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A Bibliometric of Student Engagement in Flipped Learning: Current Situation and Way Forward

Xue Luo, Bity Salwana Alias* and Jamalul Lail Abdul Wahab
The National University of Malaysia
Malaysia

Abstract. In the context of contemporary educational reform and student-centered teaching approaches, flipped learning is gaining recognition for its proven effectiveness in boosting student engagement. However, systematic research on student engagement within flipped learning environments is scarce. This study addresses this gap by conducting a bibliometric and visualization analysis of 147 articles on student engagement in flipped learning from the Web of Science core collection. Utilizing CiteSpace software, the study delves into the current state and emerging trends in the field. The analysis identifies major research hotspots and cutting-edge areas, including "student interaction", "learning motivation", "teaching strategies", "learning outcomes", and "educational technology". The findings emphasize the need for increased collaboration among authors and institutions in this domain. Furthermore, the study highlights research hotspots and frontiers such as "personalized learning", "teacher role", "curriculum design", and "learning assessment". Notably, co-citation analysis reveals that research output in this field is led by Mainland China and the United States. Overall, this research, utilizing CiteSpace, effectively identifies influential factors and future trends in student engagement in flipped learning, offering valuable references to advance both research and practice in the field. The study concludes by recommending strategic collaboration and further exploration of identified research frontiers to enhance the effectiveness and reach of flipped learning methodologies.

Keywords: student engagement; flipped learning; CiteSpace; bibliometric Analysis; educational technology; learning motivation

*Corresponding author: *Bity Salwana Alias; bity@ukm.edu.my*

1. Introduction

Within the dynamic realm of educational methodologies, flipped learning gains endorsement from UNESCO's Education 2030 Framework and has been established as a pivotal paradigm that enhances student engagement by leveraging digital tools to shift the initial interaction with new material into the student's autonomous control, validated through its widespread adoption and positive impact on student participation (huwangHwang & Chen, 2023; Kiljunen et al., 2023; Shen, 2024; Udvari & Vizi, 2023). Despite its acclaim, there remains a notable gap in the literature: the absence of comprehensive visual analyses of student engagement within flipped learning utilizing scientometric tools such as CiteSpace (Al Mamun et al., 2022). This lacuna hinders a full-fledged understanding of the pedagogical influence and limits the potential refinement of the flipped learning strategy across varied educational contexts. Addressing this gap by employing CiteSpace for a systematic analysis will not only delineate the academic discourse but also enhance the strategic application of the flipped learning model to optimize educational practices universally (Silverajah et al., 2022).

Recognizing the gap in comprehensive scientometric research within the domain, this study seeks to contribute to the scholarly dialogue by meticulously analyzing the literature indexed in the Social Science Citation Index (SSCI). By employing CiteSpace (Chen, 2006), a tool revered for its capacity to visualize and analyze academic trends and networks, the research is designed to unearth the thematic and collaborative structures that define the flipped learning discourse. The intent is to parse through the layers of academic contributions, discerning patterns and contributions that have significantly shaped the conversation, thus offering a granular view of the field's evolution.

Despite the growing body of research on flipped learning methodologies, a critical gap is a lack of comprehensive analyses of student engagement within these settings (Wong & Liem, 2022). Previous studies have primarily focused on isolated aspects of flipped learning, such as its impact on academic performance or student satisfaction (Kazanidis et al., 2019; Oliván-Blázquez et al., 2023). However, they often fall short in providing a holistic view of student engagement, failing to consider the interconnected dimensions of behavioral, emotional, and cognitive engagement simultaneously. Additionally, many studies rely on small sample sizes or lack rigorous analytical frameworks, limiting the generalizability and depth of their findings (Huang et al., 2019; Wittmann & Wulf, 2023). This study addresses these shortcomings by employing a robust scientometric approach using CiteSpace software to analyze a comprehensive dataset, thereby offering a more nuanced and complete understanding of student engagement in flipped learning. Doing so not only fills the identified gap but also provides valuable insights for educators and policymakers aiming to optimize flipped learning environments.

To bridge this gap, the study formulates six research questions through the analytical lens of CiteSpace software:

1) What are the core themes and emerging trends in student engagement within flipped learning from 2014 to 2023?
2) Who are the leading contributors, and what are the key publications that have shaped the discourse on student engagement in flipped learning during this period?
3) What patterns of collaboration exist among researchers in this field, and how have they evolved over the decade?
4) Which regions or institutions have been most active in researching student engagement in flipped learning?
5) How has the research focus on student engagement in flipped learning shifted throughout the decade?
6) How are the validity and reliability of the analysis results verified when using CiteSpace for visualizing literature on student engagement in flipped learning?

2. Literature Review

2.1 Theoretical Foundations of Flipped Learning

Flipped learning reverses the traditional teaching models and has redefined educational dynamics significantly in the last decade. This method emphasizes the critical role of technology in enhancing student autonomy and promoting an environment where learners take control of their educational processes. Louisa Tomas et al. (2019) have underlined the necessity of integrating advanced digital tools such as interactive learning platforms and virtual classrooms to foster environments conducive to active and engaged learning, which ultimately improve both student engagement and academic outcomes.

This pedagogical shift necessitates a thorough re-examination of the concept of student engagement, which has traditionally been conceptualized through three primary dimensions: behavioral, emotional, and cognitive (Pérez-López et al., 2020; Wong & Liem, 2022). The integration of technology and varying pedagogical practices uniquely influences these dimensions in flipped learning environments. Researchers like Goagoses et al. (2024) and Lee et al. (2022) argue that digital tools can challenge traditional educational dynamics, necessitating that educators develop innovative strategies to engage students effectively and maintain the integrity of the learning experience.

Behavioral engagement in flipped classrooms requires students to engage independently with learning materials outside of class and to participate actively during class sessions (Lin, 2023). Emotional engagement is enhanced through personalized learning content that aligns with individual needs and interests, thereby fostering deeper emotional connections with the educational content (Alamri et al., 2020). Cognitive engagement involves students employing more sophisticated strategies and engaging in deeper thinking processes during their learning activities (Jia et al., 2023). However, the increased reliance on technology and the requirements for self-discipline present substantial challenges that necessitate ongoing research into the theoretical foundations and practical implementations of flipped learning (Romero & Angeles, 2023).

2.2 Conceptual Framework for Student Engagement

Before delving into specific theories, it is critical to define "student engagement" within the context of flipped learning. Student engagement in flipped learning environments is characterized by multifaceted involvement across the three key dimensions mentioned above: behavioral, emotional, and cognitive. Behavioral engagement involves the observable participation of students in both preparatory activities outside of class and interactive facets within the classroom. Emotional engagement is reflected in students' affective responses to learning activities, including their interest, enthusiasm, and emotional connections to the content. Cognitive engagement denotes the intellectual commitment students make as they employ complex thinking processes to understand, integrate, and apply the knowledge they acquire.

Grounded in Astin's Student Involvement Theory, which posits that the extent of student development is directly proportional to the level of their engagement in academic and social activities, this research emphasizes the importance of active participation (Astin, 2014; Xhomara et al., 2023). We utilize Fredricks et al.'s (2004) tripartite model, which categorizes engagement into behavioral, emotional, and cognitive dimensions, to assess the comprehensive impact of flipped learning environments(Fredricks et al., 2004). Behavioral engagement is assessed through metrics such as class attendance and active participation (Xiao & Hew, 2024), while emotional engagement is gauged through surveys that measure students' interest and enthusiasm. Cognitive engagement is evaluated by analyzing students' application of critical thinking and problem-solving skills (Borgonovi et al., 2023; Li et al., 2023).

Additionally, incorporating Tinto's Retention Theory, we examine how academic and social integration contribute to student retention and success in flipped learning settings (Tinto, 2012). Qualitative measures such as interviews and focus groups capture students' sense of belonging and interactions within flipped learning environments. The positive impact of technology on engagement, supported by findings from Nkomo et al. (2021), underscores the significant role digital tools play in enhancing the learning experience in these educational settings(Nkomo et al., 2021).

2.3 Evolution of Student Engagement in Flipped Learning

Over the past decade, flipped learning has redefined educational models by shifting direct instruction from traditional collective learning spaces to individual learning spaces (Zhou, 2023). This approach enhances students' higher-order thinking skills through technology-enhanced learning experiences within the classroom (Hwang et al., 2019; Lee & Choi, 2017; Liu & Zhang, 2022). As this model gained prominence, the theoretical foundations of student engagement have advanced across three dimensions: behavioral, emotional, and cognitive.

Early research (2014–2016) focused on the novelty of flipped learning, particularly how technological tools like video lectures and online quizzes fostered behavioral engagement. These studies highlighted technology's role in stimulating

behavioral engagement but often overlooked its impact on emotional and cognitive dimensions (Giuliano & Moser, 2016; Nouri, 2016; Rossi, 2015). Later research (2017–2020) revealed that flipped learning enhanced students' intrinsic motivation and self-regulation, key components of emotional engagement (Park & Kim, 2022). For instance, Elmaadaway (2018) found higher student interest and engagement in flipped learning environments. Lo and Hew (2021) also demonstrated that flipped learning encouraged more effective learning strategies, reflecting improved cognitive engagement.

In terms of research methodologies, various approaches have been employed to explore student engagement in flipped learning. Quantitative studies have unveiled patterns in behavioral engagement, while qualitative research has delved into students' emotional and cognitive experiences. Recently, mixed-methods research has combined quantitative and qualitative data, providing a comprehensive perspective on student engagement within flipped learning.

2.3.1 Research Methodology Trends

Research trends in studying student engagement in flipped learning showcase diverse methodologies. Quantitative methods, such as surveys and questionnaires, have been widely used to reveal patterns in behavioral engagement (Lundin et al., 2018; Nkomo et al., 2021). Qualitative methods, including in-depth interviews, are vital for understanding emotional and cognitive engagement. For instance, Jones-Bonofiglio et al. (2018) provided a quantitative framework for analyzing behavioral engagement, while other scholars have used qualitative approaches to explore emotional and cognitive dimensions. Mixed-methods research, which combines quantitative and qualitative methods, offers a comprehensive perspective on the multi-dimensionality of student engagement in flipped learning (Koh & Ahn, 2023; Kurban, 2019). Integrating these methodologies enhances research reliability and enriches our understanding of educational practices, facilitating effective adjustments and implementations of teaching strategies.

2.3.2 Impacts and Challenges

One significant challenge in implementing flipped learning is the digital divide, highlighted by Akçayır and Akçayır and Sablić and Mirosavljević (Akçayır & Akçayır, 2018; Sablić & Mirosavljević, 2024) as a barrier to equitable access to resources. This challenge includes disparities in technology access among students, affecting their ability to fully participate in flipped learning. Our study will consider strategies to mitigate the digital divide, such as providing alternative access points and ensuring that technological resources are readily available to all students. By acknowledging and addressing these challenges, we aim to create a more inclusive and effective flipped learning environment.

The influence of flipped learning on enhancing student engagement is generally positive but comes with significant challenges. Numerous studies have revealed improvements in student engagement and learning outcomes, yet these advancements are not without costs. Challenges frequently mentioned include

unequal access to technology, individual differences in student motivation, and the demands on teachers for preparation and support. Akçayır and Akçayır (2018) particularly emphasize that not all students succeed equally in self-directed learning environments, highlighting the need for diverse engagement strategies. Therefore, further research in flipped learning must address these challenges to ensure that all students benefit from this instructional model.

In conclusion, significant progress has been made in understanding student engagement in flipped learning environments over the past decade. However, as the educational landscape continues to evolve, effective strategies for engaging students must also evolve. Continuing to explore and address the challenges and opportunities in this field is crucial for educators and researchers alike.

3. Methodology

3.1 Data Sources and Research Methods

The Web of Science (WoS) Core Collection was selected as the primary literature source owing to its extensive analysis functionalities, crucial for this study's scientometric approach (Li et al., 2018). The WoS supports advanced co-occurrence, citation, and keyword frequency analyses, making it ideal for examining complex research trends. The rigorous screening process of WoS ensures high-quality, global research publications. Additionally, the compatibility between WoS and CiteSpace software enhances data manipulation and visualization (Chen, 2016), facilitating the creation of comprehensive knowledge maps and the analysis of intricate citation networks. This combination allows for identifying patterns, key publications, and emerging themes in student engagement in flipped learning, thus enriching the academic depth of our analysis.

Despite the clear rationale for using WoS and CiteSpace, potential limitations exist. Relying solely on WoS may introduce bias, as it might not cover all relevant research. To address this, findings were cross-verified with other databases such as Scopus and Google Scholar. Additionally, to mitigate citation bias, stringent inclusion and exclusion criteria were applied to filter out less relevant or lower-quality studies, ensuring the robustness of the dataset. To further ensure the accuracy and relevance of the selected studies, the screening process included the involvement of two professionals with expertise in the specific field.

3.2. Data Collection and Processing

3.2.1. Data Collection

The WoS database, specifically its Social Sciences Citation Index (SSCI), was chosen for its comprehensive archive of high-impact journals that reflect evolving research trends in peer instruction. This database offers a vast collection of high-quality, citation-rich academic discourse essential for the scientometric precision our research requires (Birkle et al., 2020). A search was conducted on December 25, 2023, using the query "(TS=flipped classroom OR TS=inverted classroom OR

TS=flipped learning OR TS=inverted learning) AND (TS=student engagement OR TS=learner engagement)," yielding 428 relevant publications from the past decade.

3.2.2 Data Processing

CiteSpace was utilized for bibliometric and network analysis of the collected data (Chen & Song, 2019). By importing bibliographic data from the WoS Core Collection, CiteSpace facilitated constructing a co-citation network, identifying research hotspots, and visualizing emerging trends within flipped learning and student engagement. Centrality measurements highlighted influential works, while burst detection algorithms identified topics with significant increases in citation frequency over specific periods. This analysis provided a comprehensive overview of the evolution of research in this area, pinpointing key areas for future exploration and offering valuable insights into the intellectual structure of the field.

3.2.3 Review Process

The review process ensured consistency and accuracy through several stages. Three experienced researchers independently reviewed each of the 428 articles. The criteria for inclusion were rigorously applied to ensure relevance and quality. Each article was evaluated based on criteria such as publication period, database inclusion, language proficiency, document genre, keyword alignment, comprehensive exploration, methodological rigor, and accessibility of full texts. Discrepancies were resolved through discussion and consensus among researchers, ensuring a thorough selection process. The detailed criteria are summarized in Table 1.

Table 1: Inclusion and Exclusion Criteria for Literature Selection

Criteria	Inclusion Criteria	Exclusion Criteria
Publication Period	Studies published within the timeframe of 2013 to 2023.	Studies published before 2013 or after 2023.
Database Inclusion	Articles indexed within the SSCI of the WoS Core Collection.	Articles not indexed within the SSCI or not part of the WoS Core Collection.
Language Proficiency	Scholarly articles written in English.	Works published in languages other than English.
Document Genre	Peer-reviewed empirical research articles and systematic reviews.	Conference abstracts, book reviews, editorial commentaries, etc.
Keyword Alignment	Research employing terms such as “flipped learning,” “inverted classroom,” “flipped classroom,” “inverted learning,” “student engagement,” or “learner	Articles devoid of the specified search terms or lacking direct relevance to the theme of flipped learning and student engagement.

	engagement" within their title, abstract, or keywords.	
Comprehensive Exploration	Studies that comprehensively explore the direct impact and relationship between flipped learning methodologies and student engagement.	Studies that provide superficial or limited exploration of the relationship or treat student engagement as a secondary issue.
Methodological Rigor	Research that demonstrates methodological rigor and quality through peer review.	Articles that have not undergone peer review or lack research quality.

4. Research Findings

4.1 Number of Publications

Figure 1 presents an insightful depiction of the publication trends in student engagement within flipped learning environments from 2014 to 2023, showcasing a significant growth in academic interest. The initial stage of the graph, starting in 2014, displays a modest number of publications. This period represents the infancy of flipped learning research, focusing on building a foundational understanding of how student engagement functions in these novel educational settings. The relatively low publication count during this phase highlights the initial exploratory nature of research in this field (Akçayır & Akçayır, 2018).

Post-2018, there was a notable increase in scholarly publications on flipped learning, reflecting a shift from traditional methods to active, student-centered learning (Al-Samarraie et al., 2020). The marked rise in publications in recent years highlights the growing acknowledgment of flipped learning's effectiveness in creating active learning environments. By the conclusion of this stage, the substantial growth in the volume of literature underscores the evolution and maturity of research in the flipped learning domain, firmly establishing flipped learning as a key strategy in contemporary education.

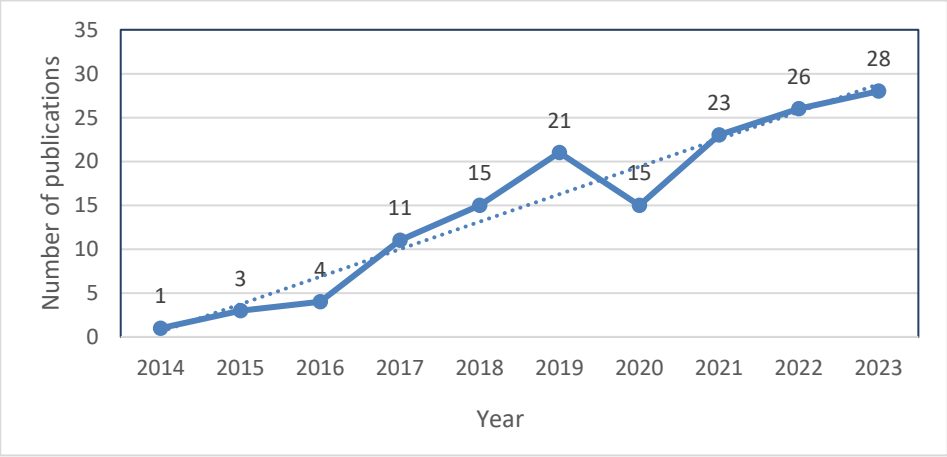

Figure 1: Annual Distribution of Publications on Student Engagement in Flipped Learning from 2014 to 2023

In 2022, research output in the field of flipped learning peaked, marking a high point in the recognition of flipped learning's effectiveness in fostering student engagement. This peak can be attributed to several factors. Firstly, the increased adoption of digital learning tools during the COVID-19 pandemic accelerated the implementation of flipped learning models, leading to a surge in related research. Secondly, significant funding from educational institutions and governments to support remote and blended learning initiatives likely contributed to the increased research activity (Bredow et al., 2021). Lastly, heightened academic interest in innovative teaching strategies to improve student outcomes further fueled the research momentum during this period.

However, a slight decline observed in 2023 suggests a possible shift in research priorities or a phase of reassessment within the academic community. This decline might be due to several reasons, including the stabilization of remote learning practices post-pandemic, which reduced the urgency for immediate research (Campillo-Ferrer & Miralles-Martínez, 2021). Additionally, shifts in funding priorities and the emergence of new educational technologies could have redirected academic focus to other innovative areas in education.

4.2 Collaboration Network

4.2.1 Country Network

The data from Table 2 reveals that mainland China is at the forefront of regional collaboration in flipped learning research, leading with 39 instances of collaboration. This highlights its strong research activity and an extensive network of international cooperation in the field. The United States follows with 25 collaborations, while Taiwan records 18. The high centrality score of 0.29 for the United States indicates its crucial role in the global collaboration network, with a centrality score above 0.1 typically signifying a key hub within the network (Chen, 2016). This prominent position of the United States could reflect its leadership in relevant research areas and the breadth of its international academic exchanges. Policies like mainland China’s "Internet Plus Education" (China, 2018) and the United States' "Technological Innovation Schools" initiative have likely bolstered this research by providing policy support and funding, encouraging academic institutions to undertake relevant studies.

Analysis of the country collaboration network, detailed in Table 2 and Figure 2, reveals that mainland China leads in regional collaboration for flipped learning research, followed by the United States and Taiwan. The high centrality score for the United States underscores its crucial role in the global collaboration network. Variations in collaboration levels suggest differences in academic resource distribution, research focus, and international cooperation strategies across regions.

Table 2: Country Network of Top 10

Rank	Countries	Frequency	Centrality	Year
1	PEOPLE'S R CHINA	39	0.09	2018
2	USA	25	0.29	2014
3	TAIWAN	18	0	2015
4	AUSTRALIA	12	0.31	2017
5	SPAIN	12	0	2017
6	ENGLAND	7	0.05	2020
7	SOUTH KOREA	7	0.01	2017
8	IRAN	6	0.03	2018
9	TURKEY	6	0	2017
10	NORWAY	4	0	2017

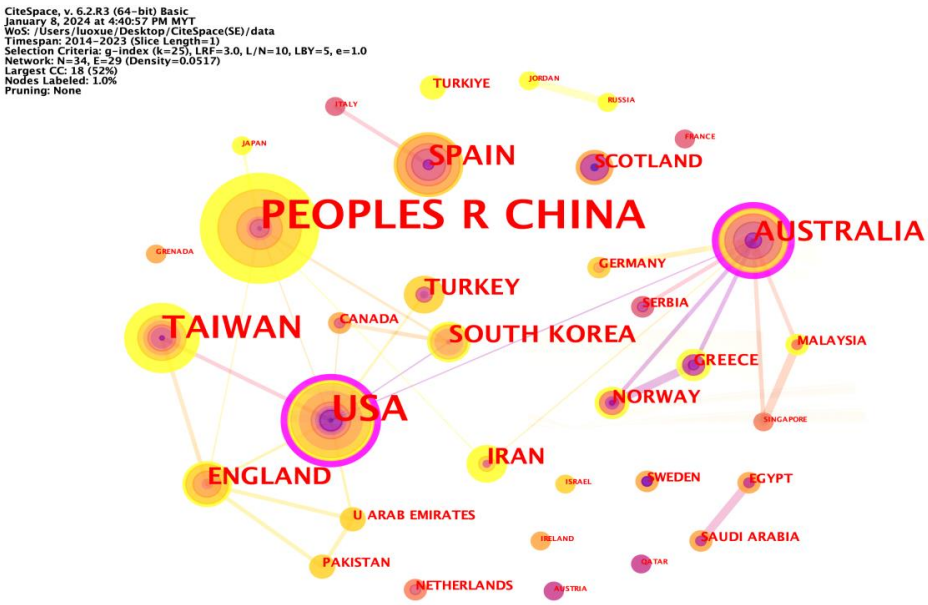

Figure 2: Country Cooperation Network

4.2.2 Institution Network

The institutional collaboration network analysis conducted as part of the study sheds light on patterns of cooperation between institutions as well as the distribution of research on student involvement in flipped learning. Figure 3 reveals that the network consists of 154 nodes and 93 links, with an overall network density of 0.0078. This low density suggests that while there is a notable frequency of collaboration among institutions researching student participation in flipped learning contexts, these collaborations are not as densely interconnected as they could be.

The low density of collaboration networks indicates that many institutions conduct research relatively independently, which can limit the sharing of ideas, resources, and methodologies. Increasing collaboration among institutions could significantly enhance the quality and impact of research in flipped learning. Collaborative efforts can lead to the pooling of diverse expertise, fostering

innovation and comprehensive research outcomes. Furthermore, it can help standardize research methodologies and practices, leading to more robust and generalizable findings.

To gain a deeper understanding of the collaboration dynamics among institutions in flipped classroom research, identifying the most productive universities is essential. As Table 3 indicates, leading institutions in terms of publication output include the University of Hong Kong, the Polytechnic University of Madrid, the National Taiwan University of Science and Technology, Baldwin University, National Chung Hsing University, and the University of North Carolina. While these universities demonstrate a commendable level of research productivity, the depth of their collaborative interactions varies. Some engage in extensive collaborations, including international partnerships, yet many of these collaborations are not deeply integrated.

Figure 3: Institution Network

Table 3: Institution Network Top10

Rank	Frequency	Year	Institution
1	10	2018	University of Hong Kong
2	4	2017	Universidad Politecnica de Madrid
3	4	2019	National Taiwan University of Science & Technology
4	3	2018	Bartin University
5	3	2019	National Chin-Yi University of Technology
6	2	2014	University of North Carolina
7	2	2022	National Cheng Kung University
8	2	2019	Universidad de Extremadura
9	2	2018	Islamic Azad University
10	2	2017	Universidad de Alcala

4.2.3 Author Network

In any research area, core authors are pivotal in contributing to the development of theories and knowledge within their discipline (Chen & Song, 2019). Analyzing their cooperation network is essential to understand the dynamics of the field. Utilizing CiteSpace software and selecting the "author" node to create a visual knowledge map allows for an effective analysis of these networks. This approach has led to the development of a cooperation network map (Figure 4) for the past decade, focusing on the research topic of student engagement in flipped learning. Additionally, a statistical table (Table 4) has been created, listing the top ten authors by publication volume. The number and thickness of the lines in the map indicate the relationships and collaboration strengths among these authors.

Table 4: Cooperating Authors Top 10

Rank	Author	Frequency	Year
1	Hew, Khe Foon	6	2018
2	Hwang, Gwo-Jen	3	2020
3	Hsia, Lu-Ho	2	2020
4	Hopcan, Sinan	2	2022
5	Gonzalez-gomez, David	2	2019
6	Eichler, Jack F	2	2016
7	Lai, Hui-Min	2	2021
8	Castedo, Ricardo	2	2019
9	Chiquito, Maria	2	2019
10	Polat, Elif	2	2022

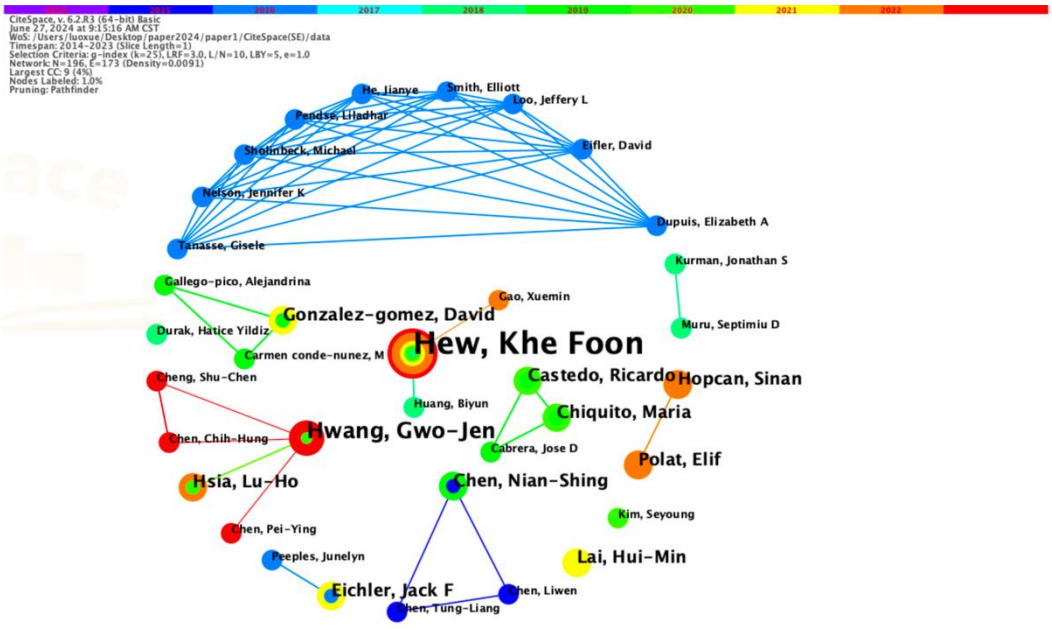

Figure 4: Visualization of Author Network

Figure 4 presents the academic collaboration network in this field, with a network density of 0.0091, signifying a moderate level of collaboration intensity. In this network, the substantial contributions of Hew, Khe Foon, and his team, along with Guo-Ren Huang, are evident. Table 4 shows their respective teams' publication outputs, with six and three papers. However, the relatively lower number of publications by other authors suggests a dispersed and somewhat isolated research landscape. This indicates that while there are leading contributors in the field, there remains considerable potential for wider collaboration and knowledge exchange. There is a clear need to promote interdisciplinary cooperation and to strengthen the connectivity within the research network.

Addressing this requires fostering environments conducive to collaborative research. Initiatives such as collaborative research grants, joint academic conferences, and interdisciplinary research forums can be instrumental in bridging existing gaps. Creating platforms for sharing methodologies, findings, and data can also enhance the cohesiveness and productivity of the research community in this field. Such efforts can lead to a more interconnected network, spurring innovative approaches and a more comprehensive understanding of student engagement in flipped learning environments.

4.3 Cited Reference Analysis

4.3.1. Literature Co-citation

Figure 5 illustrates the co-citation analysis, which provides critical insights into the intellectual structure and evolution of research in flipped learning. By examining the frequency with which pairs of documents are cited together, co-citation analysis identifies influential works and emerging trends within the field. The results highlight several key developments:

Firstly, the co-citation analysis identifies seminal papers that have shaped the foundational theories and methodologies of flipped learning. For instance, Abeysekera and Dawson's work (Abeysekera & Dawson, 2015) is frequently co-cited, indicating its pivotal role in establishing the flipped learning framework. Secondly, the evolution of research focus over time is evident through the co-citation clusters. Early research primarily concentrated on the basic implementation and benefits of flipped learning (Chen Hsieh et al., 2017; Lo & Hew, 2017), while recent studies delve into its impact on student engagement and learning outcomes (Wang & Jou, 2023; Zhou, 2023).

Additionally, the co-citation network (Figure 5) illustrates the interdisciplinary nature of flipped learning research, incorporating insights from educational technology, pedagogy, and cognitive psychology (Lundin et al., 2018; Shi et al., 2020). This interdisciplinary approach enriches the theoretical foundations and practical applications of flipped learning. Finally, the temporal mapping of co-citation clusters (Figure 6) shows a transition from exploratory studies to more empirical and experimental research (Chang, 2023; Lo, 2023; Lo & Hew, 2021),

reflecting the maturation of the field and the establishment of evidence-based practices.

The top-cited articles（Table 5） highlight the foundational and influential works in the flipped learning research field. For example, O'Flaherty and Phillips (2015) provided a comprehensive review of flipped learning in higher education, which is crucial for understanding the broader context and implications of this teaching approach. Similarly, the work by Abeysekera and Dawson (2015) focused on motivation and cognitive load, which are essential factors in the effectiveness of flipped learning models. These highly cited papers have significantly shaped the direction and focus of subsequent research.

Table 5: Top 10 Most Cited Articles

Rank	Journal	Articles	Authors	Co-citation intensity	Years
1	The Internet and Higher Education	The use of flipped learning in higher education: A scoping review	O'Flaherty, Jacqueline and Phillips, Craig	33	2015
2	Higher Education Research & Development	Motivation and cognitive load in the flipped learning: definition, rationale and a call for research	Abeysekera, Lakmal and Phillip, Dawson	23	2015
3	Computers & Education	The flipped learning: A review of its advantages and challenges	Akçayır, Gökçe and Murat, Akçayır	22	2018
4	Journal of Nutrition Education And Behavior	Enhancing Student Engagement Using the Flipped learning	Gilboy, Mary Beth et al.	20	2015
5	Computer Assisted Language Learning	Flipping the classroom for English language learners to foster active learning	Hung, Hsiu-Ting	18	2015
6	The Internet and Higher Education	The experience of three flipped classrooms in an urban university: an exploration of design principles	Kim, Min Kyu et al.	16	2014
7	Academic Medicine	The flipped learning: a course redesign to foster learning and engagement in a health professions school	McLaughlin, JE et al.	16	2014

8	Business Education & Accreditation	Student Views on the Use of Lecture Time and their Experience with a Flipped Learning Approach: Evidence from Australia	Butt, Adam	14	2014
9	Psychological and Cognitive Sciences	Active learning increases student performance in Science, Engineering, and Mathematics	Freeman, Scott et al.	14	2014
10	Computers & Education	Is FLIP enough? Or should we use the FLIPPED model instead?	Chen, Yung Lung et al.	13	2014

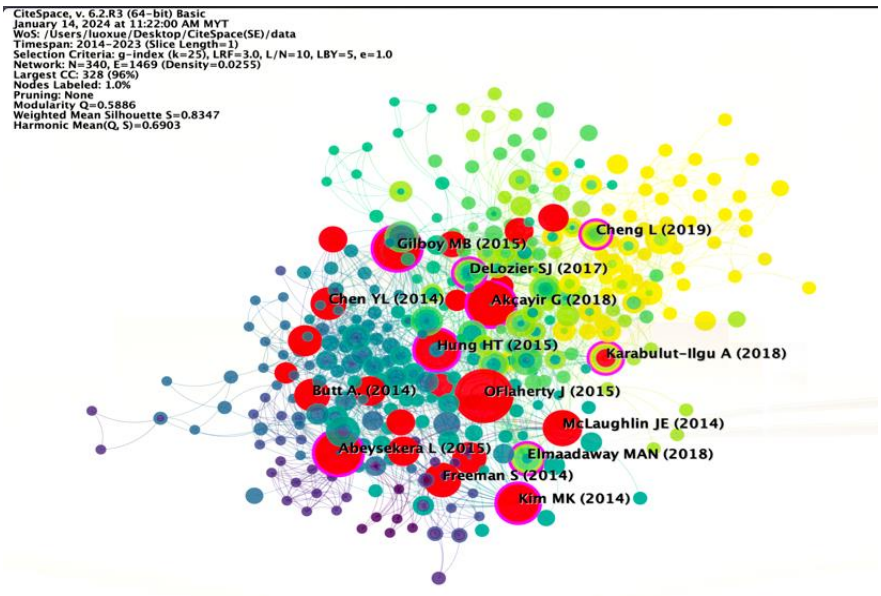

Figure 5: Literature Co-citation

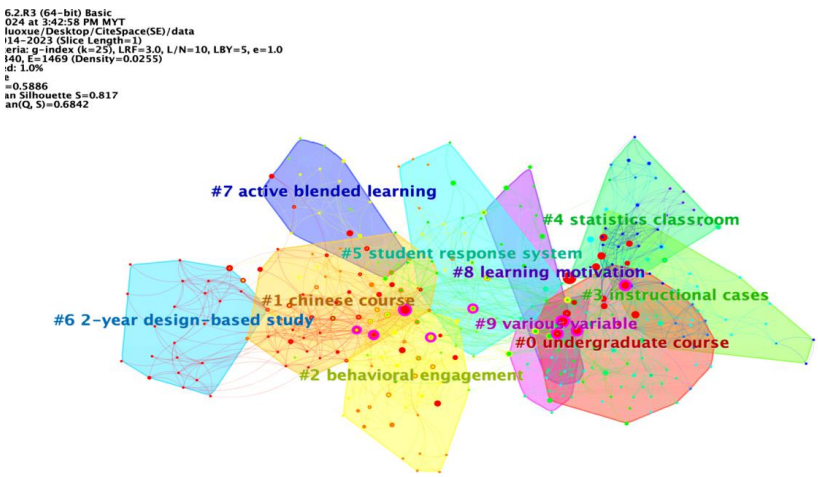

Figure 6: Cluster of Cited References

Co-citation analysis (Figure 5) identifies seminal papers and emerging trends within flipped learning. Frequently co-cited works, such as those by Abeysekera and Dawson (2015), highlight foundational theories and methodologies. The evolution of research focus over time is evident through co-citation clusters, with early research concentrating on implementation and benefits, and recent studies exploring impacts on student engagement and outcomes. The interdisciplinary nature of flipped learning research, incorporating educational technology, pedagogy, and cognitive psychology, enriches its theoretical foundations and practical applications. Temporal mapping of co-citation clusters (Figure 6) shows a transition from exploratory studies to empirical and experimental research (Table 6).

Table 6: Detail of Cited Reference Clusters

Rank	Size	Silhouette	Years	Label (LLR)
1	61	0.743	2014	Undergraduate course; female Middle-Eastern management student; comparative analysis; flipped online; traditional teaching
2	59	0.773	2019	Chinese course; enhancing behavioral engagement; motivational design; social anxiety; structural equational modeling
3	38	0.879	2018	Behavioral engagement; learning context; university student; sustainable learning; academic commitment
4	36	0.866	2013	Instructional cases; academic librarian; information literacy; online behaviour engagement; learning management system
5	27	0.931	2013	Statistics classroom; nursing education; active learning; general chemistry courses; low barrier approach
6	27	0.782	2017	Student response system; English grammar learning; foreign language; introductory course; digital system
7	24	0.883	2020	Learning outcome; 2-year design-based study; nursing undergraduate; historical control study; student achievement
8	18	0.903	2017	Active blended learning; learning preference; engagement level; nutrition education; descriptive cohort study
9	17	0.921	2015	Learning motivation; classroom teaching method; cooperative learning model; own device; knowledge skill
10	14	0.874	2015	Various variable; learning readiness; middle school; teaching programing; off-class activity completion

4.3.2 Journal Co-citation

Journal co-citation analysis (Figure 7) highlights key academic exchange platforms in flipped learning research. Prominent journals like "Computers & Education" and "The Internet and Higher Education" are highly cited, marking them as leading publications in educational technology and teaching method innovations. This analysis aids researchers in choosing suitable publication venues and shaping their research frameworks.

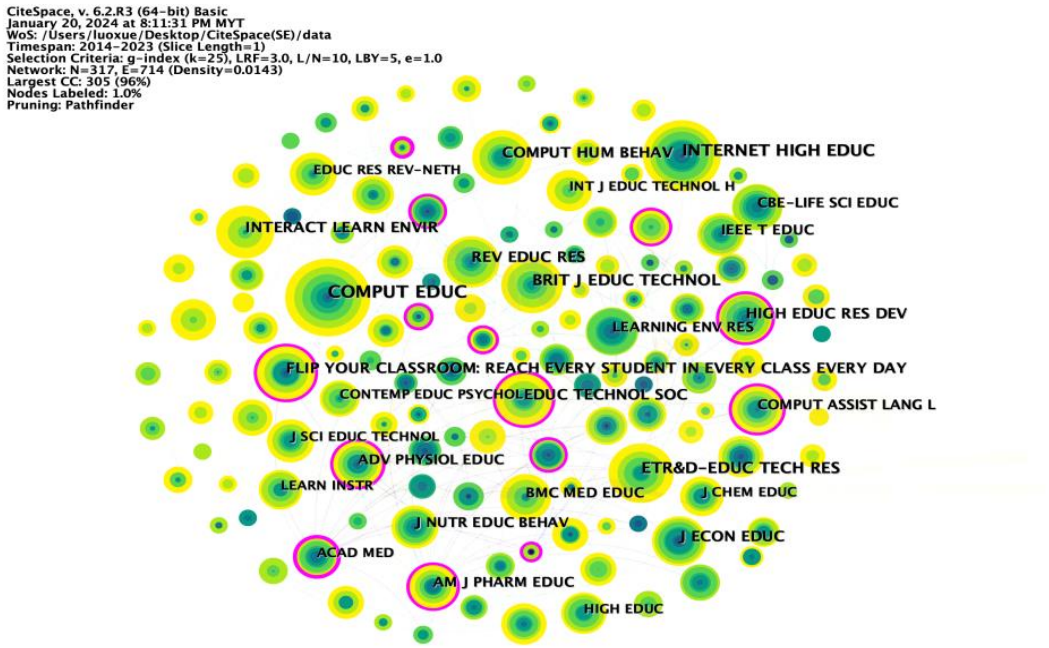

Figure 7: Journal Co-citation

For educators, this analysis is crucial, pointing to major journals that feature significant research and innovative practices in flipped learning and educational technology. This information is invaluable for staying updated on field advancements and ensuring the application of the most current and effective educational strategies. Access to these key journals enables both researchers and practitioners to engage with and contribute to the evolving landscape of flipped learning methodologies and student engagement approaches.

Table 7 showcases the prominence of journals such as "Computers & Education" and "The Internet and Higher Education" in the field of flipped learning. These publications, known for their authority in e-learning, educational technology, and internet-based educational models, play a central role in academic discourse and are instrumental in presenting educational innovations and research findings. The journal co-citation analysis helps researchers and educators pinpoint these key journals, which are influential in shaping academic trends and developments in flipped learning. This analysis serves as a valuable resource, offering essential references for enhancing educational practices and research in the field.

Table 7: Top 10 Most Cited Journals

Rank	Journal	Citation frequency	Years
1	Computers & Education	97	2015
2	The Internet and Higher Education	85	2015
3	Educational Technology Research and Development	66	2015
4	British Journal of Educational Technology	61	2015
5	Flip Your Classroom: Reach Every Student in Every Class Every Day	54	2014
6	Computers in Human Behavior	53	2017
7	Educational Technology & Society	52	2015
8	Review of Educational Research	47	2017
9	Interactive Learning Environments	47	2019
10	The Journal of Economic Education	44	2014

Figure 8 shows cases of the top 20 journals with the most significant citation bursts in the study of student engagement within flipped learning. Citation bursts represent a notable increase in citations of articles from a specific journal over a certain period (Chen et al., 2012). The "Journal of Computer Science in Teaching" demonstrated the strongest burst from 2015 to 2018, indicating intense exploration in combining flipped learning with computer science education during this period. Additionally, journals such as "Business Education & Accreditation" and "Educational Leadership" exhibited notable citation bursts between 2015 and 2020, reflecting the increased relevance of business education and educational leadership in the context of flipped learning models.

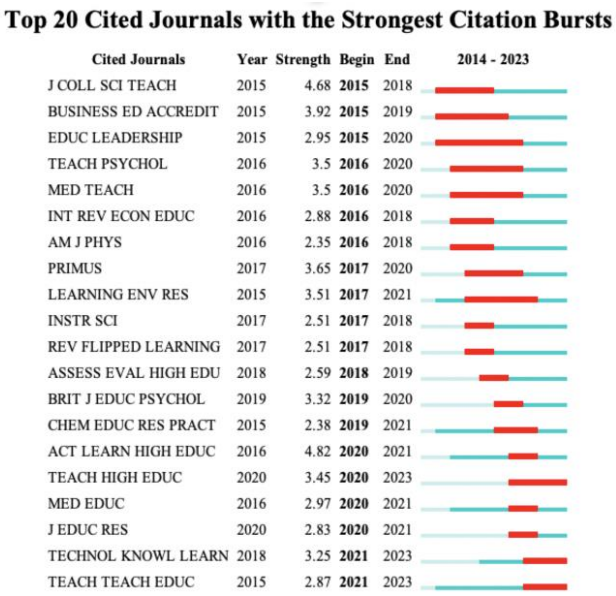

Figure 8: Journal Citation Burst Top 20

4.5 Research Hotspots

4.5.1 Keyword Co-occurrence

The keyword co-occurrence and clustering analysis (Figure 9) provide valuable insights into the prevailing themes and research priorities in flipped learning. By identifying frequently co-occurring keywords, we can discern the main topics and emerging trends within the field.

Keywords such as "student engagement," "active learning," and "blended learning" are central to flipped learning research, indicating a focus on enhancing student involvement and integrating instructional strategies to improve learning outcomes (Lo & Hew, 2020). Clusters around "digital tools," "self-regulation," and "collaborative learning" reflect a growing interest in technology's role and self-directed learning (Adhami & Taghizadeh, 2024; Esteban, 2024).

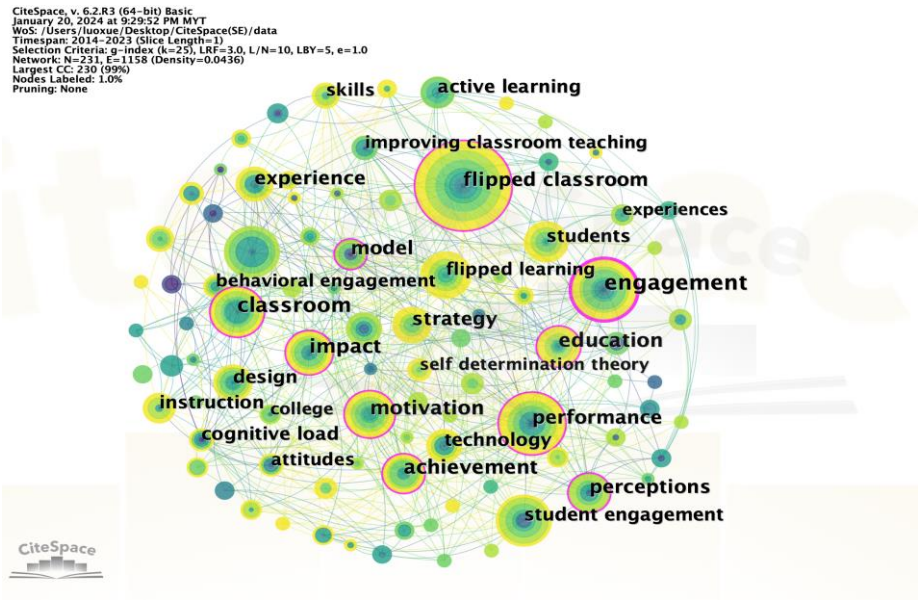

Figure 9: Keyword Co-occurrence

Temporal analysis of keyword clusters (Figure 10) shows a shift from basic implementation to nuanced studies on student engagement's cognitive and emotional aspects (Sointu et al., 2023). Recent studies emphasize these holistic benefits (Bond, 2020). The clustering analysis also identifies research gaps, such as the long-term effects and scalability of flipped learning, indicating the need for comprehensive studies on its efficacy and sustainability.

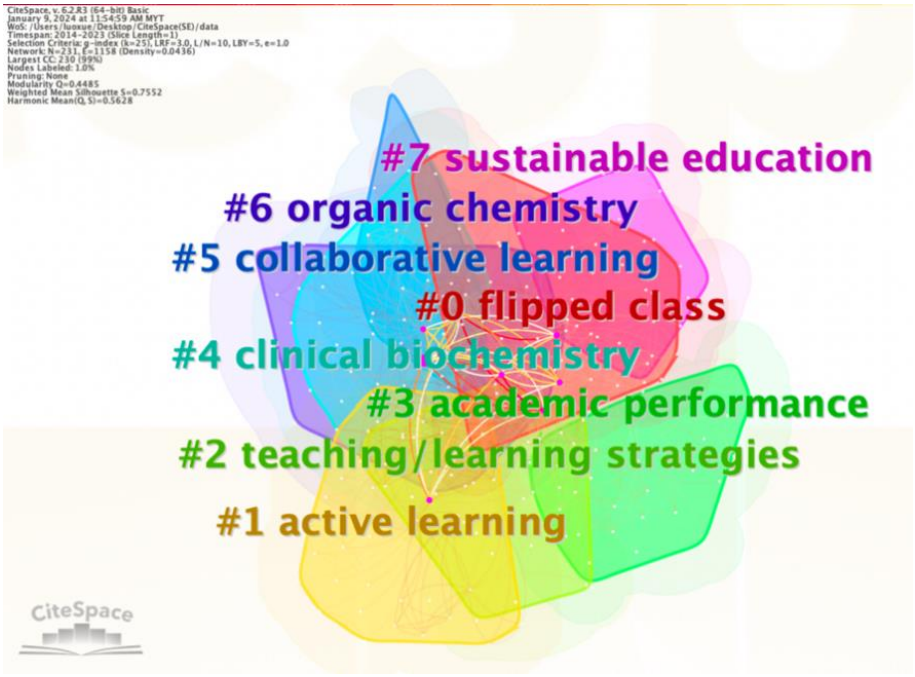

Figure 10: Keyword co-occurrence clusters

The keyword co-occurrence cluster chart in Figure 10 delineates five predominant thematic clusters within the domain of flipped learning research, elucidating a spectrum of diverse investigative pursuits across various scholarly dimensions. For instance, the focus on "student engagement" and "learning motivation" investigates the enhancement of student engagement and motivation through flipped learning (Du et al., 2023). Similarly, research centered on "teaching effectiveness" and "learning engagement" delves into the impact of flipped learning on learning outcomes and student achievement (Zainuddin, 2018). Studies concentrating on "flipped learning" and "practical experience" explore the innovative applications and practical challenges in flipped learning (Chiu, 2023; Elmaadaway, 2018). Investigations revolving around "higher education" and "educational environment" examine flipped learning's adaptability and optimization in higher education settings (Al-Samarraie et al., 2020; McNally et al., 2017). Additionally, research focusing on "flipped learning models" and "educational technology" assesses various teaching models and technology integration (Blau & Shamir-Inbal, 2017; Comber & Brady-Van den Bos, 2018; Lai et al., 2021).

These thematic clusters demonstrate the field's diversity and interdisciplinary nature, providing a robust academic base for further research. This comprehensive framework enables the exploration of topics ranging from instructional strategy efficacy to technology integration in educational settings, guiding the development of more effective and engaging flipped learning practices.

Table 8 highlights key terms in flipped learning and student engagement. "flipped learning" is notably prominent, with a high citation frequency (76) and centrality

index (0.15), confirming its central role in research. "performance" and "engagement" are also significant, with citation frequencies of 39 and 37 and centrality indexes of 0.16 and 0.25, respectively, emphasizing their connection to pedagogy effectiveness and student participation. These terms, along with others, define critical research directions and underscore flipped learning's effectiveness in enhancing engagement and outcomes.

Table 8: High Frequency Keywords

Rank	Keyword	Frequency	Centrality	Year
1	flipped learning	76	0.15	2017
2	performance	39	0.16	2015
3	engagement	37	0.25	2015
4	classroom	27	0.18	2015
5	student engagement	27	0.09	2014
6	higher education	27	0.02	2017
7	flipped learning	23	0.1	2017
8	motivation	21	0.15	2018
9	impact	20	0.14	2016
10	education	18	0.14	2017

Keyword clustering analysis elucidates the thematic concentrations within a research domain. Figure 10, depicting the keyword clustering related to student engagement in flipped learning, reveals discernible academic pursuits in this educational innovation. The data demonstrates a robust centrality for "flipped learning" (cited 76 times, centrality of 0.15), accentuating its significance within the scholarly landscape of pedagogical methodologies. Successively, "performance" (cited 39 times, centrality of 0.16) and "engagement" (cited 37 times, centrality of 0.25) are prominent, reflecting their interconnectedness with measures of educational outcomes and student involvement within this educational framework.

Table 9 shows the occurrence and frequency of keywords in 10 clusters from 2017 to 2020, indicating a consistent academic focus on certain themes. The "Active Learning" cluster emphasizes the importance of student engagement, higher education, and flipped learning, reflecting deep investigation into participative learning environments' effectiveness in higher education. A modularity Q value greater than 0.3 indicates a significant clustering structure (Chen, 2006). The clusters' modularity Q (0.4485) and average silhouette (0.7552) values demonstrate clear structure and consistency, signifying focused academic discussions on flipped learning's impact on student engagement and outcomes. This indicates that research in flipped learning is centered on active learning strategies, evaluating student and teacher experiences, and integrating technology and design strategies to enhance teaching and learning outcomes.

Table 9: Details of Keyword Clusters

Rank	Size	Silhouette	Year	Label (LLR)
1	34	0.785	2019	Augmented reality; game-based learning; creative thinking; English vocabulary acquisition; behavioral engagement; cooperative learning; learning behavior engagement; empirical study; college English; behavioral engagement
2	34	0.78	2018	Active learning; digital systems; student perception; logic functions; digital circuits | distance education; improving classroom teaching; online learning; data science applications; capstone design course
3	30	0.752	2019	Learning strategies; improving classroom teaching; pedagogical issues; motivational model; student engagement; transformative learning; active learning; reflective learning; sustainable development
4	30	0.627	2019	Academic performance; artificial intelligence; music education; intelligent learning systems; partial least squares; behavioral engagement; education setting; cognitive engagement; teaching strategies; student learning
5	27	0.716	2019	Virtual simulation platform; clinical biochemistry; practical course; inverted methodology; education; motivation; video; feedback; skills
6	24	0.79	2019	Collaborative learning; capstone design course; learning strategies; virtual reality; grammar; student engagement; k-12 education; student learning outcome; student motivation; teaching time
7	20	0.772	2017	Student-centered learning; organic chemistry; computer-based learning; second-year undergraduate; web-based learning; cognitive load; conference; model; lecture; implementation
8	19	0.76	2018	Student perception; comparative study; face-to-face learning; student performance assessment; online learning; sustainable education; transformative learning; course evaluation; inverted classroom; motivational model
9	9	0.887	2019	Engagement; taxonomy; technology; performance; model; academic achievement; control-value theory; behavioral engagement; engagement; learners
10	3	0.99	2020	Upper-division undergraduate; curriculum; distance learning; self-instruction; non-major courses

Using CiteSpace's "Burstness" feature (Chen et al., 2012), this study analyzes the top 18 keywords in Figure 11 to demonstrate their shifts in attention over time. The figure indicates that while the overall burst strength of keywords is

significant, the differences among them are not substantial, suggesting that various themes in flipped learning received similar attention. Keywords like "Organic Chemistry," "Lecture," and "Model" gained increased attention in 2015, peaking in 2016–2017, but then rapidly declined. This trend highlights that themes such as "Organic Chemistry" drew significant interest regarding their adaptability to flipped learning, whereas foundational concepts like "Lecture" and "Model" appeared early but had a shorter span of sustained attention. The burst intensity of these keywords reflects the academic community's enthusiasm and ongoing efforts in exploring student engagement in flipped learning.

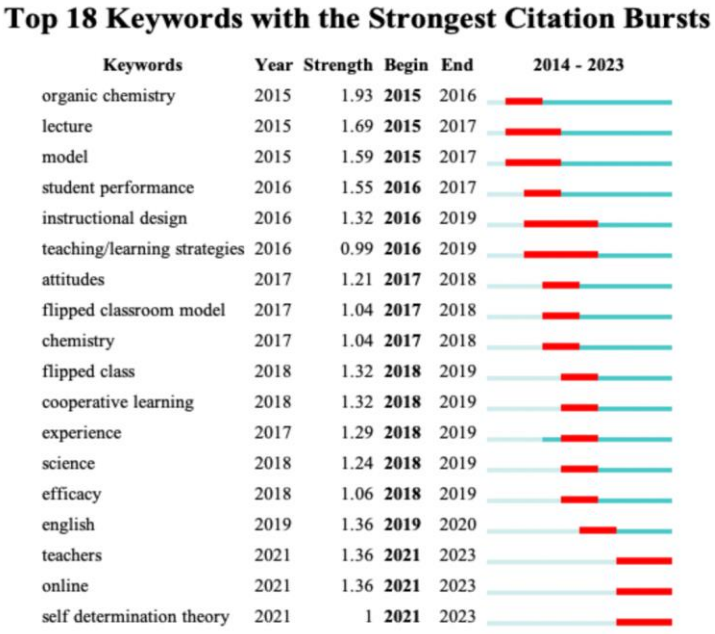

Figure 11: Keyword Burst

The keyword timeline (Figure 12) outlines the evolution of research on student engagement within flipped learning models. From 2014, research initially focused on "flipped class," "active learning," and "student engagement," transitioning to cognitive load and motivation studies between 2017 and 2018. Post-2019, "gamification" and "collaborative learning" emerged, indicative of integrating interactive and group learning strategies, responding to demands for remote education spurred by the COVID-19 pandemic. This historical timeline provides a narrative of changing research interests and the redefinition of educational strategies in flipped learning.

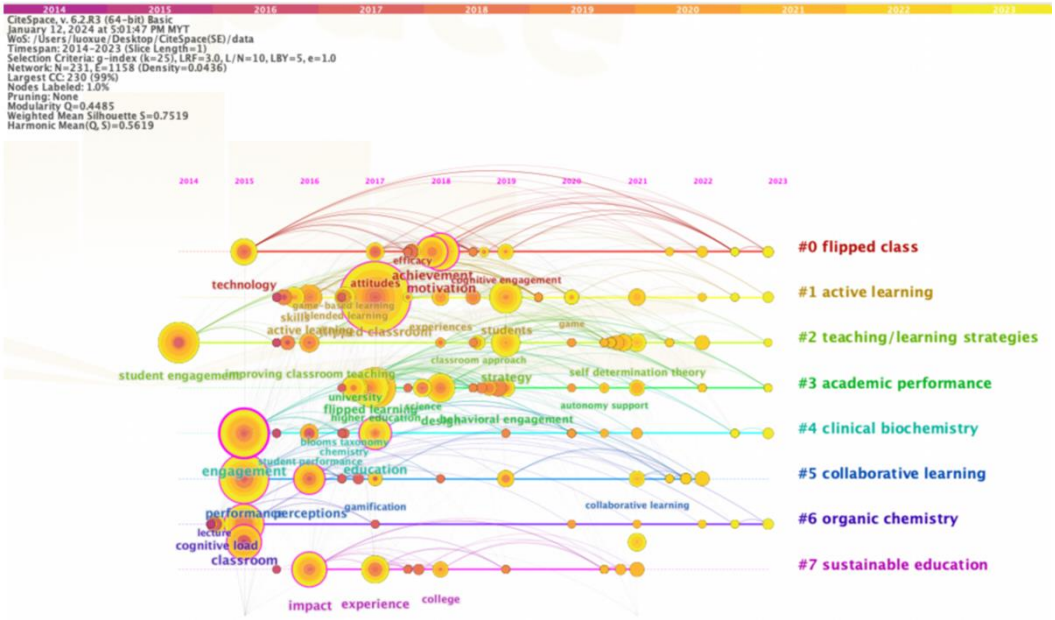

Figure 12: Keyword Timeline

5. Discussion and Implications

5.1 Discussion

This study used the CiteSpace tool to analyze central themes and trends in student engagement within flipped learning models from 2014 to 2023. By examining literature from the Social Sciences Citation Index (SSCI) database, the research aimed to uncover key themes and collaborative networks in student engagement in flipped learning. This method provides insights into the evolving dynamics of this field and highlights significant scholarly contributions.

5.1.1 Core Themes and Trends

This study expands on existing theories of student engagement and flipped learning, providing empirical evidence and identifying new research directions. It highlights the critical roles of student interaction, learning motivation, and educational technology in flipped learning environments. Increased interaction in flipped classrooms correlates positively with understanding and retention, aligning with social learning theories (Archambault et al., 2022; Gopinathan et al., 2022). Flipped learning also boosts intrinsic motivation by offering autonomy and engaging activities, as supported by the Self-Determination Theory (Ryan & Deci, 2020). Educational technology, such as video lectures and online quizzes, enhances cognitive engagement and flexible teaching methods (Jeong & Hmelo-Silver, 2016; Sugden et al., 2021). The co-citation analysis indicates that mainland China and the United States lead in flipped learning research, emphasizing the importance of geographical context in global educational practices (Dimmock, 2020).

5.1.2 Leading Contributors and Key Publications

Using the CiteSpace analytical tool, this study identified prominent scholars and institutions that have significantly influenced the discourse on flipped learning models, particularly focusing on student engagement. Over the last ten years, contributors such as the University of Hong Kong and scholars like Hew Khe Foon have been pivotal in advancing this field. Leading journals, notably "Computers & Education" and "The Internet and Higher Education," have played crucial roles in disseminating research findings that extend the boundaries of flipped learning practices. Despite high activity levels from certain researchers and institutions, the study's analysis of collaboration density suggests that there is substantial potential for increased collaborative efforts to enrich this area of academic study further.

5.1.3 Evolution of Collaboration Patterns

This study provides a detailed analysis of the shifts in research focus and collaborative patterns within the flipped learning domain, particularly regarding student engagement from 2014 to 2023. The data reveals a significant enhancement of international cooperation networks, with the collaboration between Mainland China and the United States standing out. This reflects the broader trend of globalization in educational research, emphasizing the vital role that cross-cultural and multi-disciplinary cooperation plays in propelling educational innovations.

Despite notable increases in collaboration in certain regions and among specific research teams, the overall network of inter-institutional collaborations remains relatively sparse. This finding suggests that while there has been significant progress in fostering international research ties, there remains considerable opportunity to expand and deepen these relationships (Chen, 2016). For instance, scholars like Carr and colleagues have suggested that interdisciplinary and international cooperation will become increasingly critical in future research (Carr et al., 2018). To this end, subsequent studies should aim to strengthen cross-institutional networks within flipped learning to enhance innovation and facilitate global knowledge sharing.

5.1.4 Shift in Research Focus

The study identifies a shift in research focus within student engagement in flipped learning, transitioning from theoretical foundations to practical applications. Initially, research concentrated on defining flipped learning and its theories (Birgili et al., 2021), while recent trends emphasize exploring students' experiences, cognitive adaptability, motivation, and learning outcomes in actual teaching scenarios (Lai et al., 2021; Terrenghi et al., 2019; White et al., 2017). This shift signifies a move towards empirical research and the practical implementation of flipped learning, aligning with the broader trend in educational research.

5.2. Implications

5.2.1 Theoretical Implications

By combining empirical findings with established theoretical frameworks such as the Self-Determination Theory and social learning theories, our research advances the understanding of how flipped learning environments foster different dimensions of student engagement. This integration provides a nuanced view of the relationship between flipped learning and student motivation, interaction, and cognitive engagement. The co-citation analysis underscores the leading roles of China and the United States in the research on flipped learning. This highlights the importance of cultural and educational contexts in shaping research outputs and strategies for student engagement. Understanding these geographical dynamics can inform the global application of flipped learning practices (Bishop & Verleger, 2013; Huang et al., 2019)(Huang & Bishop & Verleger, 2013). These insights contribute to the theoretical discourse by offering a global perspective on how diverse educational settings adopt and benefit from flipped learning models.

5.2.2 Practical Implications

The findings of this study offer practical recommendations for educators and policymakers aiming to enhance the implementation and impact of flipped learning. Effective integration of educational technology and the promotion of student autonomy is critical for maximizing the benefits of flipped learning. This study suggests that leveraging digital tools and encouraging self-regulated learning can significantly enhance student engagement and learning outcomes. Ongoing professional development for educators is essential to adapt to evolving instructional methods and technologies. Providing teachers with the necessary training and support can foster more engaging and productive learning environments (Lo & Hew, 2020). Additionally, increasing collaboration among institutions is vital for advancing research in flipped learning. Collaborative efforts can lead to the pooling of diverse expertise, fostering innovation and comprehensive research outcomes (Beck et al., 2022). Establishing collaborative research grants, organizing joint academic conferences, and creating online platforms for sharing data and methodologies are key strategies to foster stronger networks and enhance the quality and impact of research. This research uniquely contributes by offering a detailed bibliometric analysis that identifies key research trends and hotspots in flipped learning. By highlighting the roles of collaboration and geographical influence, the study provides new perspectives on the dynamics of educational research and practice. Integrating empirical data with theoretical frameworks advances our understanding of how flipped learning impacts student engagement and educational outcomes. These insights are invaluable for designing effective flipped learning environments and guiding future research directions.

5.3 Limitations and Future Research Directions

5.3.1 Limitations

This study contributes valuable insights into student engagement in flipped learning, yet it has certain limitations. Firstly, the research primarily relies on

literature from the Social Sciences Citation Index (SSCI) database. While SSCI encompasses a wide range of high-quality academic articles, it does not cover all relevant research in the field. Secondly, covering the period from 2014 to 2023, the study might not fully capture the most recent trends and developments in the field. Thirdly, despite involving international collaboration, the study may not fully represent the diversity of flipped learning across different cultures and educational systems. Lastly, while quantitative methods were employed to ensure data objectivity and replicability, this approach limits a deeper qualitative understanding of student engagement in flipped learning, particularly in terms of individual experiences and deeper motivational aspects.

5.3.2 Future Research Direction

Future research should investigate principals' strategies, resource provision, policy formulation, and professional growth support for teachers in flipped learning (Alias et al., 2020). Practical evaluation of flipped learning across disciplines and levels, particularly for students with diverse needs, is necessary (Yan et al., 2023). Examining international research networks and cross-cultural collaboration in flipped learning is crucial (Lawter & Garnjost, 2021)(Kumi-Yeboah & Amponsah, 2023). Comparative studies on the adaptability and effectiveness of flipped learning in different cultural contexts can help tailor teaching strategies (Aguilar-Cruz & Xiang, 2023). Exploring educational leadership in technology integration, drawing on findings from the COVID-19 pandemic, can also provide valuable insights (Hamzah et al., 2021).

6. Conclusion

This study provides a detailed examination of student engagement in flipped learning environments through a comprehensive bibliometric and visualization analysis. Using CiteSpace to map the intellectual landscape, it identified key trends and hotspots, revealing hidden patterns and relationships within the literature. Critical themes such as student interaction, learning motivation, and educational technology were highlighted, emphasizing the importance of effective technology integration and promoting student autonomy. These insights are invaluable for educators and policymakers aiming to enhance student engagement in flipped learning environments.

The study underscores the significance of collaboration and geographical influences in shaping research in this field. The active roles of China and the United States illustrate the impact of cultural and educational contexts on research outputs and strategies. Stronger cross-institutional and cross-cultural cooperation can build robust networks, enhancing the quality and impact of research. Contributions from diverse cultural contexts enrich the understanding and implementation of flipped learning models, emphasizing the need for tailored approaches to various educational settings.

Furthermore, this research integrates empirical findings with theoretical frameworks grounded in constructivist and engagement theories. It reaffirms the importance of student engagement through behavioral, emotional, and cognitive

dimensions, aligning with Bloom's taxonomy and active learning principles. By reallocating in-class time for active learning exercises, flipped learning significantly enhances cognitive engagement and critical thinking (Howell, 2021; Oliván-Blázquez et al., 2023). The validity and reliability of the findings were ensured through rigorous methodologies, including co-citation analysis and burst detection (Huang et al., 2023; Trujillo & Long, 2018). This comprehensive approach provides a deeper understanding of the complexities and potential of flipped learning environments, guiding future studies and informing practical applications in education.

7. Acknowledgments

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8. References

Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research & Development*, *34*(1), 1-14. https://doi.org/10.1080/07294360.2014.934336

Adhami, N., & Taghizadeh, M. (2024). Integrating inquiry-based learning and computer supported collaborative learning into flipped classroom: Effects on academic writing performance and perceptions of students of railway engineering. *Computer Assisted Language Learning*, *37*(3), 521-557. https://doi.org/10.1080/09588221.2022.2046107

Aguilar-Cruz, P. J., & Xiang, Z. P. (2023). Online Collaborative Learning: Connecting Classrooms Between China and Colombia in pandemic times [Article]. *Academia Y Virtualidad*, *16*(1), 91-105. https://doi.org/10.18359/ravi.5929

Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education*, *126*, 334-345. https://doi.org/10.1016/j.compedu.2018.07.021

Al Mamun, M. A., Azad, M. A. K., Al Mamun, M. A., & Boyle, M. (2022). Review of flipped learning in engineering education: Scientific mapping and research horizon. *Education and Information Technologies*, *27*, 1261-1286. https://doi.org/10.1007/s10639-021-10630-z

Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: a review of the evidence across disciplines. *Educational Technology Research and Development*, *68*(3), 1017-1051. https://doi.org/10.1007/s11423-019-09718-8

Alamri, H., Lowell, V., Watson, W., & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, *52*(3), 322-352. https://doi.org/10.1080/15391523.2020.1728449

Alias, B. S., Rashid, N. A., & Abdullah, S. N. (2020). Headmaster'S Practice and Teacher Readiness on Inclusive Education Programmes. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *17*(7), 10989-11004. https://archives.palarch.nl/index.php/jae/article/view/4363

Archambault, L., Leary, H., & Rice, K. (2022). Pillars of online pedagogy: A framework for teaching in online learning environments. *Educational psychologist*, *57*(3), 178-191. https://doi.org/10.1080/00461520.2022.2051513

Astin, A. W. (2014). Student involvement: A developmental theory for higher education. In *College student development and academic life* (pp. 251-262). Routledge. https://doi.org/10.4324/9781315051888-15

Beck, S., Bergenholtz, C., Bogers, M., Brasseur, T. M., Conradsen, M. L., Di Marco, D., Distel, A. P., Dobusch, L., Dörler, D., Effert, A., Fecher, B., Filiou, D., Frederiksen, L., Gillier, T., Grimpe, C., Gruber, M., Haeussler, C., Heigl, F., Hoisl, K., . . . Xu, S. M. (2022). The Open Innovation in Science research field: a collaborative conceptualisation approach [Article]. *Industry and Innovation*, *29*(2), 136-185. https://doi.org/10.1080/13662716.2020.1792274

Birgili, B., Seggie, F. N., & Oğuz, E. (2021). The trends and outcomes of flipped learning research between 2012 and 2018: A descriptive content analysis. *Journal of Computers in Education*, *8*(3), 365-394. https://doi.org/10.1007/s40692-021-00183-y

Birkle, C., Pendlebury, D. A., Schnell, J., & Adams, J. (2020). Web of Science as a data source for research on scientific and scholarly activity. *Quantitative Science Studies*, *1*(1), 363-376. https://doi.org/10.1162/qss_a_00018

Bishop, J., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. 2013 ASEE Annual Conference & Exposition,

Blau, I., & Shamir-Inbal, T. (2017). Re-designed flipped learning model in an academic course: The role of co-creation and co-regulation. *Computers & Education*, *115*, 69-81. https://doi.org/10.1016/j.compedu.2017.07.014

Bond, M. (2020). Facilitating student engagement through the flipped learning approach in K-12: A systematic review. *Computers & Education*, *151*, 103819. https://doi.org/10.1016/j.compedu.2020.103819

Borgonovi, F., Pokropek, M., & Pokropek, A. (2023). Relations between academic boredom, academic achievement, ICT use, and teacher enthusiasm among adolescents. *Computers & Education*, *200*, 104807. https://doi.org/10.1016/j.compedu.2023.104807

Bredow, C. A., Roehling, P. V., Knorp, A. J., & Sweet, A. M. (2021). To flip or not to flip? A meta-analysis of the efficacy of flipped learning in higher education. *Review of Educational research*, *91*(6), 878-918. https://journals.sagepub.com/doi/10.3102/00346543211019122

Campillo-Ferrer, J. M., & Miralles-Martínez, P. (2021). Effectiveness of the flipped classroom model on students' self-reported motivation and learning during the COVID-19 pandemic. *Humanities and Social Sciences Communications*, *8*(1), 1-9. https://doi.org/10.1057/s41599-021-00860-4

Carr, G., Loucks, D. P., & Blöschl, G. (2018). Gaining insight into interdisciplinary research and education programmes: A framework for evaluation. *Research Policy*, *47*(1), 35-48. https://doi.org/10.1016/j.respol.2017.09.010

Chang, D. Y.-S. (2023). Flipping EFL low-proficiency students' learning: An empirical study. *Language Teaching Research*, 13621688231165474. https://doi.org/10.1177/13621688231165474

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for information Science and Technology*, *57*(3), 359-377. https://doi.org/10.1002/asi.20317

Chen, C. (2016). *CiteSpace: a practical guide for mapping scientific literature*. Nova Science Publishers Hauppauge, NY, USA.

Chen, C., Hu, Z., Liu, S., & Tseng, H. (2012). Emerging trends in regenerative medicine: a scientometric analysis in CiteSpace. *Expert opinion on biological therapy*, *12*(5), 593-608. https://doi.org/10.1517/14712598.2012.674507

Chen, C., & Song, M. (2019). Visualizing a field of research: A methodology of systematic scientometric reviews. *PloS one*, *14*(10), e0223994. https://doi.org/10.1371/journal.pone.0223994

Chen Hsieh, J. S., Wu, W.-C. V., & Marek, M. W. (2017). Using the flipped classroom to enhance EFL learning. *Computer Assisted Language Learning*, *30*(1-2), 1-21. https://doi.org/10.1080/09588221.2015.1111910

China, M. o. E. o. (2018). *Accelerating Integration and Innovative Development Making Education Informatisation 2.0 a Reality*. Ministry of Education of China. http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/moe_1485/201804/t20180424_334116.html

Chiu, T. K. (2023). Student engagement in K-12 online learning amid COVID-19: A qualitative approach from a self-determination theory perspective. *Interactive Learning Environments*, *31*(6), 3326-3339. https://doi.org/10.1080/10494820.2021.1926289

Comber, D. P. M., & Brady-Van den Bos, M. (2018). Too much, too soon? A critical investigation into factors that make Flipped Classrooms effective. *HIGHER EDUCATION RESEARCH & DEVELOPMENT*, *37*(4), 683-697. https://doi.org/10.1080/07294360.2018.1455642

Dimmock, C. (2020). Connecting research and knowledge on educational leadership in the West and Asia: Adopting a cross-cultural comparative perspective. *Comparative Education*, *56*(2), 257-277. https://doi.org/10.1080/03050068.2019.1703393

Du, J. R., Chen, X. Y., Wang, T., Zhao, J. J., & Li, K. (2023). The effectiveness of the fully online flipped classroom for nursing undergraduates during the COVID-19: Historical control study. *NURSING OPEN*, *10*(8), 5766-5776. https://doi.org/10.1002/nop2.1757

Elmaadaway, M. A. N. (2018). The effects of a flipped classroom approach on class engagement and skill performance in a blackboard course. *British Journal of Educational Technology*, *49*(3), 479-491. https://doi.org/10.1111/bjet.12553

Esteban, A. J. (2024). Theories, Principles, and Game Elements that Support Digital Game-Based Language Learning (DGBLL): A Systematic Review. *International Journal of Learning, Teaching and Educational Research*, *23*(3), 1-22. https://doi.org/10.26803/ijlter.23.3.1

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational research*, *74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Giuliano, C. A., & Moser, L. R. (2016). Evaluation of a Flipped Drug Literature Evaluation Course. *AMERICAN JOURNAL OF PHARMACEUTICAL EDUCATION*, *80*(4), Article 66. https://doi.org/10.5688/ajpe80466

Gopinathan, S., Kaur, A. H., Veeraya, S., & Raman, M. (2022). The role of digital collaboration in student engagement towards enhancing student participation during COVID-19. *Sustainability*, *14*(11), 6844. https://doi.org/10.3390/su14116844

Hamzah, N. H., Nasir, M. K. M., & Wahab, J. A. (2021). The Effects of Principals' Digital Leadership on Teachers' Digital Teaching during the COVID-19 Pandemic in Malaysia. *Journal of Education and E-Learning Research*, *8*(2), 216-221. https://doi.org/10.20448/journal.509.2021.82.216.221

Howell, R. A. (2021). Engaging students in education for sustainable development: The benefits of active learning, reflective practices and flipped classroom pedagogies. *Journal of Cleaner Production*, *325*, 129318. https://doi.org/10.1016/j.jclepro.2021.129318

Huang, B., Hew, K. F., & Lo, C. K. (2019). Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive

engagement. *Interactive Learning Environments*, *27*(8), 1106-1126. https://doi.org/10.1080/10494820.2018.1495653

Huang, H., Jian, M., & Wu, X. (2023). Research hotspots and development trends of international learning cycle model: Bibliometric analysis based on CiteSpace. *Heliyon*. https://doi.org/10.1016/j.heliyon.2023.e22076

Hwang, G. J., & Chen, P. Y. (2023). Effects of a collective problem-solving promotion-based flipped classroom on students' learning performances and interactive patterns [Article]. *Interactive Learning Environments*, *31*(5), 2513-2528, Article 1568263. https://doi.org/10.1080/10494820.2019.1568263

Hwang, G. J., Yin, C. J., & Chu, H. C. (2019). The era of flipped learning: promoting active learning and higher order thinking with innovative flipped learning strategies and supporting systems [Editorial Material]. *Interactive Learning Environments*, *27*(8), 991-994. https://doi.org/10.1080/10494820.2019.1667150

Jeong, H., & Hmelo-Silver, C. E. (2016). Seven affordances of computer-supported collaborative learning: How to support collaborative learning? How can technologies help? *Educational psychologist*, *51*(2), 247-265. https://doi.org/10.1080/00461520.2016.1158654

Jia, C. Y., Hew, K. F., Jiahui, D., & Liuyufeng, L. (2023). Towards a fully online flipped classroom model to support student learning outcomes and engagement: A 2-year design-based study. *INTERNET AND HIGHER EDUCATION*, *56*, Article 100878. https://doi.org/10.1016/j.iheduc.2022.100878

Kazanidis, I., Pellas, N., Fotaris, P., & Tsinakos, A. (2019). Can the flipped classroom model improve students' academic performance and training satisfaction in Higher Education instructional media design courses? *British Journal of Educational Technology*, *50*(4), 2014-2027. https://doi.org/10.1111/bjet.12694

Kiljunen, J., Sointu, E., Äikäs, A., Valtonen, T., & Hirsto, L. (2023). Higher education and the flipped classroom approach: efficacy for students with a history of learning disabilities [Article; Early Access]. *Higher Education*, 17. https://doi.org/10.1007/s10734-023-01162-1

Koh, T., & Ahn, J. (2023). The Effects of Student-Engaged Video Lectures on Motivation for Sustainable Flipped Learning. *SUSTAINABILITY*, *15*(5), Article 4617. https://doi.org/10.3390/su15054617

Kurban, C. F. (2019). Designing effective, contemporary assessment on a flipped educational sciences course. *INTERACTIVE LEARNING ENVIRONMENTS*, *27*(8), 1143-1159. https://doi.org/10.1080/10494820.2018.1522650

Lai, H. M., Hsieh, P. J., Uden, L., & Yang, C. H. (2021). A multilevel investigation of factors influencing university students' behavioral engagement in flipped classrooms. *COMPUTERS & EDUCATION*, *175*, Article 104318. https://doi.org/10.1016/j.compedu.2021.104318

Lawter, L., & Garnjost, P. (2021). Cross-Cultural comparison of digital natives in flipped classrooms [Article]. *International Journal of Management Education*, *19*(3), 10, Article 100559. https://doi.org/10.1016/j.ijme.2021.100559

Lee, J., & Choi, H. (2017). What affects learner's higher-order thinking in technology-enhanced learning environments? The effects of learner factors. *Computers & Education*, *115*, 143-152. https://doi.org/10.1016/j.compedu.2017.06.015

Li, K., Rollins, J., & Yan, E. (2018). Web of Science use in published research and review papers 1997-2017: a selective, dynamic, cross-domain, content-based analysis. *Scientometrics*, *115*(1), 1-20. https://doi.org/10.1007/s11192-017-2622-5

Li, W., Huang, J.-Y., Liu, C.-Y., Tseng, J. C., & Wang, S.-P. (2023). A study on the relationship between student'learning engagements and higher-order thinking skills in programming learning. *Thinking Skills and Creativity*, *49*, 101369. https://doi.org/10.1016/j.tsc.2023.101369

Lin, Y. T. (2023). Learning Performances towards the BookRoll E-Book System for Flipped Classrooms in Software Engineering Education. *EDUCATIONAL TECHNOLOGY & SOCIETY*, *26*(3), 190-202. https://doi.org/10.30191/ETS.202307_26(3).0014

Liu, D., & Zhang, H. (2022). Improving students' higher order thinking skills and achievement using WeChat based flipped classroom in higher education. *Education and Information Technologies*, *27*(5), 7281-7302. https://doi.org/10.1007/s10639-022-10922-y

Lo, C. K. (2023). Strategies for enhancing online flipped learning: A systematic review of empirical studies during the COVID-19 pandemic. *Interactive Learning Environments*, 1-29. https://doi.org/10.1080/10494820.2023.2184392

Lo, C. K., & Hew, K. F. (2017). A critical review of flipped classroom challenges in K-12 education: Possible solutions and recommendations for future research. *Research and practice in technology enhanced learning*, *12*, 1-22. https://doi.org/10.1186/s41039-016-0044-2

Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: the effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments*, *28*(4), 464-481. https://doi.org/10.1080/10494820.2018.1541910

Lo, C. K., & Hew, K. F. (2021). Developing a flipped learning approach to support student engagement: A design-based research of secondary school mathematics teaching. *Journal of Computer Assisted Learning*, *37*(1), 142-157. https://doi.org/10.1111/jcal.12474

Lundin, M., Bergviken Rensfeldt, A., Hillman, T., Lantz-Andersson, A., & Peterson, L. (2018). Higher education dominance and siloed knowledge: a systematic review of flipped classroom research. *International Journal of Educational Technology in Higher Education*, *15*(1), 1-30. https://doi.org/10.1002/cae.21910

McNally, B., Chipperfield, J., Dorsett, P., Del Fabbro, L., Frommolt, V., Goetz, S., Lewohl, J., Molineux, M., Pearson, A., & Reddan, G. (2017). Flipped classroom experiences: student preferences and flip strategy in a higher education context. *Higher Education*, *73*, 281-298. https://doi.org/10.1007/s10734-016-0014-z

Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021). Synthesis of student engagement with digital technologies: a systematic review of the literature. *International Journal of Educational Technology in Higher Education*, *18*, 1-26. https://doi.org/10.1186/s41239-021-00270-1

Nouri, J. (2016). The flipped classroom: for active, effective and increased learning - especially for low achievers. *International Journal of Educational Technology in Higher Education*, *13*, Article 33. https://doi.org/10.1186/s41239-016-0032-z

Oliván-Blázquez, B., Aguilar-Latorre, A., Gascón-Santos, S., Gómez-Poyato, M. J., Valero-Errazu, D., Magallón-Botaya, R., Heah, R., & Porroche-Escudero, A. (2023). Comparing the use of flipped classroom in combination with problem-based learning or with case-based learning for improving academic performance and satisfaction. *Active Learning in Higher Education*, *24*(3), 373-388. https://doi.org/10.1177/14697874221081550

Park, S., & Kim, N. H. (2022). University students' self-regulation, engagement and performance in flipped learning. *European Journal of Training and Development*, *46*(1/2), 22-40. https://doi.org/10.1108/EJTD-08-2020-0129

Romero, A. A., & Angeles, E. D. (2023). Flipped classroom in a digital learning space: Its effect on the students' attitude toward mathematics. *International Journal of Learning, Teaching and Educational Research*, *22*(1), 210-227. https://doi.org/10.26803/ijlter.22.1.12

Rossi, R. D. (2015). ConfChem Conference on Flipped Classroom: Improving Student Engagement in Organic Chemistry Using the Inverted Classroom Model.

JOURNAL OF CHEMICAL EDUCATION, *92*(9), 1577-1579. https://doi.org/10.1021/ed500899e

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions [Article]. *Contemporary Educational Psychology*, *61*, 11, Article 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Sablić, M., & Mirosavljević, A. (2024). Implementing Flipped Classroom in the Digital Learning Environment. *Education and Self Development*, *19*(1), 38-49. https://doi.org/10.26907/esd.19.1.04

Shen, Y. (2024). Examining the efficacies of instructor-designed instructional videos in flipped classrooms on student engagement and learning outcomes: An empirical study [Article; Early Access]. *Journal of Computer Assisted Learning*, 15. https://doi.org/10.1111/jcal.12987

Shi, Y., Ma, Y., MacLeod, J., & Yang, H. H. (2020). College students' cognitive learning outcomes in flipped classroom instruction: a meta-analysis of the empirical literature. *Journal of Computers in Education*, *7*, 79-103. https://doi.org/10.1007/s40692-019-00142-8

Silverajah, V. S. G., Wong, S. L., Govindaraj, A., Khambari, M. N. M., Rahmat, R., & Deni, A. R. M. (2022). A Systematic Review of Self-Regulated Learning in Flipped Classrooms: Key Findings, Measurement Methods, and Potential Directions [Review]. *Ieee Access*, *10*, 20270-20294. https://doi.org/10.1109/access.2022.3143857

Sointu, E., Hyypiä, M., Lambert, M. C., Hirsto, L., Saarelainen, M., & Valtonen, T. (2023). Preliminary evidence of key factors in successful flipping: Predicting positive student experiences in flipped classrooms. *Higher Education*, *85*(3), 503-520. https://doi.org/10.1007/s10734-022-00848-2

Sugden, N., Brunton, R., MacDonald, J., Yeo, M., & Hicks, B. (2021). Evaluating student engagement and deep learning in interactive online psychology learning activities. *Australasian Journal of Educational Technology*, *37*(2), 45-65. https://doi.org/10.14742/ajet.6632

Terrenghi, I., Diana, B., Zurloni, V., Rivoltella, P. C., Elia, M., Castañer, M., Camerino, O., & Anguera, M. T. (2019). Episode of Situated Learning to Enhance Student Engagement and Promote Deep Learning: Preliminary Results in a High School Classroom. *FRONTIERS IN PSYCHOLOGY*, *10*, Article 1415. https://doi.org/10.3389/fpsyg.2019.01415

Tinto, V. (2012). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago press.

Trujillo, C. M., & Long, T. M. (2018). Document co-citation analysis to enhance transdisciplinary research. *Science advances*, *4*(1), e1701130. https://doi.org/10.1126/sciadv.1701130

Udvari, B., & Vizi, N. (2023). Employing the flipped classroom to raise the global citizenship competences of economics students to a global issue. *The International Journal of Management Education*, *21*(1), 100736. https://doi.org/https://doi.org/10.1016/j.ijme.2022.100736

Wang, J., & Jou, M. (2023). The influence of mobile-learning flipped classrooms on the emotional learning and cognitive flexibility of students of different levels of learning achievement. *Interactive Learning Environments*, *31*(3), 1309-1321. https://doi.org/10.1080/10494820.2020.1830806

White, P. J., Naidu, S., Yuriev, E., Short, J. L., McLaughlin, J. E., & Larson, I. C. (2017). Student Engagement with a Flipped Classroom Teaching Design Affects Pharmacology Examination Performance in a Manner Dependent on Question Type. *AMERICAN JOURNAL OF PHARMACEUTICAL EDUCATION*, *81*(9), Article 5931. https://doi.org/10.5688/ajpe5931

Wittmann, S., & Wulf, T. (2023). Effects of flipped classes on student learning: The role of positively perceived instructor attitude towards students. *The International Journal of Management Education*, *21*(1), 100735. https://doi.org/10.1016/j.ijme.2022.100735

Wong, Z. Y., & Liem, G. A. D. (2022). Student engagement: Current state of the construct, conceptual refinement, and future research directions. *Educational psychology review*, *34*(1), 107-138. https://doi.org/10.1007/s10648-021-09628-3

Xhomara, N., Gusho, L., & Muçaj, A. (2023). Course Organization, Faculty-Student Interaction, and Student Involvement and Their Influence to Students' Course Outcomes. *Research in Education and Learning Innovation Archives*(30), 19-38. https://doi.org/10.7203/realia.30.21524

Xiao, Y., & Hew, K. F. T. (2024). Intangible rewards versus tangible rewards in gamified online learning: Which promotes student intrinsic motivation, behavioural engagement, cognitive engagement and learning performance? *British Journal of Educational Technology*, *55*(1), 297-317. https://doi.org/10.1111/bjet.13361

Yan, J., Liu, S. H., Armwood-Gordon, C., & Li, L. (2023). Factors affecting Active Flipped Learning on Underrepresented students in Three STEM Courses. *EDUCATION AND INFORMATION TECHNOLOGIES*. https://doi.org/10.1007/s10639-023-12234-1

Zainuddin, Z. (2018). Students' learning performance and perceived motivation in gamified flipped-class instruction. *COMPUTERS & EDUCATION*, *126*, 75-88. https://doi.org/10.1016/j.compedu.2018.07.003

Zhou, X. (2023). A conceptual review of the effectiveness of flipped learning in vocational learners' cognitive skills and emotional states. *Frontiers in Psychology*, *13*, 1039025. https://doi.org/10.3389/fpsyg.2022.1039025