

FLIPPED CLASSROOM IN HIGHER EDUCATION: A LITERATURE REVIEW OF PUBLICATIONS IN MAJOR REFERRED JOURNALS FROM 2014 TO 2020

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ABSTRACT

In recent years, the flipped classroom has aroused an international research upsurge. Although there are many literature reviews on flipped classrooms, applying and exploring flipped classroom models in higher education is not enough. To understand fully applying flipped classrooms in university settings, this study reviewed 23 articles on flipped classrooms in higher education published in five major educational technology research journals from January 2014 to December 2020. Most research has focused on undergraduate higher education, conducting quantitative studies on subjects such as STEM and education. China has contributed the most to flipped classroom-related research in higher education. Most of the articles have corroborated the positive influence of flipped classrooms on students' academic performance, motivation, attitude, perception, and satisfactions, as well as the cultivation of students' higher-order thinking ability, and few have discussed the challenges faced by flipped classrooms. In addition, the study corroborated several gaps in the literature. More research needs concern associated with the negative views of teachers and students on flipped classrooms in colleges and universities. This study can provide a valuable reference for educators and researchers in flipped classrooms.

Keywords: Higher education, flipped classroom, academic performance

INTRODUCTION

The rapid development of emerging technologies provides unprecedented opportunities for researchers and practitioners in education around the world. Education used more and more computers, interactive devices, multimedia, and the Internet (Cheung & Slavin, 2012). Higher education workers recognize that to keep students engaged, increase their satisfaction, and promote their learning, the use of technology is critical, whether or not to adopt traditional teaching methods (O'Flaherty & Phillips, 2015).

From the economic perspective, it is difficult for universities to reduce class size and open more classes, and it is difficult to raise the attention to individual students when the ratio of students and teachers is low. These continue to challenge higher education practitioners to find more cost-effective, student-centered tactics, approaches, and curricula that engage students in the classroom and thus improve the effectiveness of the learning (Strayer, 2012).

In recent years, the traditional teacher-centered of teaching in higher education has shifted towards active learning and student-centered learning experiences that cause a sense of engagement and contribute to acquiring knowledge and skills needed for the job (Sousa & Rocha, 2019). Cooperative learning (Azizan, Mellon, Ramli, & Yusup, 2017; Johnson, 2009),

Problem-based learning (Loyens, Jones, Mikkers, & Van Gog, 2015; H. G. Schmidt, Molen, Winkel, & Wijnen, 2009), and Flipped classroom (Awidi & Paynter, 2019; Maureen et al., 2000) are some of the most effective examples.

In student-centered learning cases, the flipped classroom is flexible and adaptable when used in combination with other active learning methods (Zainuddin, 2018). Its digital and audiovisual parts create an emotional connection with Generation Z students, which is the goal of higher education (Anthony, 2015; Priporas, Stylos, & Fotiadis, 2017). Improving students' higher-order thinking skills, such as creativity, is an important task facing higher education institutions in a rapidly changing digital world.

Flipped learning is suited to higher education settings and large lecture courses, where student participation is often low (Marcey & Department, 2014). Reviewing the previous studies, it found applying and exploring the flipped model in higher education is not enough. To understand fully applying flipped classrooms in a university environment, this paper reviews the relevant literature on flipped classrooms in universities.

The review addressed the following four research questions.

- (1) In the research involving flipped classrooms in higher education, what is the publication journal and publication year of the paper, the level of education of the participants, national background, subject area, assessment type and supporting technology, research design, and research purpose?
- (2) How to design the classroom activities of flipped classrooms?
- (3) What are the educational outcomes produced by flipped classrooms?
- (4) What technology in supporting teaching, learning, and assessment?

LITERATURE REVIEW

Flipped classroom

The flipped classroom model began to appear in higher education classrooms in 2000 (Lage, Platt, & Treglia, 2000). The essence of flipped classrooms is the exchange of teachers' time to impart basic knowledge in class and students' time to apply knowledge or do homework outside class (Bergmann & Sams, 2012). In the flipped classroom, the main purpose of teachers' classroom changes from helping students understand and memorize knowledge to stimulating students' higher-order thinking so students can master their learning progress and rhythm (Kyukim, Kim, Khera, & Joan, 2014). Compared with a traditional classroom, flipped classroom pays more attention to students' participation in knowledge construction and provides students with more opportunities for cooperation and application through group discussion, practical assignments, projects, and other ways (Davies, Dean, & Ball, 2013; Lai & Hwang, 2016).

Past Studies

There are many published articles in higher education on the systematic review of flipped classrooms. For example, (K. S. Chen et al., 2018) conducted a meta-analysis of 46 items on the effectiveness of flipped classrooms in medical education. According to Evans et al. (2019), many systematically studies applying flipped classroom teaching method in health professional education. For example, applying flipped classrooms in nursing education that are associated with this teaching method (Evans et al., 2019). Van et al. (2019) conducted a meta-analysis of 114 items on the effectiveness of flipped classroom teaching in secondary and college education. Researchers like Lo et al. (2017) reviews math flipped classroom research in K-12 and higher education settings while Al-Samarraie et al. (2017) have researched applying flipped classrooms in seven university disciplines. Brewer & Movahedazarhouligh (2018) analyzed the

research status of flipped classrooms in higher education from the implementation, efficiency, and quality. O'Flaherty and Phillips (2015) provide a comprehensive review of the research on emerging the flipped classroom and its link to pedagogy and educational outcomes. Despite these reviews, there is a lack of comprehensive research on teaching resources, activity design, technology, assessment types, effectiveness, and other flipped classroom in colleges and universities. Because flipped classroom has become a focus for teachers and education policy it seems necessary to fill this research gap. The purpose of this review is to provide a reference for the current implementation of flipped classroom in colleges and universities, as higher education sectors increasingly shift to online delivery and the widespread adoption of flipped classroom. In particular, the design the types and applications and specific technologies of flipped classroom to attract students to improve the effectiveness of flipped classroom and the learning experience of students.

METHOD

Inclusion and exclusion criteria

The two main inclusion criteria for articles considered in this review are:

- (1) The article should be published in a peer-reviewed journal.
- (2) The selected literature sources are top publications in educational technology research.

Use the Google Academic Indicator to identify the five top journals in educational technology based on the journals' 5-year H Index and H Median Indicator. The search for top journals is as follows: Category: Social Sciences; Subcategory: Educational technology and dedicated to collaborative and open research on learning analytics. As a result, we identify and use the following journals in the current research: Computers and Education (CAE), British Journal of Educational Technology (BJET), Internet and Higher Education (IHEDUC), Educational Technology, and Society (JETS), Computer Assisted Learning (JCAL). Table 1 shows the impact factors (according to the journal citation report of the Institute for Scientific Information (ISI)) and the H5 index (according to the Google Academic Indicator). Chose the review period from 2014 to 2020 because it provides the latest trends in flipped classroom research. Table 2 shows the inclusion and exclusion criteria.

Table 1: Educational technology journals included in literature review research

Academic Journal	Impact Factor JCR (2018)	h5-index Google Scholar (2014–2018)
Computers & Education	5.627	94
British Journal of Educational Technology	2.588	56
Internet and Higher Education	5.284	50
Educational Technology & Society	2.133	49
Journal of Computer Assisted Learning	2.451	35

Table 2: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
2014 - 2020	Articles outside this time range
English	Non-English
Articles are published on CAE, BJET, Conference papers, Book chapters, Master's IHEDUC, JETS, JCAL	thesis, Doctoral dissertations
Article was peer-reviewed	Review articles and Theoretical articles
Higher education (in any subject) must be the first requirement	Not higher education

Search strategy

We search the subject of the article using the following search terms :(" Flipped Classroom "or" Flipped Mode "or" Flipped Learning "or" Flipped Method "or" Flipped Environment "or" Flipped Teaching "or" Flipped Education "or" Flipped Classroom "or" Reverse Classroom "or" Inverted Classroom ") AND (" University Learning/Situation "or" Higher Education "or" Undergraduate "or" Undergraduate/Graduate ")

Research Selection

The search results were 40 articles (not including duplicates). After preliminary screening, the researcher deleted 13 articles (excluded by checking the title or abstract). In addition, excluded 4 articles unrelated to the scope of our study (according to inclusion and exclusion criteria) after full-text eligibility checks. Eventually 23 articles were used. Inclusion and exclusion criteria for literature retrieval are based on mature PRISMA principles (Moher, Liberati, Tetzlaff, Altman, & Group, 2009).

Analysis framework and coding

According to the research question, We studied the following characteristics and appropriately coded :(1) the journal of publication, (2) the year of publication, (3) the education level of the participants (undergraduate, master students, and Ph.D. students, in-service teachers), (4) the national background, (5) the subject area (STEM, social sciences, education, arts, medicine, and health, not specified),(6) types of assessment (formative, summative, self-assessment, peer assessment, teacher assessment), (7) supporting techniques, (8) research design (quantitative, qualitative, or mixed).

RESULTS

The authors conducted a literature search in five major educational technology research journals and identified 23 relevant articles published between January 2014 and December 2020. Table 3 shows the results of our review of 23 journal articles on flipped classrooms in higher education published between January 2014 and December 2020. The following is a detailed analysis of the review results, organized into four sections based on the four questions of the study (refer Table 3).

Table 3: Detailed analysis of the review results

No	Study	Academic Journal	Subjects	Country	Course Name	Technologies Used	Assessment Type	Research Design	Research Purpose
1	(Kong & Song, 2015)	CAE	(n=26) In-service teachers	Hong Kong	The in-service teacher professional development programme	BYOD, Edmodo	Summative assessment, Formative assessment	Mixed	Identify future directions for teacher professional development on e-learning for reflective engagement in flipped classrooms in higher education. The exploration of how online behavior engagement affects achievement in the flipped classroom.
2	(Wang, 2017)	CAE	(n=488) Undergraduate students	Taiwan	10 Programming courses	Moodle	Formative assessment, Summative assessment, Self-assessments	Quantitative	Evaluate the efficacy of the online flipped classroom through the lens of transactional distance theory. Present a successful flipped classroom proposal in terms of knowledge, skills, and engagement.
3	(Stohr, Demaziere, & Adawi, 2020)	CAE	(n=52) Master and Ph.D. students	Sweden	Modelling of Nuclear Reactors	Ping Pong, Mediasite, Adobe Connect	Peer-assessment	Quantitative	Explore gamification strategies to motivate students to participate in more out-of-class activities without forfeiting the quality of work. To verify whether flipped classrooms can improve formative learning outcomes of first-year university students concerning self-regulation principles.
4	(Murillo-Zamorano, Sanchez, & Godoy-Caballero, 2019)	CAE	(n=160) Undergraduate students	Spain	Macroeconomics	Blend space platform, Google+, Google Drive, mobile devices	Not specified	Quantitative	Develop a more robust model for flipped learning in higher education.
5	(Huang & Hew, 2018)	CAE	(n=80) Master students	Hong Kong	Basic statistics course and SPSS	Moodle	Peer-assessment	Mixed	
6	(Ng, 2018)	CAE	(n=73) Fresh students	Hong Kong	Information Technology in Education	Google wiki, Pixlr, Google form, YouTube	Summative assessment, Formative assessment, Self-assessment	Mixed	
7	(Y. Chen, Wang, Kinshuk, & Chen, 2014)	CAE	(n=32) Graduate students	Taiwan	Computer Network and Internet	Holistic Flipped Classroom (HFC)platform, Cyber F2F	Formative assessment	Qualitative	

8	(Wang, 2019)	CAE	(n=431) Undergraduate students	Taiwan	9 Programming courses	Moodle	Formative, Summative assessment, Self-assessments, Peer-assessment	Quantitative	Explore online behavioral engagement with in-class and out-of-class activities affected achievement in flipped classrooms. Flexible assessment combined with a flipped-classroom approach to teaching.
9	(Wanner & Palmer, 2015)	CAE	(n=109) Undergraduate students	Australia	Governance and Sustainable Development in the Social Sciences	Not specified	Self-assessments	Qualitative	Devised and examined a novel extension of the FC model.
10	(Blau & Shamir-Inbal, 2017)	CAE	(n=36) Students(27 in-service teachers, 9 digital content designers)	Israel	Technologies and Learning Systems	Google Apps, Moodle	Self-assessments, Peer-assessment, Technology-enhanced embedded assessment	Qualitative	Examines the differential impact of studying in a flipped classroom (FC), blended learning (BL), traditional learning (TL), and e-learning (EL) on learning performance, self-efficacy beliefs, intrinsic motivation, and perceived flexibility. Investigate the impact of the flipped classroom on the promotion of students' creative thinking. Determine the effectiveness of the flipped classroom approach to teaching instructional media design subjects. Suggests a gamified flipped-classroom approach to address in-class activities that can be supported in large lectures. Ascertain the implications of designing and
11	(N. T. T. Thai, De Wever, & Valcke, 2017)	CAE	(n=90) The second-year undergraduate students	Vietnam	Invertebrates	Not specified	Not specified	Quantitative	
12	(Al-Zahrani, 2015)	BJET	(n=55) University students	Saudi Arabia	E-Learning course	YouTube	Not specified	Quantitative	
13	(Kazanidis, Pellas, Fotaris, & Tsinakos, 2019)	BJET	(n=128) The third-year undergraduate students	Greek	Instructional design and learning theories in Informatics	Blog, Moodle forums, Emails, Skype	Formative assessment	Quantitative	
14	(Sailer & Sailer, 2020)	BJET	(n=205) Educational science students	German	Two lectures in an educational science program	Quizalize	Formative assessment	Quantitative	
15	(Lee & Choi, 2018)	BJET	(n=61) Juniors and	Korea	College life science course	YouTube	Teacher-assessments, Peer-assessment	Quantitative	

			sophomores						implementing FL pre-class learning.
16	(van Leeuwen, Bos, van Ravenswaaij, & van Oostenrijk, 2019)	BJET	(n=150) University students	Netherlands	Centered around designing educational materials (DEM)	PeerWise	Formative assessment	Quantitative	Investigate to what extent taking into account Temporal patterns of student activity as well as instructional conditions can help to explain student achievement. Proposed a flipped learning approach with a reflection-promoting mechanism to promote students' reflection in the dance course.
17	(Hsia & Hwang, 2020)	BJET	(n=129) University students	Taiwan	College dance course	Evernote	Not specified	Mixed	Explored the effects of online academic help-seeking (OAHS) and flipped learning (FL) on students' development of involvement, self-efficacy, and self-directed learning.
18	(Chyr, Shen, Chiang, Lin, & Tsai, 2017)	JETS	(n=102) The first-year university students	Taiwan	Applied Information Technology: Office Software	LINE	Formative assessment	Quantitative	Implementation of the flipped approach in a higher education institution in Turkey.
19	(Kurt, 2017)	JETS	(n=62) The second-year students	Turkey	Classroom Management course	Edmodo, Present. me	Not specified	Mixed	Investigate the effect of using learning analytics-based process feedback on students' perceptions of the community of inquiry (teaching, social and cognitive. Presence) and their reflective thinking skills.
20	(Yilmaz, 2020)	JCAL	(n=104) University students	Turkey	Computer	Moodle	Formative assessment	Mixed	Compares Face-to-face learning (F2F), fully e-learning (EL), blended learning (BL), and flipped classroom (FC) with respect to students' learning
21	(Ngoc Thuy Thi Thai, Wever, & Valcke, 2020)	JCAL	(n=106) The third-year undergraduate students	Vietnam	Animal and Human Physiology	Dokeos platform	Not specified	Qualitative	

									performance.
22	(Yorganci, 2020)	JCAL	(n=163) The first-year students	Turkey	Mathematics	Moodle, Khan Academy platform	Not specified	Quantitative	Implementing flipped learning approach based on 'first principles of instruction' in mathematics courses. Examined the effects of self-efficacy, self-regulation, and social presence on learning engagement in University classes using a flipped learning approach.
23	(Doo & Bonk, 2020)	JCAL	(n=390) undergraduate students	Korea	Philosophy of Consideration	Not specified	Not specified	Quantitative	

Research Question 1: Type of journal classification

In research involving flipped classrooms in higher education, (a) journal and year of publication of the paper, (b) education level of participants, (c) national background, (d) subject area, (e) assessment type and supporting technology, (f) research design and (g) research purpose?

Classification by the number of articles published by year and journal

Table 4 shows the number of articles on flipped classrooms in higher education published in five selected major educational technology journals between January 2014 and December 2020. CAE journals published most of the articles (11), followed by BJET(6) and JCAL(4), JETS published only 2, and IHEDUC did not meet the inclusion criteria. Figure 1 shows the number of flipped classroom articles in higher education published between January 2014 and December 2020, in terms of year of publication. As can be seen from the figure, the number of literature was growing in the first two years (2014-2015). In 2016, the five major educational technology journals did not meet the inclusion criteria. After that, the number of publications related to the flipped classroom in higher education increased rapidly (2016-2017). Then, for some time, the number of publications on flipped classrooms in higher education showed a trend of slow decline (2017-2018). Today, the number of publications on flipped classroom research in higher education is on the rise again (2018-2020).

Table 4: Articles about flipped classrooms in higher education by an academic journal

Academic Journal	Articles	%
Computers & Education	11	48%
British Journal of Educational Technology	6	26%
Internet and Higher Education	0	0%
Educational Technology & Society	2	9%
Journal of Computer Assisted Learning	4	17%

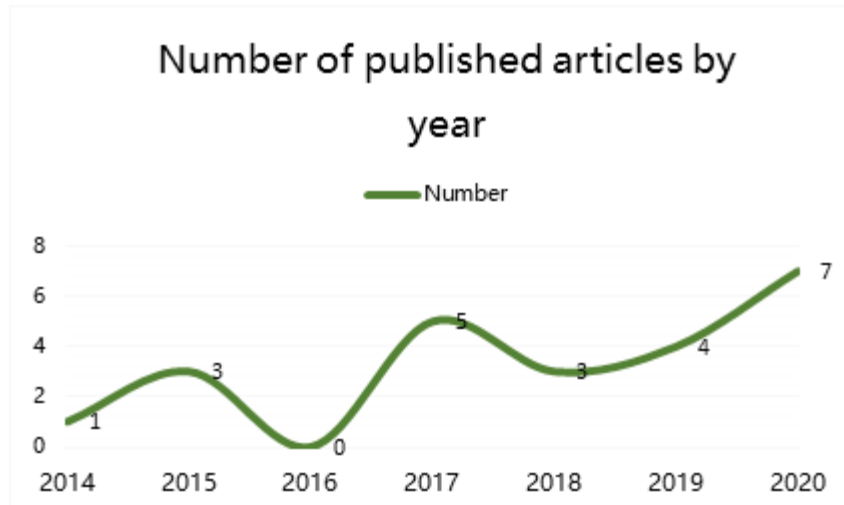


Figure 1: Number of literature published from 2014 to 2020

Classification according to the subjects

In most flipped classroom studies in higher education, participants are undergraduate students (74%), followed by master and doctoral students (17%), and part-time teachers (9%) (Figure 2).

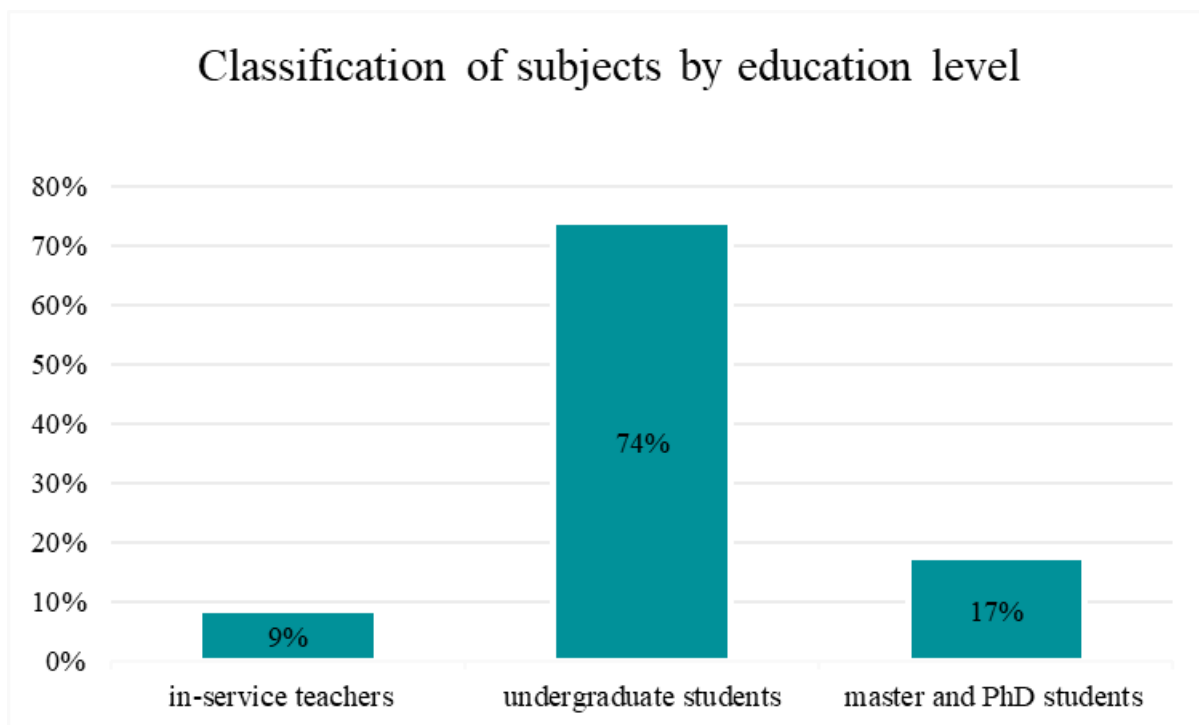


Figure 2: Classification of subjects according to their education level

Classification by national background

Most of the articles were written in four specific country contexts: China (Taiwan and Hong Kong, 35%), Turkey (13%), Vietnam (9%), and South Korea (9%). In the literature on flipped classroom research in higher education, the authors from Taiwan contributed the most (5 articles), followed by Hong Kong (3 articles) and Turkey (3 articles). Other countries (such as

Spain, Australia, Israel, Saudi Arabia, Greece, Sweden, Germany, and the Netherlands each account for 4%) also have research on flipped classrooms in higher education (as shown in Figure 3).

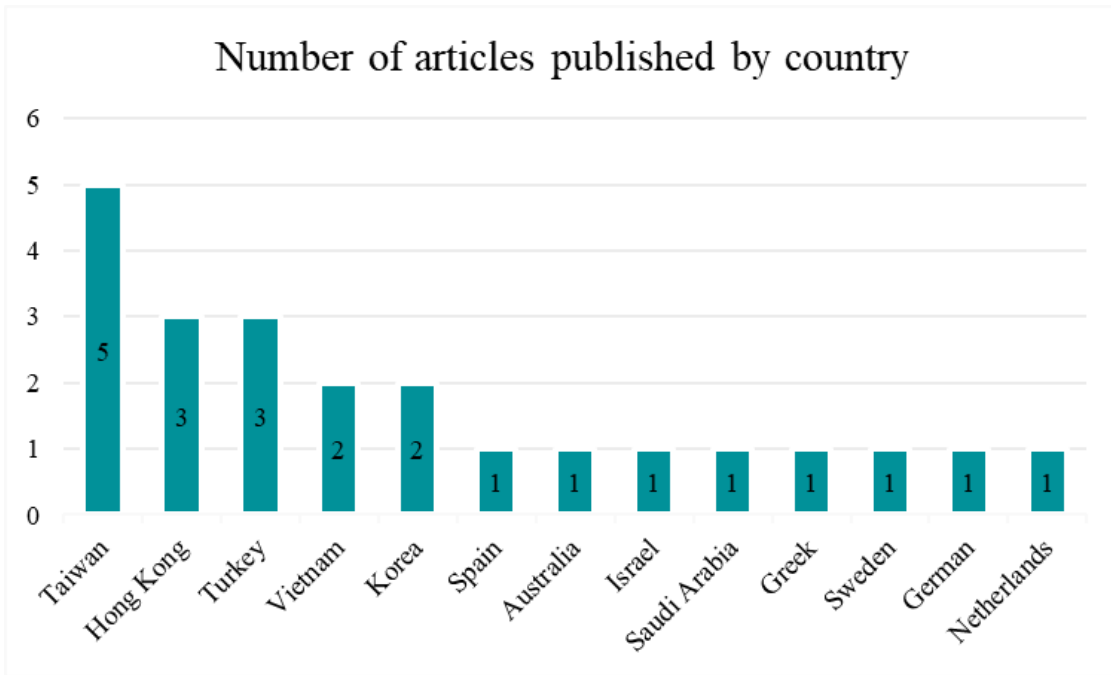


Figure 3: Classifies the number of articles published by the country

Classification by field of study

About 43% of the articles reviewed were STEM subjects (engineering and technology, science, math). 52% involved social sciences, education, and the arts. There is also a study in medicine and health sciences (Figure 4).

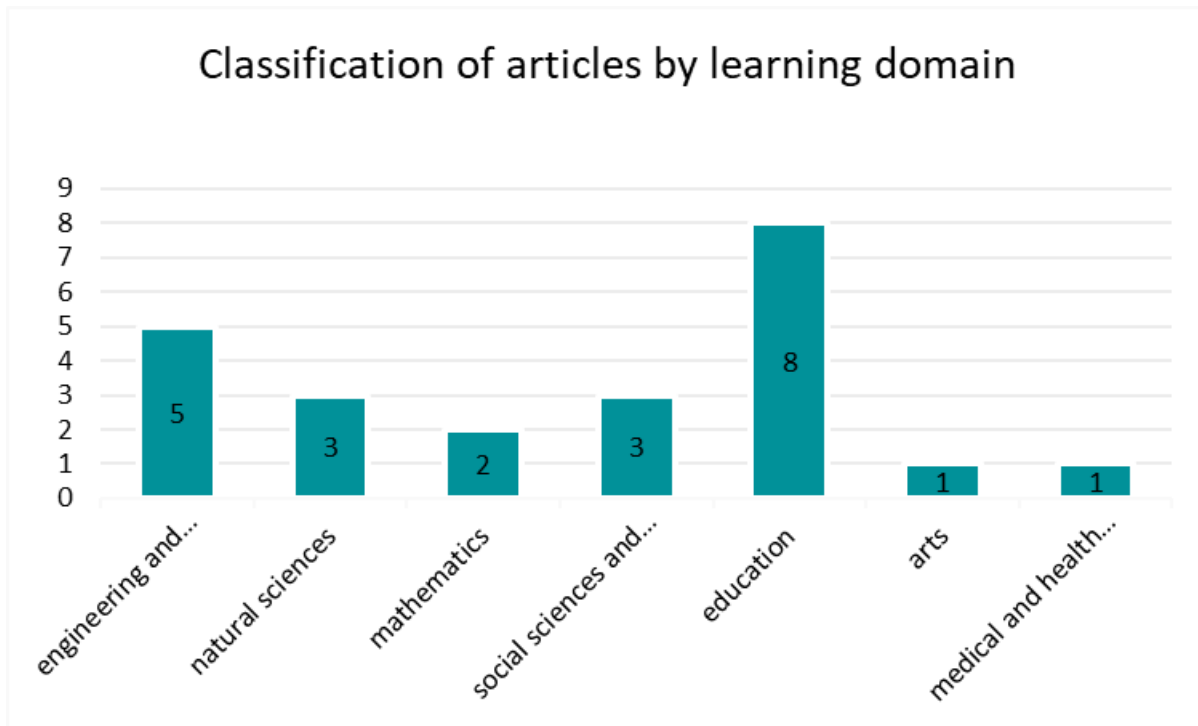


Figure 4: Classified by learning domain

Classified by assessment type and supporting technology

Most of the reviewed articles mentioned formative assessment (43%), followed by a combination of formative and summative assessment (17%), followed by self-assessment (13%) and peer assessment (13%), and a combination of self-assessment and peer assessment (9%). 13% were assessed using mobile devices (1,7,18). The researchers believe that mobile devices, due to their universal nature and instant feedback mechanisms, are a suitable medium for conducting formative assessments indoors or outdoors, anytime, anywhere (Hwang & Chang, 2011). Mobile devices are also an appropriate means of self-assessment and peer review (Nikou & Anastasios, 2013). In addition, one article mentions an additional type of assessment (technology-enhanced embedded assessment) (Figure 5). 35% of the articles did not specify the type of assessment.

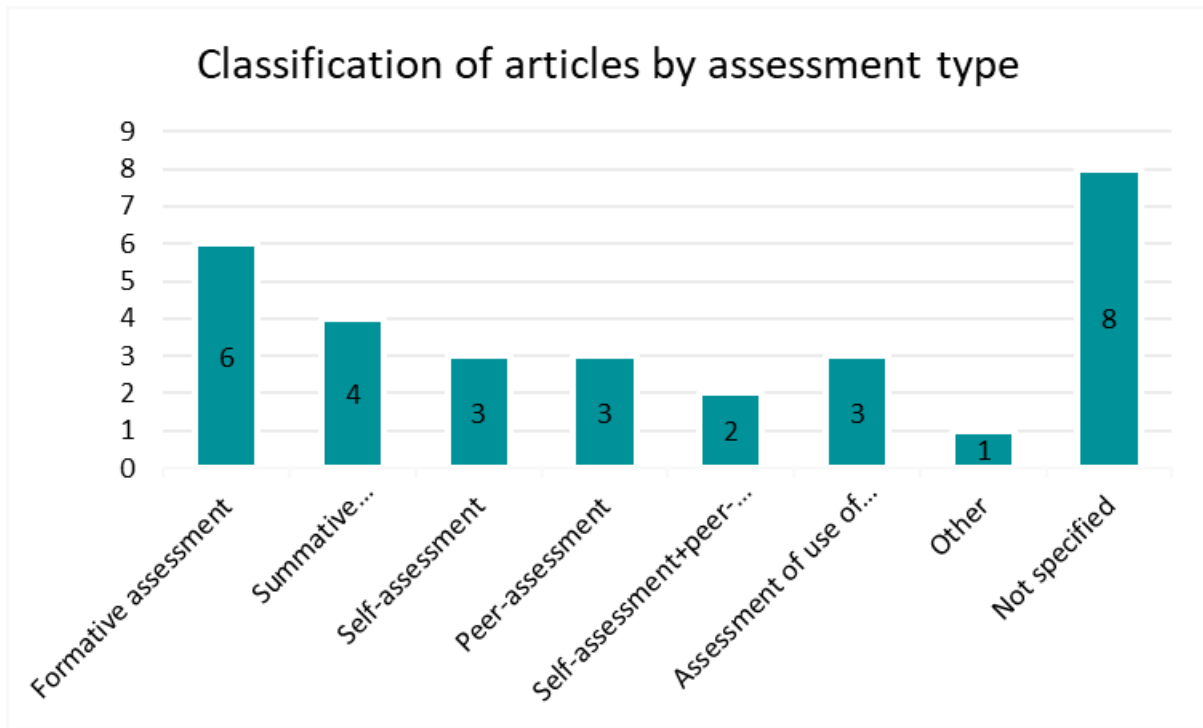


Figure 5: Categorized by assessment type

Classification based on research design

Most of the review articles were based on quantitative design (13, 57%), followed by mixed study design (6, 26%). Only (4, 17%) articles were based on qualitative research design, as shown in Figure 6.

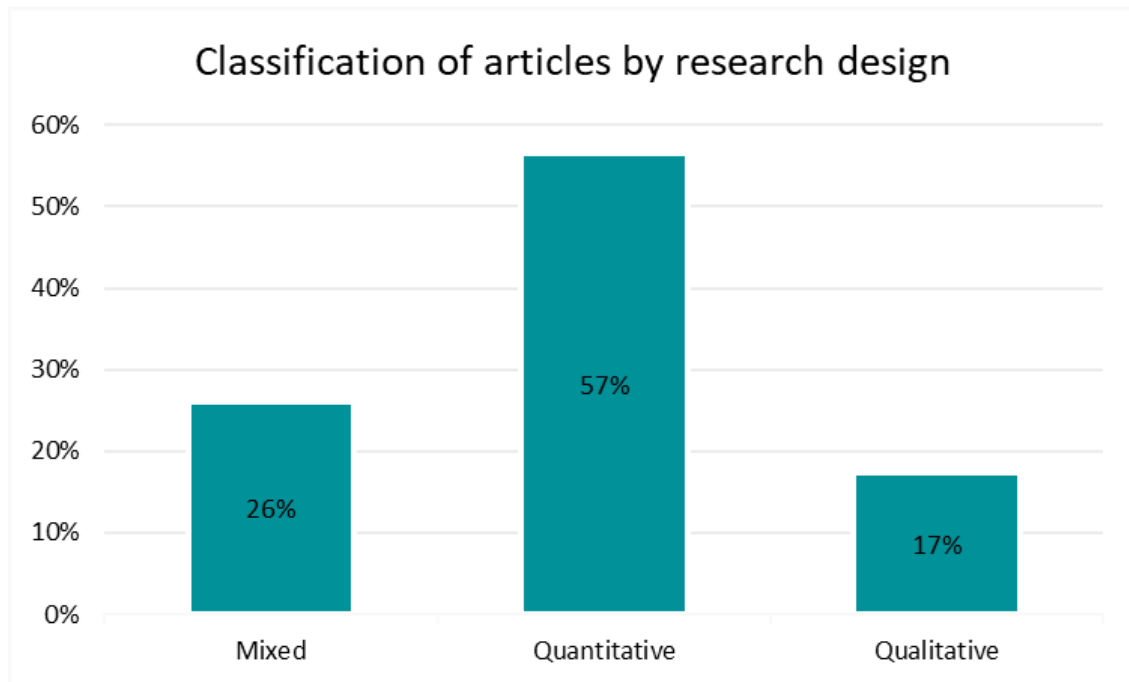


Figure 6: Classification by study design

Classification according to research purposes

Regarding the research purpose of the review articles, we classified the articles as follows: 10 articles (43%) evaluated the effectiveness of flipped classroom practices in higher education, and 13 articles (57%) realized the optimal design of flipped classrooms in higher education.

Research Question 2: How to design the classroom activities of flipped classrooms?

There are three learning stages in the flipped classroom, including the pre-class stage, in-class stage, and after-class stage. In this article, the pre-class stage and the post-class stage are referred to as the extra-curricular stage.

Extracurricular Asynchronous Activities

Resources for the pre-class stage include lecture/tutorial videotape (1, 3-7, 9-17, 19-23), video embedded with online quizzes (3), lecture recording (10, 18), flash (18), reading materials (1, 2, 4, 5, 7-10, 13, 15, 16, 19, 20, 22), presentation files (10, 13), study guides (10, 13), timetables (10), links to collaborative documents (10), pre-class tasks (5), online quizzes (2, 3, 7, 9, 19, 20, 22), etc. In the above articles, (Lee & Choi, 2018) verified the importance of pre-class learning in the flipped classroom.

Stage after-class teacher by organizing online synchronous video conference (3, 10, 16, 18), online tutoring (3), online questionnaire (2, 4, 12), self-report (6, 13), self-reflection (1, 2, 8, 9), self-assessment (2, 8), BBS (5-10, 13, 18-20, 23), exercises (2, 22), homework (2, 3, 8, 12, 13, 19), email (3), learning results shared by students (10) and other activities to optimize flipped classroom.

Synchronized classroom activities

The in-class stage is the activity in the Face-to-Face (F2F) flipped classroom: case-based presentations, team-based discussions, group discussions, expert-led discussions, role-playing, and student presentations, discussions, and debates (1, 2, 6-8, 10, 12, 15, 16, 19, 21-23), as well as mini-lectures and tutoring (1-3, 6, 8, 9, 15-17, 19) to close knowledge gaps. In addition, there are classroom tests (1, 2, 7, 8, 12, 14, 15, 18), timely summary and feedback (3, 4, 11, 12, 21), practice (6, 7), homework (8) and other activities organized to understand students' knowledge mastery, as well as gamification competitions as a form of classroom activities (4).

Research Question 3: What are the educational outcomes produced by flipped classrooms?

Most of the articles did not have a control group (43%), 30% of the articles evaluated educational outcomes by comparing existing courses using traditional teaching methods with courses using flipped classrooms, and 17% of the articles evaluated educational outcomes by comparing courses using traditional flipped classroom teaching mode with an optimized flipped classroom. The remaining articles (9%) used other classrooms such as full e-learning (EL), blended learning (BL), enhanced hybrid model, and flipped classrooms as a comparison study.

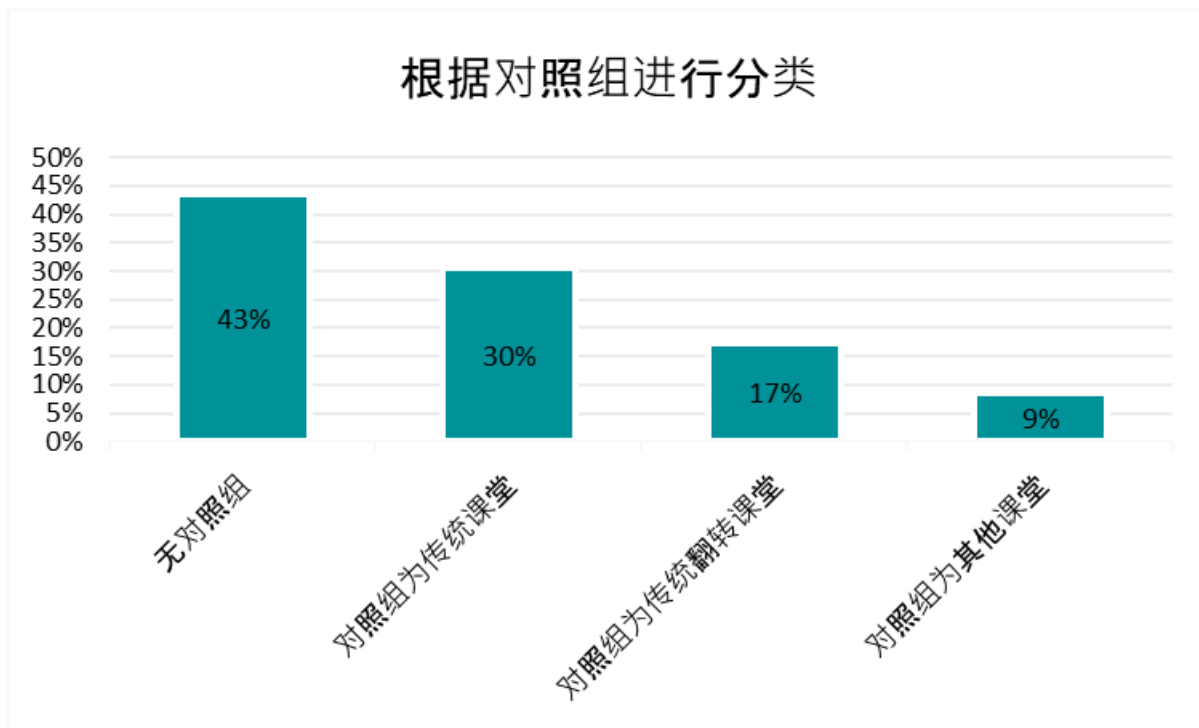


Figure 7: Classification according to the control group

Many articles, using Likert scale surveys and anonymous open surveys, reported students' views on the flipped classrooms and increased satisfaction (7, 9, 13, 19, 20), higher motivation (11, 14), better academic performance (2, 4, 11, 13, 14, 17, 19, 21, 22), better creative thinking ability (12), higher participation (4, 7, 9, 18), the better quality of homework and activities in and out of class (5), better formative learning outcomes (6), higher self-efficacy (11, 18, 19, 21, 22), better reflective thinking ability (1, 17, 20), better self-directed learning (18), support to develop the five core competencies (communication, collaboration, critical thinking, complex problem solving and creativity) (10).

While flipped classrooms can bring positive educational outcomes, teachers say flexible learning and flipped classrooms in particular need more effort. About half of the teachers stated that they had a low level of investment in flipped classrooms and felt much pressure to incorporate flipped classrooms into their curriculum (9).

Research Question 4: The contribution of technology in supporting teaching, learning, and assessment

The flipped classroom is usually considered to replace traditional classroom teaching with video (Sams & Bergmann, 2013). In this review, teachers used YouTube video (1, 12, 15), Mediasite video hosting platform (3), online video Blendspace (4), Zoom Video conferencing (10), Present. me (19) and other platforms can record lectures/tutoring videos for students. In addition, videos are distributed to students through various platforms such as Edmodo (1, 19), Khan Academy (22), Moodle (2, 5, 8, 10, 13, 20, 22), Ping Pong (3), Virtual Learning Environment (VLE) (4), Evernote (17) and DokeOS Platform (21). These platforms can provide support for students to interact with classmates and teachers outside the classroom (S. M. P. Schmidt & Ralph, 2016). There are various social networking sites (SNS) that can be used for knowledge sharing, information distribution, and interaction between students, such as Adobe Connect online meeting platform (3), Virtual learning community Google+ (4), Google Drive (4),

Google Wiki (6), Google Apps for Education Platform (10), Blogs, emails, and Skype (13). Various mobile technologies support personalized learning and assessment, such as BODY (1), mobile devices (7), LINE (18). In the practice of flipped classrooms, gamification technologies such as Kahoot gamification education platform (4) and gamification classroom question-and-answer platform Quizalize (14) and Peerwise (16) are also used.

CONCLUSION

The current study reviewed 23 articles on applying flipped classrooms in higher education published in five major educational technology research journals between January 2014 and December 2020. This study presents the following new findings that hold in the above-selected journals:

- 1) CAE journals published most of the studies. The least field of study is the arts and medical and health sciences. Undergraduates are the main research subjects in higher education. China has contributed the most to flipped classroom-related research in higher education.
- 2) Most studies used formative assessment and a combination of formative and summative assessment. Most studies preferred research method is the quantitative research design.
- 3) There is no control group in most studies, and the main purpose is to optimize the design of flipped classrooms in higher education, to better carry out flipped classroom practice in higher education.
- 4) Most studies reported significant positive effects on students' academic achievement, motivation, attitudes, perception, satisfaction, and learning engagement. Very few discussed the temporal and institutional challenges of flipped classrooms.
- 5) The selected article focuses more on the cultivation of students' higher-order thinking abilities, such as creative thinking, reflective thinking, self-directed learning, and five core abilities (communication, collaboration, critical thinking, complex problem solving, and creativity) in higher education by flipped classroom.
- 6) Course activity design mostly follows Bloom's Hierarchy Theory.

The higher-order cognitive processes in Bloom's educational goals include analysis, evaluation, and creation, while the lower-order cognitive processes include memory, understanding, and application. Bloom's classification of cognitive objectives enables low-order thinking and high-order thinking to be implemented in teaching.

Students' completion of extracurricular tasks helps to improve the quality of interaction in class (Gross, Pietri, Anderson, Moyano-Camihort, & Graham, 2015). In the flipped classroom, students' learning content outside the classroom is low-level cognitive goals (memory and understanding), while the learning content in the classroom is high-level cognitive goals (application, analysis, evaluation, and creation) (Gilboy, Heinerichs, & Pazzaglia, 2015). Cooperative learning, inquiry-based learning, and problem-based learning in the classroom can promote classroom interaction and achieve high-level cognitive goals. Moreover, the flipped classroom is not a kind of activity. It is usually interspersed with teachers' explanations, group discussions, and students' demonstration of various activities which teachers are required to design. Moreover, flipped classroom pays more attention to realizing high-level goals from low-level cognitive goals.

There are also various different disciplines adopt different learning activities in extracurriculars and classrooms (Berrett, 2012). For example, liberal arts teachers would choose concept maps and discussions (Kong, 2014), while math teachers would choose to do exercises. Teachers design appropriate worksheets based on teaching objectives to enable students to

achieve high-level cognitive goals (application, analysis, synthesis, evaluation) in a variety of activities (Gasparič, 2017). Classroom activities include exercises, past exam questions, discussions, problem-solving, concept maps, jigsaw, role-playing, games, debates, hands-on activities, real-world problem-solving, discovery learning, project-based learning, etc.

In addition, based on the selected journals, flipped classroom applications in Higher Education identified the following major research gaps:

- 1) The fields of arts, sports, and other disciplines needed more exploration and research that emphasize cultivating practical ability.
- 2) Investigating the effectiveness of applying flipped classroom methods in different disciplines of higher education needed more research.
- 3) Application of emerging technologies, such as mobile technology, in flipped classrooms.
- 4) Investigating the issues and concerns associated with negative perceptions of flipped classroom practices needed more research.

This study provides a synthesis of current research and provides an indicator for future research on applying flipped classrooms in higher education, so it can provide a valuable reference for educators and researchers working in this field.

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