

More Questions and Answers for the Flipped Classroom Approach: A Review of Reviews

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Abstract

In recent years, the educational strategy called the flipped classroom (FC) has gained notable publicity and popularity in education. A substantial number of articles related to FC have been published aimed to synthesizing this extensive body of research on the flipped classroom. Hereto, this paper examined 13 reviews aiming to identify the characteristics of review studies and the current state of knowledge on the flipped classroom as a pedagogy approach. Despite the methodological differences, the results of this review confirm that FC has positive impacts on students' learning experiences in general. This study revealed a need for increased support for research in FC design, implementations, and practices. More longitudinal analyses are necessary to better understand the best practices of FC implementation or whether the effectiveness of FC practices is influenced by contextual elements, such as disciplines, subject domains, the complexity of learning content, academic levels, and implementation duration.

Keywords: flipped classroom, inverted classroom, scope review, comparison study

Introduction

Flipped classroom (FC) is an instructional approach that extends traditional classroom-based learning through technology (Karabulut-Ilgu et al., 2018). FC is also referred to as inverted learning or flipped learning. The concept of FC emerged in 2000 when Lage, Platt, and Treglia proposed the idea of an “inverted classroom”. In an inverted classroom, the students' first learning activity happens before the class and then uses the in-class time for more engaging activities like problem-solving (Lage et al., 2000). In 2007, FC gained its popularity after two high school teachers, Jonathan Bergmann and Aaron Sams, used video lectures as students' pre-class assignments for their chemistry classes (Lage et al., 2000; Tucker, 2012). Various models were proposed for FC implementation, such as the FLIP model (i.e., flexible environment, learning culture, intentional content, and professional educator) (Flipped Learning Network, 2014) and “FLIPPED” model, which extends the FLIP model by adding three more elements (i.e., progressive activities, engaging experiences, and diversified platforms (Chen et al., 2014). While there is no fixed model, the essential idea of FC is to have lectures and direct instruction delivered before class through online videos. And then, the actual class time is used for more engaging collaborative learning activities, such as hands-on activities, discussions, and interactions (Flipped Learning Network, 2014; Tucker, 2012). The instructional approach aims to

transform students from passive learners to active learners, who can self-direct their learning to improve personal analytical, integration, and critical thinking skills for higher levels of learning (Hu et al., 2017).

Given the advancement of technology that provides tools for delivering flipped learning, FC has gained much popularity and scholarly attention in recent years (Akçayir & Akçayir, 2018; Bergmann & Sams, 2012). Various class activities, teaching tools, and techniques have been used to carry out the FC approach (Lundin et al., 2018; O’Flaherty & Phillips, 2015; Ward et al., 2018). Examples of the inside- and outside-of-class activities include reviewing case studies, playing games, role-playing, working on peer-reviewed assignments, watching video-recorded lectures, and working on post-class homework (Ward et al., 2018). The teaching techniques used in FC include prerecorded lectures, case-based presentations, team-based discussions, panel discussions, and debates (O’Flaherty & Phillips, 2015). Digital technology is also used to implement FC. For example, social media or networking sites like YouTube or blog posting is applied as platforms to share educational resources (Lundin et al., 2018). Additionally, the FC approach is widely implemented across different education levels, such as K-12 and higher education (Cheng et al., 2019), and disciplines, like engineering (Kerr, 2015), clinical pharmacy (See & Conry, 2014), chemistry (Baepler et al., 2014), and computer science (Giannakos et al., 2014).

The advantages of FC included better students’ learning achievements, improvement on learning experiences, and increases students’ motivation and satisfaction during the learning process are broadly indicated in previous research (Koo et al., 2016; Sergis et al., 2018). On the other hand, the challenges of FC included time limitation for pre-class activity preparation, time-consuming and less effective for learning (Koo et al., 2016; Roehling et al., 2017).

For a field to continuously progress, it is essential to be aware of its developmental patterns in the past to obtain insights for future implications (Dwivedi et al., 2011). As FC has progressively expanded over the years, a lot of research addressed the development of FC and its impacts. However, each review has its own focus, scopes, and comprehensiveness (Karabulut-Ilgü et al., 2018; Oliver & Luther, 2020). For instance, Cheng et al. (2019) reviewed the impacts of FC on students’ learning outcomes. Liu and colleagues’ (2019) review focused on the teaching effects of FC. Some research addressed FC and its impacts on both teaching and learning (Karabulut-Ilgü et al., 2018; Oliver & Luther, 2020).

Furthermore, mixed results were reported in the review studies with a focus on FC effectiveness. Researchers indicated that the positive impacts of FC on student learning, which included better learning performance, enhanced student engagement, increased student satisfaction, the development of problem-solving and cooperation skills, and improvement of theoretical knowledge (Akçayir & Akçayir, 2018; Hu et al., 2018; Karabulut-Lieu et al., 2018). On the other hand, although research results showed that FC in class seemed to produce positive learning outcomes, the effect is not long-lasting and not all course evaluations are positive (Betihavas et al., 2016; Presti, 2016).

With the different perspectives of examination of each review, different sets of studies might be selected, and, accordingly, different analysis results and conclusions would generate. Despite the contribution of these researchers, the diversity in selected information in existing review articles prompts a need to conduct a review of reviews study to provide a synopsis of the evidence of FC. Reviews of reviews are referred to as umbrella reviews, reviews of systematic reviews, overviews of reviews, a synthesis of reviews, and a summary of systematic reviews

(The Joanna Briggs Institute, 2014). This approach has been used to summarize the extensive scientific knowledge on widely explored research topics in nursing and medical fields (Egan et al., 2008; Mikton, & Butchart, 2009) and is becoming increasingly common in education and other fields (Chen et al., 2018; Pahlevan-Sharif et al., 2019). Reviews of reviews aim to summarize the existing research syntheses regarding a topic of interest (The Joanna Briggs Institute, 2014), which is compatible with the purpose of this current study.

The purpose of this study is to provide an overview of the features and impacts of FC from previously published FC reviews in the past decade. Through the lens of reviews of reviews, the close investigation of relevant FC reviews can provide vital insights into the expanding and popular trend of FC and to identify the insights to shed light for future research. This study is intended to capture the essence of the existing reviews in the area of FC to answer the following research questions:

1. What are the characteristics of review studies on the flipped classroom?
2. What are the findings of the FC reviews?

Methodology

Standard reviewing methods were applied in the current study to identify existing reviews, instead of primary research (Khan et al., 2001). The present study uses reviews as the unit of analysis, which differs from a conventional review that uses primary studies as the unit of analysis (Kache & Seuring 2014; Keller & Torre, 2015).

Search Strategy

Social Science Citation Index (SSCI) was the database used to identify the relevant reviews on flipped classrooms. SSCI was selected because it covers top-tier or highly ranked journals in social sciences based on the sophisticated selection process, specifically, the Web of Science Core Collection Journal Selection Process (Web of Science Group, 2019). The Web of Science (WoS) platform, one of the largest academic database search platforms, was applied to access SSCI.

In order to identify the largest possible number of articles in our initial search, the authors of this study used strategies that included a range of terms for their main research variables (e.g. flipped classroom, flipped approach, flipped instruction, flipped learning strategies, inverted classroom, systematic review, meta-analysis, scoping review, etc.). The Boolean operator “or” was used with related terms to broaden their search before narrowing down by the selection criteria. They also used truncation to include variation of words. For example, the authors used “flip*” to find items, including terms like “flip,” “flipping,” and “flipped” and “invert*” to search article items that contained “inverting” or “inverted.” After completing the above search process, they further applied selection criteria to screen out irrelevant results. The language restriction was English.

Inclusion and exclusion criteria

Criteria for inclusion of papers included (a) peer-reviewed journal articles; (b) articles classified as reviews, systematic reviews, or meta-analyses; (c) articles that reported on/about the flipped classroom; and (d) articles that were published in English. Studies were included if they reviewed any studies on the flipped classroom. Studies that did not meet these inclusion criteria were excluded, such as those that reviewed conference papers instead of published journal articles, studies that did not follow the systematic analysis procedure, and those that failed to report the process of literature selection. Restricting eligibility to publications in peer-reviewed journals enabled consistent quality across disciplines and databases covered in the literature search.

Selection process and data analysis

After completing the initial search process, all studies were examined by the two authors. After the initial database search, the two authors independently scrutinized the titles and abstracts from the electronic searches followed by the full text of all citations that definitely or possibly met the predefined selection criteria. If a disagreement occurred between the two authors, a third person would share their judgment. A discussion would follow among the three individuals until a consensus was reached. This exact process was also applied when a disagreement occurred during the coding stage.

After excluding duplicated records identified across SSCI searches, the titles and abstracts of 361 records were screened. After a full text review and discussion, a total of 13 unique reviews met the inclusion criteria. The two authors assessed the manuscripts independently and resolved any disagreements about inclusion by consensus after discussion. For each study included, information was obtained, such as bibliographical data, study purpose, study design, learning context, and primary results. Content analysis is the approach for data analysis. Both authors coded the qualitative data attained from the articles, respectively. Any discrepancies in the coded data between the two authors were discussed with a third reviewer until reaching a consensus of the coded data.

Results

Characteristics of the Included FC reviews

This section discusses the characteristics of retained FC reviewed, including background information (i.e., publication year, academic discipline, education level), research focus, and research methods.

Background information. Results show that one to two FC review research were published in 2015, 2016, 2017, and 2019. However, in 2018, the FC reviews publications peaked when seven articles were published that year. Additionally, authors of the 13 FC reviews came from a variety of regions, including North America (five articles from the U.S.), Asia (two from Hong Kong, one from China, and one from Taiwan), Europe (one article from Turkey and one article from Sweden) and Australia (two articles). All of the FC reviews focused on English-

based FC studies. Nine of the 13 FC reviews examined FC studies within a single academic discipline, including nursing (4), health (2), engineering (1), mathematics (1), and education technology (1). Moreover, the majority of them examined the effectiveness of FC in the context of higher education.

Research focus. When examining the purpose study of the included FC reviews, four different research focuses emerged, including overall trends, effectiveness of FC on learning, current state of FC knowledge or practice, and benefits and challenges of FC implementation. It is worth noting that some of the included FC reviews may have had more than one study focus and/or was conducted in multiple stages. For example, the review of Lo et al. (2017) initially conducted a meta-analysis of 21 comparison studies about FC to examine the effects of FC for math education learning, following synthesized findings of 61 FC studies to identify the benefits and challenges of FC on students' learning.

Some features were found among the FC reviews with the same research focus. For example, the FC reviews that focused on FC current development situation frequently applied some aspects to present the developmental trend among the FC studies, such as publication trend (i.e., year, author, publication venue), keyword, and subject area. The FC reviews that focused on FC effectiveness examined the issues and factors related to the effect of FC approaches on teaching and learning, such as students' academic levels and duration of implementation. Furthermore, some of the FC reviews that addressed the current knowledge or practice status of FC also investigated the development or effectiveness of FC. For example, Ward's (2018) review integrated the application of FC in nursing education based on 14 related literatures. In addition to identifying main FC application themes in nursing education, students' academic learning outcomes and their measurements were also provided.

Research methods. Research methods of FC reviews can generally be categorized into qualitative and quantitative. The qualitative methods focused on content analysis to generate common themes among studies, and the quantitative methods studies focused on numerical data. However, some qualitative studies may have used quantitative data-analysis techniques, such as frequency or percentage analysis to describe the themes. Therefore, the authors broadly sorted FC reviews into three categories of research methods: qualitative review, quantitative review, and mix-method review. Among the thirteen FC reviews, one of them used a mixed method (8%), seven used a qualitative method (54%), and five of them used quantitative methods (38%) to analyze data. In terms of research approaches, there were meta-analyses, systematic review, literature reviews, and scoping review. All qualitative reviews utilized content analysis. Furthermore, FC reviews indicated that techniques and standard content analysis were used for qualitative data analysis, such as the coding protocol, rating scale, and framework. Some included studies that applied more than one research approach. For example, the study of Lo et al. (2017) stated that they applied two approaches, such as content analysis and meta-analysis. The content analysis was used to examine current FC practice, and the meta-analysis method was used to conduct the statistical data of the effect value by homogeneity studies.

Primary Findings of FC Reviews

Three overarching themes emerged from results of FC reviews, including overall trends, effectiveness of FC on learning, and benefits and challenges of FC implementation.

Research trends of FC studies. The top two main trends of FC studies in this FC reviews were (a) focused more on higher education and (b) small-scale research. Higher education was the development trend that was indicated most frequently in eight of the thirteen included FC reviews. For example, Akcayir and Akcayir (2018) pointed out a particular composition of FC studies participants. While the FC approach seemed suitable for courses in all learning levels, many study participants in existing FC studies are composed of students in higher education institutions. Moreover, Cheng et al. (2019) pointed out that accessibility of study participants is also one of the reasons for this, since FC researchers are mainly from higher education institutions. It might be easier for them to find access to student populations in higher education than in K-12 schools.

Small-scale research was also frequently used by FC studies, as it was indicated in half of the included FC reviews. Although the length of time of FC implementation varied considerably study-by-study, seven of the thirteen reviews revealed that many of the FC studies were small-scale research, such as small sample size, localized recruitment, and descriptive design. The duration of the implementation mostly ranged from one unit in a semester to one full semester. The tendency of localization in FC studies might result in the application of small-scale design. For example, 26 of the 31 FC articles that Lundin and colleagues (2018) reviewed were composed of experiences from a single course or classroom.

Effectiveness of FC on learning. Results showed that both qualitative and quantitative analysis methods were used to examine effectiveness of FC on learning. Table 1 summarizes the study findings regarding the effectiveness of FC that is indicated in the included FC reviews. To summarize, 12 of the 13 FC reviews concluded that FC had overall positive impacts on learning compared to in-class, lecture-based learning. It is also worth noting that Chen et al. (2018) found a progressive improvement tendency in the FC outcomes over time through a meta-regression analysis. In other words, FC studies published in recent years seemed to support the improved outcomes under FC conditions more. Moreover, the effectiveness of FC was usually evaluated through academic performance (n=4), satisfaction (n=5), engagement (n=4), motivation (n=1), and self-reported learning attitude (n=1).

Table 1
Summary of Findings Regarding the Effectiveness of FC

Category	n	Source of Review
Overall positive impact on student learning outcomes	12	S1, S2, S3, S4, S6, S7, S8, S9, S10, S11, S12, S13
Academic performance (e.g. test scores, course grade, knowledge score)	4	S2, S3, S4, S8
Satisfaction	5	S3, S9, S10, S11, S12
Engagement	4	S3, S6, S9, S11
Motivation	1	S3
Attitude	1	S3
Factors on the effectiveness of FC		
Type of content knowledge	5	S1, S8, S11, S12, S13

Subject areas/discipline	3	S1, S4, S13
Student levels (K-12, HE)	2	S1, S3
Duration of Implementation	2	S1, S3,

Some FC reviews further examined influential factors associated with the differences in the positive effects of FC on learning and found possible factors, including content knowledge (n=5), subject area (n=3), student academic level (n=2), and duration of implementation (n=2). In terms of knowledge content, many FC reviews concluded that FC had greater impacts on improving practical knowledge learning, such as design and experiment than theoretical knowledge learning (Hu et al., 2018).

Results also indicated that the variance of FC effectiveness in learning was within different subject areas. For example, Cheng et al. (2019) found a higher effect size of FC on learning subjects like art and humanities than social sciences, mathematics, health, etc. Chen et al. (2018) indicated that the FC approach had greater positive application impacts on medicine and pharmacy than nursing and other health-related professions. The difference may be reasonable, since the FC approach did not seem applicable to certain types of content knowledge. Therefore, it was necessary to consider the subject area's features when the FC approach was applied. Additionally, the effects of FC on learning outcomes among different student's academic levels were not conclusive. Akcayir and Akcayir (2018) indicated that the effects of FC on learning outcomes were higher in older learners. However, Cheng et al. (2019) found that the impact of FC approach outperformed the non-FC approach in higher education, but the effects on graduate students were overall negative. This means that postgraduate students learned better in non-FC conditions. The duration of FC implementation may result in differences in the FC effects, and a shorter implementation period seemed better. Cheng et al. (2019) found that overall, while students in FC were significantly outperformed students in non-FC conditions, the FC studies with a longer duration of FC implementation had smaller effect sizes than studies with a shorter period. Akcayir and Akcayir's (2018) study also indicated a similar conclusion that the effects of FC might not sustain over longer-term applications.

Benefits and challenges of FC implementation. The benefits of FC implementation commonly reported by both students and instructors were flexibility, it enabled individualized learning, and students were better prepared before class (Akcayir & Akcayir, 2018; Karabulut-Lieu et al., 2018). In addition to the benefits of FC implementation, challenges of FC implementation were noted in the FC reviews. For instance, there were concerns about the quality of the learning materials, the time-consuming nature of FC for course content preparation, technological issues, the need for out-of-class activity guidance, and the time required by instructors to integrate into their curriculum. Some FC reviews also indicated possible conditions that hindered instructors from adopting the FC approach. This was especially true regarding courses that involved large amounts of factual content and hand-on activities as well as the requirement of frequent interactions and collaborative group activities (Akcayir & Akcayir, 2018; Karabulut-Lieu et al., 2018; Lo et al., 2017).

Discussion & Conclusion

This review of reviews included 13 studies about FC that were published by SSCI-indexed journals in the last decade. The results of FC reviews raised some concerns about the existing FC studies from the following aspects, including the study design of FC studies, the definition of learning effects, and the analysis of FC effectiveness.

The Study Design of FC Needs to Be More Diverse

Regarding the study design in investigating FC practices and evaluating FC effectiveness, there were several concerns identified by FC reviews. First, the majority of FC studies focused on comparing FC and general non-FC conditions. However, as Lundin et al. (2018) indicated in their review, comparison studies' fundamental problem was in these kinds of studies. This means that the non-FC context, like the in-class, lecture-based teaching approach, was most likely to be treated as unsuccessful, and FC was seen as a solution. The effect of FC in improving student learning seemed to be taken for granted, commonly without explanation of the pedagogical design and implementation settings (Lundin et al., 2018). Therefore, future FC studies need to employ more alternative quantitative, qualitative, and mixed methods to understand the FC phenomena in depth.

Second, many FC studies evaluated influential factors based on small-size, local case, and short implementation period. For example, 26 of the 31 FC studies that Lundin et al. (2018) included in their review were locally situated in terms of the sample (commonly 20 to 40 students) or case (mostly in higher education) and focused on only one course. Such a small-scale design made the generalizability of these studies' results a likely issue. The fragmented knowledge contributions also showed that the development of FC's related field had yet to be stabilized (Lundin et al., 2018). Moreover, FC's positive effect at the beginning might not be sustained throughout the semester when students in non-FC conditions catch up by the end of the course (Evans et al., 2018). In order to see if the FC approach can be appropriately adapted in a broader-level implementation, higher quality studies focusing on longitudinal, large-scale, and numerous-courses designs are needed in the future (Akçayır & Akçayır, 2018; Karabulut-İlgu et al., 2018; Lundin et al., 2018). Chen and colleagues (2018) further proposed the critical potential of FC in education. It seems appropriate to further understand whether FC approaches work and, if so, in what types of situations and contexts.

Third, other issues might limit background information relevant to the implementation and practice of the FC approach. Some examples of this may include the difficulty of the content knowledge, instructors' teaching experiences with the pedagogy, or students' self-efficacy of using technology tools (Evans et al., 2018). However, the most recent FC studies failed to discuss these issues properly or provide sufficient related information. For example, since effective pre-class learning in FC has highly relied on students' self-regulation skills, it is an essential factor to be explored for the overall success of the FC practice (Cheng et al., 2019). Evans et al. (2018) also indicated the need to discuss faculty preparation issues for the FC approach. How to provide training to faculty in terms of technology usage, pedagogical design, and instructional supports may be important questions to answer as well as other factors in the success of FC.

The Definition of Learning Effects of FC Needs to Be Clarified

Results from the FC reviews raised a concern about the definition of learning effects used in FC studies to examine the FC effectiveness. For example, Evans et al. (2018) pointed out that inconsistency in terminology was a concern in the FC studies. Additionally, when discussing possible conceptual ideas related to the effectiveness of FC, most of the FC studies mentioned a mix of pedagogical strategies without providing a thorough explanation nor referring to the educational or learning theories framework. Blended learning and active learning were two of the ideas that were commonly brought up when examining factors associated with the effectiveness of FC (Lundin et al., 2018). While blended learning and active learning are considered effective strategies to support learning, few studies distinguish the impacts of FC from the effects of blended learning or active learning. It aligned with Akcayir and Akcayir (2018)'s argument that without identifying the definition of the conceptual terms, it is difficult to determine that the shown effect of FC was the result from FC or from other learning modalities.

In addition to the definition of learning effects, the type of indicators used to examine FC effects on learning could also be a potential issue. The retained FC reviews showed that academic performance (e.g., test scores and course grades) and self-reported data (e.g., participants' motivation and perceptions of the learning experience in FC situations) were the primarily common evaluation methods used in FC studies. However, Lundin et al. (2018) argued that most of the FC studies in their review chose inappropriate ways to examine the effects on student learning. They stated that survey data like pre-and post-test scores or course questionnaires could not provide an in-depth analysis of whether or what learning occurred in FC. Given that the purpose of FC was to promote higher-level cognitive skills like application, creation and behavioral change, lower-levels of assessment like recall in a test may not necessarily be considered as an appropriate way to evaluate the effects of the FC approach (Chen et al., 2018). To delineate FC's effectiveness, better sensitive indicators to measure the higher-level cognitive outcomes need to be developed (Chen et al., 2018).

Despite the Overall Positive Impact on Learning, the Varied Effects of FC should be Further Examined with Sufficient Qualitative and Quantitative Data

Most of the FC reviews discussing the effect of FC included in this study indicated that compared to the in-class or lecture-based approach, the positive impact of FC on students' learning outcomes had the effect sizes as small to medium (Chen et al., 2018; Cheng et al., 2019). Furthermore, lacking reviews that can evaluate the effectiveness of FC systematically may result from insufficient data or design information in previous FC studies. Hew and Lo (2018) indicated that scant FC studies provided the detailed and necessary information to conduct a qualitatively or quantitatively systematic review, which may be why only five FC reviews in the present study contained enough statistical data to conduct their studies using a software like Comprehensive Meta-Analysis (CMA). Besides the shortage of necessary data for statistical investigation from FC studies, the lack of information about the pedagogical design and implementation of FC makes it hard to perform qualitative analyses. Cheng et al. (2019) indicated that FC researchers seemed interested in reporting the effects of FC on students' learning outcomes, rather than examining the learning environment's actual design and implementation features (pedagogy). Without the essential information like the instructional strategies that applied the FC approach during the online and in-class time or the instructors'

teaching experiences related to the FC approach, it would be difficult to know which factors contributed to the overall impacts of FC. The above results suggest that more information is needed to support the effects of FC on teaching and learning.

While most FC reviews agreed on the overall positive impact of FC on learning, compared to non-FC conditions, in general, the effect size varied. Also, its actual effectiveness on learning remains debatable. More detailed qualitative and quantitative data are needed for further systematic analysis to provide high-quality evidence to form policy decisions on how best to use FC to enhance learning. A more solid theoretical background to distinguish FC from other learning approaches like blended learning and self-regulated learning is needed to determine what contributes to the learning effect in FC conditions. A stronger focus on the planned studies about evaluation or assessment of FC and the development of evaluation tools could provide experimental evidence of the impact of FC on teaching and learning. A broader-level study design that focuses on longitudinal, large-scale, and multiple courses is needed, as well.

The authors acknowledge some inherent limitations in this study. In general, the discussions in this study are based on the information and findings from the included 13 FC reviews. In other words, their study heavily relied on the quality of these review studies. Possible problems from previous FC reviews, such as inadequate literature search or improper analysis of the findings, can impact the quality and results of this study. Furthermore, although they tried to locate high-quality reviews in the first place, it was inevitable to lose detailed information of the primary literature. They developed a search strategy to search for FC reviews that were published in a major database. However, there is still a possibility that they may have missed some relevant FC reviews. Studies that were published after the search date in this review were not included either. In addition, the authors did not check if the included reviews selected the same FC studies. Therefore, FC reviews that focused on similar research purposes might partially consist of the same FC studies.

As stated by many scholars, the FC approach holds much potential, including more hands-on time with students and opportunities for active and collaborative learning. The authors are looking forward to seeing more creative adoption of FC as a pedagogical tool that can be used with other strategies, rather than substituting or replacing another. They hope to promote more effective and engaging practices in teaching that ultimately create a highly positive impact on student learning. There needs to be additional research in a broader range of learning contexts, while combining FC approaches with other instructional innovations to achieve such goals.

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