles were jointly studied according to Figure 4 with the purple cluster 5. Apart from that, other authors ranked in the top 5 were Gašević d. (106), Jovanović j. (97), Pardo a. (97). According to Figure 4, the red cluster 1 indicated that author Gašević d., Jovanović j., and Pardo a. were closely worked together. It is worth mentioning that none of the published articles by Gašević d., who participated in relatively more studies, was the first author. The authors ranked the 7th, 8th, 9th, and 10th in Table 2 with the same number of citations and also worked together on the published articles based on Figure 4 with the green cluster 2. There can be an inference that this research field has not attracted enough scholars to do research and collaborate, and the available research literature is also insufficient.

Table 2. Most Influential Authors (with more than 50 citations in total)

Rank	Author	Number of Publications	Number of Citations
1	hwang g.-j.	2	349
2	lai c.-l.	2	336
3	gašević d.	4	106
4	jovanović j.	3	97
5	pardo a.	3	97
6	öztürk m.	2	62
7	janssen j.	3	59
8	kester l.	3	59
9	phielix c.	3	59
10	van alten d.c.d.	3	59
11	zheng b.	3	52
12	matcha w.	3	51

A citation analysis was performed to generate a map of the most-cited journals based on citation analysis. The minimum number of documents of a source was adjusted to 2, and 16 sources met the thresholds. While exporting the results obtained by VOS viewer into an Excel file, the researcher set a minimum number of citations to be achieved by a source in an Excel file set to 100. Table 3 displayed 3 journals that have more than 100 citations. It shows that the most cited journals are Computers and Education (citations 547, documents 5), Journal of Computer Assisted Learning (citations 176, documents 5), and British Journal of Educational Technology (citations 141, documents 3).

Table 3. Most Influential Journals (with more than 100 citations in total)

Rank	Journal	Number of Documents	Number of citations
1	Computers and Education	5	547
2	Journal of Computer Assisted Learning	5	176
3	British Journal of Educational Technology	3	141

Further analysis of the most influential articles on self-regulated learning in flipped classrooms has been carried out by citation analysis. The number of citations was adopted to measure the literature's impact. The full dataset of 107 articles yielded 1,933 citations (Table 4), with only one article being cited more than 300 times and only one article being cited more than 100 times, plus 16 uncited articles.

Table 4. Article Citation Information

Citation Information	Total
Total citations	1933
Uncited articles	16
Articles with 300+ citations	1
Articles with 100+ citations	1
Articles with 50+ citations	9

Table 5 listed the most highly cited articles. As shown, 2 articles achieved more than 100 citations (Lai & Hwang, 2016; Sun et al., 2018), and 9 articles reached more than 50 citations (Blau & Shamir-Inbal, 2017; Çakiroglu & Öztürk, 2017; Fincham et al., 2019; Ng, 2018; Shyr & Chen, 2017; Sletten, 2017; Sun et al., 2016; Wang, 2016; Zainuddin & Perera, 2019).

Table 5. Most Influential Articles (with more than 30 citations)

Rank	Author(s)	Article Title	Year of Publication	Number of Citation	Research Methodology
1	Lai C.L., Hwang G.J.	A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course	2016	330	Quantitative
2	Sun Z., Xie K., Anderman L.H.	The role of self-regulated learning in students' success in flipped undergraduate math courses	2018	121	Quantitative
3	Blau I., Shamir-Inbal T.	Re-designed flipped learning model in an academic course: The role of co-creation and co-regulation	2017	95	Qualitative
4	Sun J.C.Y., Wu Y.T., Lee W.I.	The effect of the flipped classroom approach to Open Course Ware instruction on students' self-regulation	2017	92	Quantitative
5	Shyr W.J., Chen C.H.	Designing a technology-enhanced flipped learning system to facilitate students' self-regulation and performance	2018	75	Quantitative
6	Sletten S.R.	Investigating Flipped Learning: Student Self-Regulated Learning, Perceptions, and Achievement in an Introductory Biology Course	2017	66	Quantitative
7	Zainuddin Z., Perera C.J.	Exploring students' competence, autonomy and relatedness in the flipped classroom pedagogical model	2019	56	Mixed method
8	Çakiroğlu Ü., Öztürk M.	Flipped classroom with problem based activities: Exploring self-regulated learning in a programming language course	2017	56	Qualitative
9	Fincham E., Gašević D., Jovanović J., Pardo A.	From Study Tactics to Learning Strategies: An Analytical Method for Extracting Interpretable Representations	2019	55	Quantitative
10	Ng E.M.W.	Integrating self-regulation principles with flipped classroom pedagogy for first year university students	2018	51	Mixed method
11	Wang Y.-H.	Could a mobile-assisted learning system support flipped classrooms for classical Chinese learning?	2016	51	Mixed method
12	Wang K., Zhu C.	MOOC-based flipped learning in higher education: students' participation, experience and learning performance	2019	47	Mixed method
13	Baytiyeh H.	The flipped classroom model: when technology	2017	42	Qualitative

Rank	Author(s)	Article Title	Year of Publication	Number of Citation	Research Methodology
		enhances professional skills			
14	Moos D.C., Bonde C.	Flipping the Classroom: Embedding Self-Regulated Learning Prompts in Videos	2016	40	Mixed method
15	Van Alten D.C.D., Phielix C., Janssen J., Kester L.	Self-regulated learning support in flipped learning videos enhances learning outcomes	2020	39	Quantitative
16	Zou D.	Gamified flipped EFL classroom for primary education: student and teacher perceptions	2020	34	Qualitative
17	Wang F.H.	On the relationships between behaviors and achievement in technology-mediated flipped classrooms: A two-phase online behavioral PLS-SEM model	2019	32	Quantitative
18	Montgomery A.P., Mousavi A., Carbonaro M., Hayward D.V., Dunn W.	Using learning analytics to explore self-regulated learning in flipped blended learning music teacher education	2019	30	Quantitative

Topical foci and underexplored research areas

Researchers have recognized that the keywords used by authors play a crucial role in seeking out research trends and benchmarks. Apart from that, author keywords can be used to measure the development of a research theme in a particular field because these keywords often relate closely to the concepts behind them, especially when they are frequent in documents (Zupic & Čater 2014). An analysis of the co-occurrences of author keywords with VOSviewer was conducted to answer the third research question. The topical foci and general progress of a specific research field can be identified. It is essential noting that to eliminate redundant keyword co-occurrences when analyzing the author keyword co-occurrences, a thesaurus file was employed to avoid the duplicates caused by the difference in subject matter (e.g., “humans” and “human”; “learning strategies,” “learning tactics” and “learning strategy”). In assessing the frequency of appearance of any keyword, it was determined that the least number of occurrences of any keyword is 2, and of the 273 author keywords, 32 meet the threshold. The generated overlay visualization map is demonstrated in Figure 5, and related keywords are commonly listed together as indicated by the same color. It reveals the frequently used author keywords in the publications on self-regulated learning in flipped classrooms.

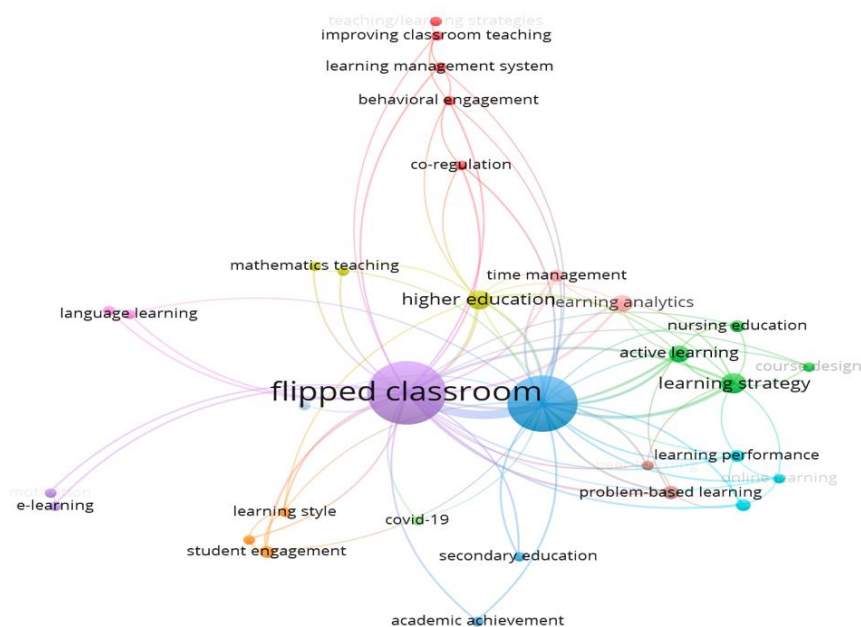


Figure 5. Topical Foci in the Studies on Self-regulated Learning in Flipped Classrooms

As displayed in the results, significant concepts derived from the keywords were categorized into 12 clusters. There is a strong correlation between these keywords based on their recurrence dimension, letterform dimension, and the concentration of the connecting lines, which indicates the strength of this correlation (Sweileh et al., 2017). Each node represents a keyword, and the size of each node is proportional to the total strength of the link between co-occurring keywords. Except for the search terms flipped classroom shown in purple (occurrences 79) and self-regulated learning shown in blue (occurrences 62), the other most used keywords were “learning strategy” (shown in green with occurrences 9), “higher education” (shown in yellow with occurrences 8), “active learning” (shown in green with occurrences 6), “learning analytics” (shown in red with occurrences 6), and “problem-based learning” (shown in brown with occurrences 4).

Similarly, clusters are created using keywords that are the strongest among them as determined by the co-occurrence force of keywords determined using the VOSviewer program. Thus, the flipped classroom has to do with self-regulated learning (cluster 5) through e-learning,

student engagement, behavioral engagement, and learning management system (clusters 5, 7, and 1), and the improvement of academic achievement (cluster 3).

Discussion

By 2020, the year of the COVID-19 outbreak, the number of publications reached the highest (29 articles) since, during the pandemic, of the countries in the world, the majority applied defense laws that limited the movement of humans to reduce the spread of the virus, resulting in students, teachers, and instructors staying home (Hijazi & AlNatour, 2021). Many schools and universities have adopted flipped classrooms around the world, replacing traditional classrooms (Zou et al., 2021). However, the use of flipped classrooms, especially the use of online classrooms, dramatically increases the number of students who need to be self-regulated learning students (Du et al., 2022). To address this issue, many scholars produced studies on self-regulated learning in flipped classrooms in 2020. In 2021, the number of relevant articles in 2022 dropped slightly, and up to now, the number of articles in 2022 (15 articles) is not as many as articles in 2020, perhaps because there is only half a year's worth of data available (until July 20th, 2022). Considering the growth in the number of publications, it is estimated that the number of publications may be slightly higher than in 2021. In light of the published articles, it appears that scholars continue to pay attention to self-regulated learning in flipped classrooms research.

Another finding is that the number of articles and citations that have been published in China is significantly higher due to a substantial student population as well as a strong population base. Additionally, in recent years, with the rapid development of China's information and communication technology (ICT) in the educational sector (Zheng et al., 2016), self-regulated learning in flipped classrooms has become one of the major research focus areas in the academic field (e.g., Ng, 2018; Shyr & Chen, 2017).

Based on the findings, Table 3 shows the most cited journals, and the prominent finding was that these three journals are all ranked Q1 by Scimago JR, indicating that these authoritative journals are aware of the significance of self-regulated learning in flipped classrooms and are trying to promote an understanding of this research area among all scholars in the field.

Additionally, the most highly cited article recommended a self-regulated flipped classroom approach to help students schedule their out-of-class time effectively since there is a lack of self-regulated learning competence among students, which prevents them from browsing and comprehending instructional materials outside of class on their own (Lai & Hwang, 2016). Lai and Hwang also strongly influenced the development of self-regulated learning in flipped classrooms, and they pioneered pertinent research on this subject. The study concluded that implementing the self-regulated strategy in flipped classrooms improved students' self-efficacy, as well as their strategies for planning and utilizing their study time, enabling them to learn more effectively and achieve higher levels of learning success (Lai & Hwang, 2016). The subsequent empirical publication by Sun et al. (2018) focused on the connection between academic achievement and self-regulatory constructs. A significant positive relationship was found between students' self-efficacy and their use of help-seeking strategies in the pre-and in-class flipped classrooms, as well as academic achievement, based on the study's findings (Sun et al., 2018).

Apart from that, there were 9 articles in this list of 18 influential articles that adopted quantitative research methodology, 5 articles conducting mixed-method research methodology, and only 4 using qualitative research methodology. According to the literature, it is evident that flipped classrooms promoted better self-regulated learning skills among students on a quantitative level (Shyr & Chen, 2017; Zainuddin & Perera, 2019). However, more qualitative investigation is needed in terms of how and why.

The results also could reveal that implementing flipped classrooms with self-regulated learning is accompanied by the topical foci and underexplored research areas findings. In this area of research, it is also evident that there is a greater emphasis on tertiary education than on primary and secondary education in this field. Moreover, nodes in Figure 5 with small sizes represent themes related to this research field, which need additional research to be investigated in depth to determine their significance. These include "behavioral engagement," "co-regulation,"

“course design,” “language learning,” “peer-learning,” “primary education,” “secondary education,” “self-regulated learning strategies,” and “teacher education,” representing the under-explored research fields of self-regulated learning in flipped classrooms. As a reference, Figure 5 can be used to organize search and retrieval equations in future research, or it can also be used to identify issues related to self-regulated learning in flipped classrooms that need to be addressed.

Limitation

The results of this study involve a comprehensive quantitative analysis of the self-regulated learning in the flipped classroom knowledge base, but it still has some limitations. One of the limitations of this study lies in the fact that the research documents were obtained using a single database from Scopus. The selection criteria were also limited to journal articles only in English, so certain data that could have contained the primary research foci may have been overlooked due to the limitation. As a result, how citation maps are produced and interpreted differs according to the thresholds at which they are made and explained. It is intended that the bibliometric analysis be used as an adjunct to other review methods, so despite the inherent limitations of the bibliometric analysis, this research can still provide thought-provoking insights and significant perspectives into this area for researchers interested in self-regulated learning in flipped classrooms.

Conclusion

To a modest extent, this study examines a general overview of the self-regulated learning in flipped classrooms research that has taken place between 2015 and 2022 based on the scientific mapping, including publication trajectory, country contributions, most influential authors, journals, articles, and corresponding research methodology, topical foci, and underexplored research areas. The bibliometric analysis has found that: 1) There was a slight increase in publications between 2010 and 2021, indicating that the field is still developing, mainly due to the COVID-19 pandemic. This finding is corresponding to previous research that flipped classroom instruction will be essential to post - pandemic education (Clark et al., 2021). 2) China and the United States have contributed the most to the field. 3) Amongst the most influential journals in this domain, the Computers and Education, Journal of Computer Assisted Learning, and British Journal of Educational Technology are the three most significant contributors with 13 documents published in total in this field. 4) According to the analysis of the most influential articles, the most cited paper is from Lai and Hwang (2016) with 330 citations, and they were also the most influential authors in this field. 5) Based on keywords co-occurrences, research foci were identified to be “learning strategy”, “higher education”, “active learning” “learning analytics”, and “problem-based learning”. The underexplored themes are “behavioral engagement”, “co-regulation”, “course design”, “language learning”, “peer-learning”, “primary education”, “secondary education”, “self-regulated learning strategies”, and “teacher education”.

Accordingly, in addition to contributing to the growing body of literature on self-regulated learning in flipped classrooms, this bibliometric analysis can also be considered an instrument to assist new entrants to the field of self-regulated learning in flipped classrooms by providing them with the guidance and direction needed to identify the research priorities for further studies. Therefore, to address the current research insufficiency in this area, the researcher has called on scholars worldwide to establish a worldwide network of cooperation and to commit their efforts to address this issue continuously. The following suggestions are presented based on the results of this study: 1) it is recommended that future studies will evaluate this topic from the perspective of other bibliometric methodologies, such as co-citation, bibliographic coupling, and intellectual structure; 2) further research will need to be devoted to the primary and secondary education areas, not only to the higher education; 3) variables such as self-regulated learning strategies in language learning can be studied in future studies using qualitative research methodology.

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