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IMPACT OF FLIPPED LEARNING ON STUDENT SELF-EFFICACY ACROSS AGE GROUPS AND SUBJECT DOMAINS: A SYSTEMATIC REVIEW OF 44 STUDIES (2015-2024)

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ABSTRACT

Aim/Purpose	Flipped learning, in which students engage with instructional content before class and participate in active learning during class time, has emerged as an innovative teaching approach. While previous research has explored various aspects of flipped learning, its impact on student self-efficacy across different contexts remains understudied.
Background	This systematic review addressed two key research questions: (1) How does the flipped classroom approach affect students' self-efficacy? and (2) Does this effect vary by subject domain and student age?
Methodology	Following PRISMA guidelines, we analyzed 44 peer-reviewed articles (published between 2015 and 2024) from four major databases, encompassing 5,434 participants across 17 countries.
Contribution	This review uniquely contributes to the field by providing the first comprehensive analysis of the impact of flipped learning on self-efficacy across different educational contexts and age groups.
Findings	The review revealed that flipped classrooms significantly enhanced self-efficacy across all age groups, from K-12 to adult learners, with particularly strong effects in traditionally challenging subjects like mathematics and science. Quantitative analysis showed that 41 out of 44 (93%) studies reported positive effects on student self-efficacy, while only 3 showed no significant impact. Unlike previous research suggesting the effectiveness of flipped learning was limited to technical subjects, our findings demonstrate its broader applicability across diverse disciplines, including language learning and arts education. The study identified key success factors, including pre-class video accessibility (reported by

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	85% of studies) and interactive in-class activities (implemented in 91% of studies). However, technical infrastructure challenges and increased teacher preparation time emerged as primary implementation barriers.
Recommendations for Practitioners	These findings have important practical implications for educational institutions considering flipped learning implementation, suggesting the need for robust technical support systems and professional development resources for teachers.
Impact on Society	This review demonstrates that flipped learning represents a powerful tool for enhancing student self-efficacy across diverse educational contexts, but its effectiveness depends heavily on thoughtful implementation and adequate support structures.
Future Research	Future research could examine the optimal duration and intensity of flipped learning interventions and investigate how different types of pre-class content affect student self-efficacy outcomes.
Keywords	active learning, flipped learning, self-efficacy, self-regulation

INTRODUCTION

Modern education is continuously evolving with innovative approaches designed to enhance student learning and engagement. Among these approaches, flipped learning has emerged as a transformative pedagogical approach that fundamentally reimagines traditional classroom structures. In this model, students engage with new content outside of class through pre-recorded lectures or reading, while classroom time is dedicated to interactive, collaborative, and applied activities. Although the basic framework of flipped learning has gained considerable recognition, its impact on student self-efficacy, which is a critical predictor of academic success and persistence, remains incompletely understood.

Previous research has documented the various benefits of flipped learning for students, including improved learning outcomes (Cheng et al., 2019), enhanced student engagement (Bond, 2020), increased satisfaction (O’Flaherty & Phillips, 2015), and strengthened critical thinking skills (Akçayır & Akçayır, 2018). However, a significant gap exists in our understanding of how flipped learning affects student self-efficacy across educational contexts, age groups, and subject domains. This gap is particularly notable given that student self-efficacy – an individual’s confidence in their ability to complete specific tasks – plays a crucial role in shaping students’ attitudes, motivation, and academic behaviors. Students’ self-efficacy relates to individuals’ perceptions or beliefs about their academic abilities (Bandura, 1986). Students with high levels of academic self-efficacy typically achieve higher levels of performance, set higher goals, and are more resilient when facing difficulties (Bandura, 1986).

A recent meta-analysis by Y. L. Sun et al. (2023) examined the effect of flipped learning on student self-efficacy but focused exclusively on traditional versus flipped classroom comparisons in technical subjects. Our study extends this research by addressing two critical research questions.

1. How does the flipped classroom approach affect student self-efficacy across different educational contexts?
2. Does the impact of flipped learning on student self-efficacy vary by subject domain and student age?

The novelty of this study lies in its comprehensive examination of the impact of flipped learning on student self-efficacy across diverse educational settings, participants, and age groups. Unlike previous studies focusing on specific disciplines or contexts, this systematic review synthesizes evidence from

multiple educational levels (K-12, university, and adult education) and various subject domains (including technical and non-technical). This broader perspective enables us to identify patterns and principles that can guide effective implementation across different educational contexts.

The findings of this review have significant practical implications for educators and administrators. Understanding how flipped learning affects student self-efficacy across different educational contexts can help teachers design more effective flipped learning experiences, while insights into implementation challenges can guide institutions in developing the necessary support systems. By examining the interplay between flipped learning and student self-efficacy, this study contributes to our understanding of how innovative pedagogical approaches can empower learners and transform traditional educational models.

Bandura's (1986) self-efficacy theory provides a robust theoretical framework for understanding how flipped learning influences students' confidence and capabilities. The theory's focus on mastery experiences, vicarious learning, social persuasion, and psychological states aligns well with the core elements of flipped learning: self-paced content engagement, peer collaboration, teacher guidance, and active learning experiences (Bandura, 1986). This theoretical alignment suggests that flipped learning has the potential to enhance student self-efficacy through multiple pathways, making it worthy of systematic investigation.

The use of technology in flipped learning environments has generally been viewed favorably, with video lectures being particularly well received because of their flexibility and ability to be replayed. Students appreciate the ability to pause, rewind, and revisit lectures to facilitate their understanding (Algarni & Lortie-Forgues, 2023). Technological integration has been associated with increased student enjoyment, motivation, and peer interactions, ultimately fostering greater engagement and improving learning outcomes (Akçayır & Akçayır, 2018). However, the relationship between technological affordances and student self-efficacy requires a closer examination, particularly across educational contexts and subject areas.

Through this systematic review, we aim to provide educators and researchers with a comprehensive understanding of how flipped learning influences student self-efficacy while identifying the key factors contributing to implementing flipped learning across different educational contexts. By addressing these questions, this study fills a crucial gap in the literature and provides practical guidance for educators seeking to leverage flipped learning to enhance student confidence and success.

METHODS

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

ELECTRONIC SEARCH STRATEGY

The databases Web of Science, Educational Resources Information Center (ERIC), and Education Full Text EBSCO were searched for relevant texts using the search terms “flipped learning and self-efficacy,” “flipping and self-efficacy,” “flipping classroom and self-efficacy,” and “inverted classroom and self-efficacy” on May 1, 2024. All articles published between January 2015 and May 2024 were reviewed. Duplicate articles were excluded from the analysis.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria were defined as follows: (1) studies published in peer-reviewed articles, (2) contemporary research articles published from 2015 to May 2024, (3) studies that examined the effect of flipped classroom teaching methods on student self-efficacy, (4) studies with a comparison group (randomized or non-randomized, interventional), (5) participants were students, (6) the outcomes include improved or reduced student self-efficacy, and (7) studies published in English. Studies were included irrespective of students' educational level and subject type. The exclusion criteria were: (1)

studies that were review articles, editorials, conference proceedings, book chapters, and reports, (2) the outcomes did not include self-efficacy, (3) duplicate reports, or (4) articles not written in English.

A total of 44 articles were selected for full-text data review. The selection of the included articles was verified by an independent researcher, and any disputes were resolved through discussion.

DATA EXTRACTION

Data were extracted into a Microsoft Excel sheet. Data extracted included the authors, year of study, country of study, aim of the study, study design, subject matter domain of the study, education level of participants, classroom type, mode of intervention for flipped classrooms, period of intervention, in-class activities, method of outcome assessment, tool used to measure student self-efficacy, effect of intervention, and benefits and limitations of flipped classrooms.

DATA CODING AND ANALYSIS

All papers considered in this study were coded and analyzed using content analysis, a widely used approach for textual analysis. This method facilitates data comparison, contrast, and categorization (Krippendorff, 2019). Content analysis is a methodological and reproducible approach for condensing a large amount of textual information into smaller content categories. This was achieved using the clear coding principles outlined by Berelson (1952). The data were open-coded using the eight procedures outlined by Tesch (1990). Microsoft Excel was used to organize codes and categories effectively.

The studies were coded according to the first author's surname and year of publication. The study design included mixed-methods, quantitative randomized controlled trials, quantitative non-randomized studies, and quantitative descriptive studies. The mode of intervention was the method and medium used to teach students in the flipped classroom, which included educational videos, clips, or podcasts. The period of intervention was the period during which a flipped classroom was used to teach the students. The in-class activities were the methods used to ensure student engagement in class. The outcome assessment was the tool used to evaluate subject understanding. The subject taught using flipped classrooms was recorded. The measurement and effect of student self-efficacy was the scale or tool used to measure student self-efficacy and the effect of the intervention on student self-efficacy, respectively.

Students' age determines their perceptions, self-regulation, and affective characteristics (Bond, 2020). Since these characteristics may affect student self-efficacy (the main outcome), studies were separated based on the age of participants, and the results were reported for the three age groups. Adult students (pre-service teachers or potential trainers), ii) University students (college, university, or post-graduate students), and iii) K-12 students (elementary, middle, and secondary students). Data were also compared for the three age groups of students.

Data were summarized for each variable described above. Studies reporting qualitative data on student self-efficacy were analyzed separately. Data on the benefits and limitations of flipped classrooms were extracted and coded using inductive coding. Narrative synthesis of the data was preferred over meta-analyses because each study used different tools/questionnaires for the analysis of outcomes and student self-efficacy, making it difficult to compare the results across the studies. To establish inter-rater reliability, all studies were independently coded by two researchers (the author of this paper and an independent researcher with extensive experience in research). Twelve articles were randomly selected for comparison. Two code sets were analyzed using SPSS to calculate Cohen's kappa coefficient, resulting in a value of 0.74. Viera and Garrett (2005) indicate that values ranging from 0.61 to 0.80 reflect optimal agreement among researchers.

RESULTS

SELECTION OF STUDIES

The literature search identified 5475 studies after searching the Web of Science, Scopus, ERIC, and EBSCO databases. After applying the inclusion criteria, 161 relevant studies were screened. The full texts of these studies were examined, and 44 were included in this review (Figure 1).

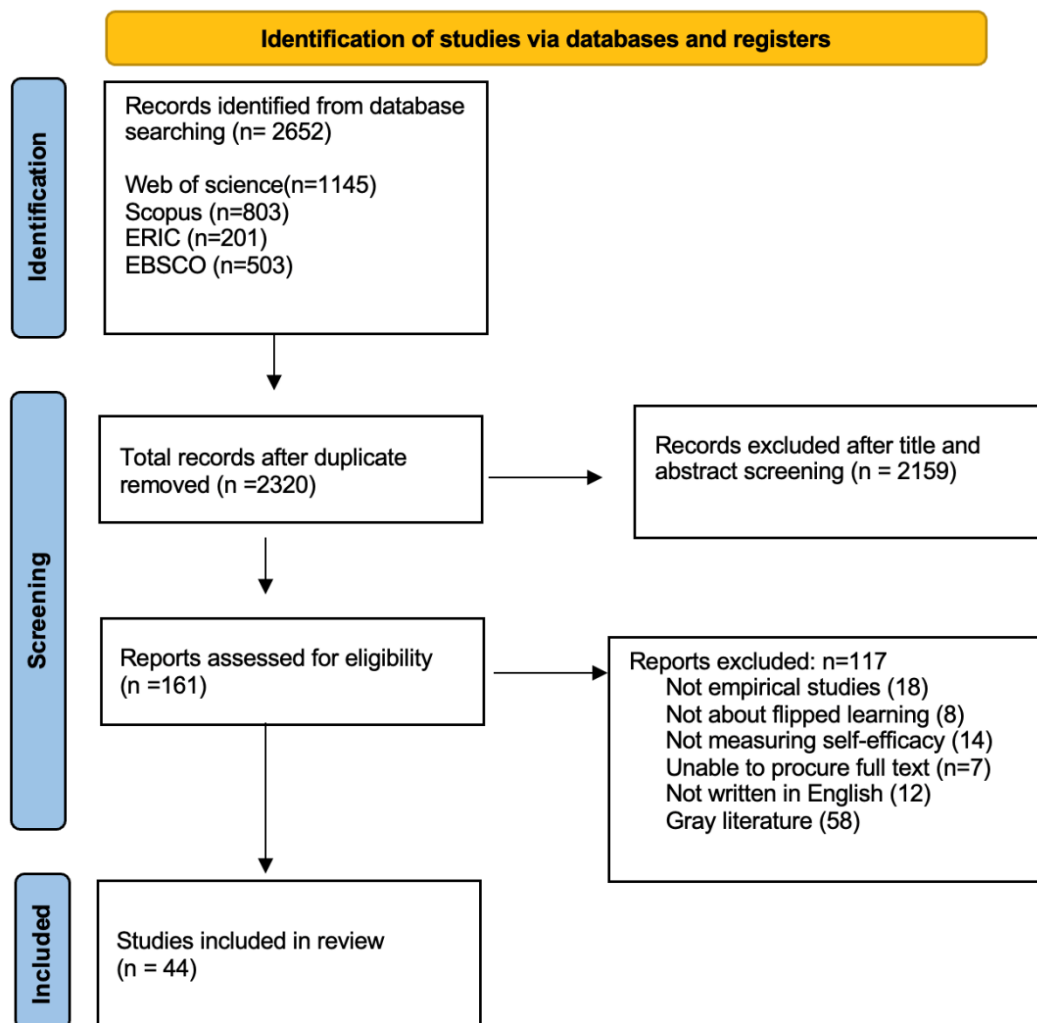


Figure 1. PRISMA flow diagram

YEAR-WISE DISTRIBUTION OF STUDIES

Studies were published between 2015 and 2024, with most published between 2020 (n=10) and 2023 (n=9) (Figure 2). Only one study was reported in 2024 because the search was conducted only four months into the year.

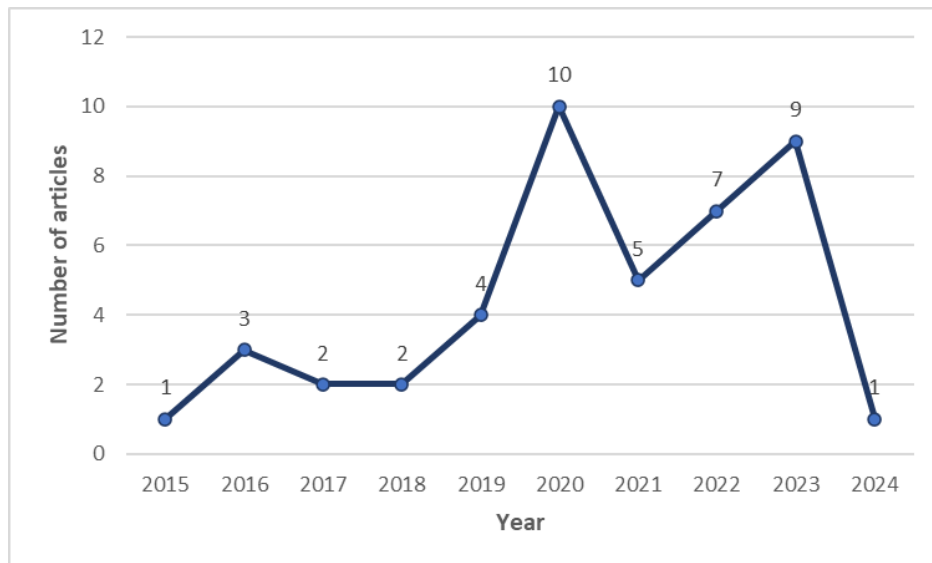


Figure 2. Year-wise distribution of studies

LOCATION OF INCLUDED STUDIES

The studies were conducted in 17 countries, including Taiwan (n=9), Turkey (n=7), China (n=4), Indonesia (n=4), Iran (n=3), the United States of America (n=3), Saudi Arabia (n=2), and Spain (n=2). One study was conducted in Australia, Canada, Cyprus, East Asia, France, Ghana, India, Korea, Malaysia, and Vietnam (see Appendix).

STUDY CHARACTERISTICS

A total of 44 studies were included in the review. The studies are summarized below based on the age of the participants (see Appendix).

Adult students

In a total sample of 872 pre-service teachers, 9/47 (19%) studies examined the effect of flipped classroom teaching on student self-efficacy. Teachers' self-efficacy is important for them to be confident and effective teachers, thus positively contributing to student learning (Kadioglu & Oskay, 2023). All nine studies were, in essence, pre-test and post-test study designs. Only one study described the effect of flipped classrooms on student self-efficacy (Candaş & Altun, 2023). In 3/9 (33%) studies, an analysis of participant responses (student satisfaction) was conducted after the intervention (Candaş & Altun, 2023; Dickenson, 2016; Kizkapan, 2023). The subject matter domain for the flipped classroom was science and its allied subjects for 5/9 (56%) studies, teaching methods for 3/9 (33%) studies, and English language for 1/9 (11%) studies. All studies compared the effects of flipped classrooms with those of traditional classrooms. Jin and Harp (2020) compared flipped classrooms with team-based flipped learning and found that team-based learning was more effective. The mode of intervention for 8/9 (89%) studies was audio-visual, and 1/9 (12%) studies (Candaş & Altun, 2023) did not report a mode of intervention. The in-class activities for these students included quizzes, group discussions, and task-based assessments. Outcome assessments were performed using a self-developed assessment for 7/9 (77%) studies and a previously published scale for 2/9 (22%) studies (Jin & Harp, 2020; Kadioglu & Oskay, 2023). Student self-efficacy was measured using an established scale by all studies except one study that used a self-designed scale (González-Gómez et al., 2022) and another study that did not measure student self-efficacy quantitatively (Candaş & Altun, 2023), instead describing the effect of flipped classrooms on student self-efficacy. All studies reported a significant positive effect of flipped classrooms compared with traditional teaching methods.

University students

In a total sample of 3430 university students, 24/44 (55%) studies examined the effect of flipped classroom teaching on student self-efficacy. The studies were, in essence, pre-and post-test study designs. There were 3/24 (13%) studies (Doo & Bonk, 2020; Latorre-Coscolluela et al., 2022; Li & Yang, 2021) that used an observational study design to describe the effect of flipped classrooms. In addition, 3/8 (38%) studies (Ahmed & Asiksoy, 2021; Hsia & Hwang, 2020; Li & Yang, 2021) followed the intervention with an analysis of participants' responses. The subject matter domain was science and its allied subjects for 15/24 (58%) studies; art in the form of dance, photography, and billiard skills for 4/24 (16%) studies; language and education for 4/24 (16%) studies; and one study that did not mention the subject domain. There were 13/24 (54%) studies that compared traditional classrooms with flipped classrooms and 2/24 (8%) studies that described the effect of flipped classrooms on students. The remaining 9/24 (37%) studies compared the effects of a modified flipped classroom with those of the original flipped classroom. All studies used audio-visual aids for the intervention, which included presentations, short videos, and relevant YouTube videos. Only one study (Ahmed & Asiksoy, 2021) used games as the intervention method. In-class activities for these students were usually peer or group discussions, worksheets, assignments, or peer-teacher discussions. The in-class activities were not described for 3/24 (13%) studies (AlJaser, 2017; Liu et al., 2019; Ramadoni & Mustofa, 2022). Outcome assessment was performed using an established test for only 9/24 (37%) studies, a self-developed method of assessment for 13/24 (54%) studies, and the assessment method was not mentioned for 2/24 (8%) (Croy et al., 2020; Li & Yang, 2021). Student self-efficacy was measured using published scales in most studies except for 9/24 (37%) that used a self-developed or adapted scale (Ahmed & Asiksoy, 2021; AlJaser, 2017; Li & Yang, 2021; Y. N. Lin et al., 2021; Ramadoni, 2023; Ramadoni & Mustofa, 2022; Sockalingam et al., 2016; Zheng et al., 2020; Zhu et al., 2020). When comparing flipped and traditional learning, a significant positive effect of flipped classrooms on student self-efficacy was reported in 18/24 (75%) studies, although no significant effects of flipped classrooms were reported in 3/12 (25%) studies (Ahmed & Asiksoy, 2021; Croy et al., 2020; Thai et al., 2020). In addition, one study observed a significant negative outcome (Ramadoni, 2023) in a comparison of conventional flipped classrooms to peer-teaching flipped classrooms; peer teaching had a more positive impact on student self-efficacy than conventional flipped classrooms. Although Ramadoni (2023) reported a negative effect, there had been more effort given in the study toward implementing a peer-teaching flipped classroom in comparison to the flipped classroom, resulting in a spurious negative effect for flipped classroom teaching.

K-12 students

Twelve studies examined the effect of flipped classroom teaching on student self-efficacy in a total sample of 1506 K-12 students. All study designs were, in essence, pre-test and post-test study designs. An observational study was used to describe the effect of flipped classrooms in 3/12 (25%) studies (Doo & Bonk, 2020; Latorre-Coscolluela et al., 2022; Li & Yang, 2021). An analysis of participant responses regarding the effect of flipped classrooms was conducted in 3/8 (38%) (Algarni & Lortie-Forgues, 2023; Boateng et al., 2022; Chang, 2023). The subject matter domain for the flipped classrooms was science and its allied subjects in 5/12 (58%) studies, English language in 5/12 (42%), and arts in 2/12 (17%) studies. Traditional classrooms were compared with flipped classrooms in 9/12 (54%) studies, and the effect of a modified flipped classroom was compared with a flipped classroom in 3/12 (25%) studies (Lai & Hwang, 2016; J. C. Y. Sun & Lin, 2022; Ye et al., 2019). The mode of intervention for all studies was audio-visual, such as vodcasts, visualizations, educational videos, and clips, except for two studies, which used games (Ökmen & Kılıç, 2020) and e-books (Lai & Hwang, 2016). Students used different in-class activities such as peer evaluation, monitoring platforms, group discussions, and assignments. The monitoring methods were not reported in 2/12 (16%) studies. Outcome assessment was conducted using an established test for 2/12 (17%) studies (Algarni & Lortie-Forgues, 2023; Namaziandost & Çakmak, 2020) and a self-developed method of assessment in 9/12 (75%) studies. Only 1/12 (8%) of the study did not mention the method of assessment (Marina & Ridlo, 2021). Student self-efficacy was measured using published scales in most

studies, except for 2/12 (17%) studies that used a self-developed or adapted scale (Astawa et al., 2022; Marina & Ridlo, 2021). A significant positive effect on student self-efficacy was found using the flipped classroom method compared to the traditional method.

SUBJECTS AND TIME OF INTERVENTION

Subjects taught in flipped classrooms were categorized into mathematics, teaching methods, English language, arts, science, medicine, and related subjects, as well as computers. Most studies have used flipped classrooms for mathematics, English language, and teaching methods, which are considered difficult to master and may be a significant source of anxiety for students. Improved student self-efficacy in these subjects will motivate students and improve the ability of pre-service teachers to teach. Most studies intervened for 1-8 weeks or more than 8 weeks. The minimum period of intervention was one session (number of hours not mentioned), and the maximum period was 18 weeks. The intervention period was less than one week for 3/44 (7%). This was a very short intervention period, and there may be no effect of the intervention (Y. L. Sun et al., 2023).

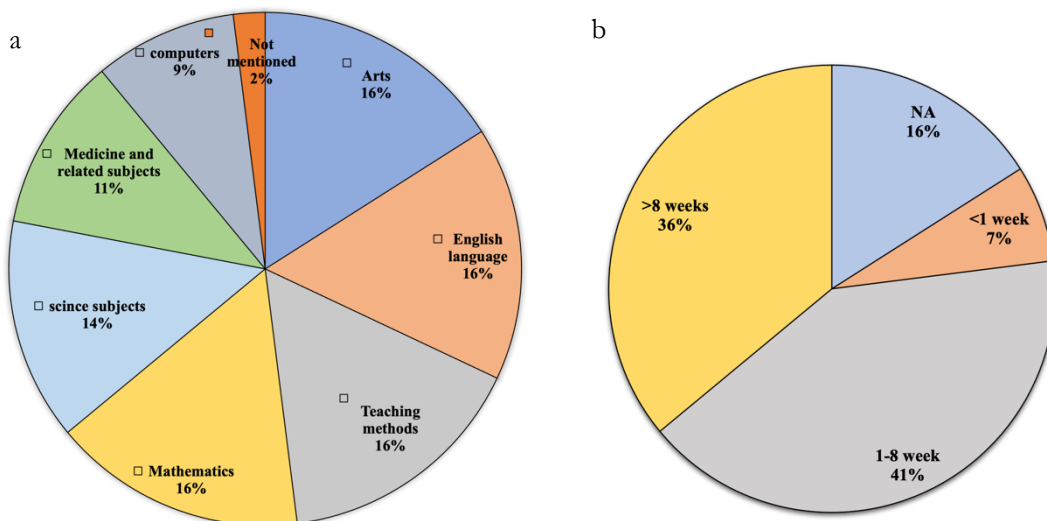


Figure 2. Description of flipped classrooms wherein (a) indicates subjects domains chosen for intervention, and (b) indicates the period of intervention

TOOLS USED TO MEASURE STUDENT SELF-EFFICACY

The most frequently used tool to measure student self-efficacy was the Motivated Strategies for Learning Questionnaire developed by Pintrich et al. (1993), with 9/44 (20%) studies using the tool, 4/44 (9%) studies used the self-efficacy questionnaire developed by Wang and Hwang (2012), and the remaining studies using scales such as the Technological Pedagogical Content Knowledge (TPACK) Scale (Kadioglu & Oskay, 2023), self-efficacy questionnaire (Chang, 2023; G. Y. Lin, 2016), Scientific Research Self-Efficacy Scale (SRSES) (Akçöltekin, 2020; Kizkapan, 2023), Foreign Language Self-Efficacy Scale (Bachman, 1990; Bi et al., 2023; Karnchanachari, 2019), General Self-Efficacy Scale (GSE) (Croy et al., 2020; Latorre-Coscolluela et al., 2022; Schwarzer & Jerusalem, 1995), self-efficacy questionnaire (Zhao et al., 2021), mathematics self-efficacy scale (Umay, 2001; Yorganci, 2020), self-efficacy questionnaire (Thai et al., 2020; Zajacova et al., 2005), Computer Attitude Scale (CAS) (Selwyn, 1997) and pre-service teachers' ICT competencies (Jin & Harp, 2020; Tondeur et al., 2017), the self-efficacy questionnaire (Najeeb & George, 2022; Wang & Lin, 2007; Ye et al., 2019), Computer Programming Self-Efficacy Scale (CPSS) (Altun & Mazman, 2012; Özyurt & Özyurt, 2018), Ohio State Teacher Efficacy Scale (OSTES) (Dickenson, 2016; Tschannen-Moran & Hoy, 2001), Computer Programming Self-Efficacy Scale (CPSES) (D'Souza & Rodrigues, 2015; Ramingalingam & Wiedenbeck, 1998), and General self-efficacy scale (GSES) (Li & Yang, 2021).

PERCEPTIONS OF THE FLIPPED CLASSROOM APPROACH

A total of 20/44 (47%) studies conducted qualitative studies on the advantages and limitations of flipped classrooms. Respondents from these studies believed that the flipped classroom approach enhanced subject understanding and engagement because of the ability to see videos whenever they needed to further their understanding, which increased interactions with peers and teachers and improved learning outcomes (Table 1). The main limitations identified were that there could be technical issues in watching the videos such as an unreliable internet connection (Ahmed & Asiksoy, 2021; Algarni & Lortie-Forgues, 2023), restructuring the course material to the needs of a flipped classroom takes significant time and increases the workload for teachers (Algarni & Lortie-Forgues, 2023; Boateng et al., 2022; Chyr et al., 2017; Zhu et al., 2020), problematic student behavior may be encouraged by the approach (such as laziness) (Dickenson, 2016; Zhu et al., 2020) and surprisingly, in one study, a student responded that flipped classrooms reduced subject understanding (Kadioglu & Oskay, 2023).

Table 1. Benefits of a flipped classroom approach

Codes	n	References
Need based availability of content	8	(Ahmed & Asiksoy, 2021; Algarni & Lortie-Forgues, 2023; Boateng et al., 2022; Chyr et al., 2017; Dickenson, 2016; Kadioglu & Oskay, 2023; Yorganci, 2020; Zhao et al., 2021)
Enhanced peer interaction	6	(Algarni & Lortie-Forgues, 2023; Astawa et al., 2022; Chang, 2023; Hsia & Hwang, 2020; Kadioglu & Oskay, 2023; Zheng et al., 2020)
Increased/enhanced teacher interactions	5	(Ahmed & Asiksoy, 2021; Aksoy & Pasli Gurdogan, 2022; Algarni & Lortie-Forgues, 2023; Chyr et al., 2017; Zhao et al., 2021)
Enhanced subject understanding	5	(Aksoy & Pasli Gurdogan, 2022; Astawa et al., 2022; Li & Yang, 2021; Ramadoni, 2023; Ramadoni & Mustofa, 2022)
Improved learning outcomes	4	(Namaziandost & Çakmak, 2020; Özyurt & Özyurt, 2018; Sockalingam et al., 2016; Zhu et al., 2020)
Increased confidence	2	(Astawa et al., 2022; Boateng et al., 2022)
Enhanced engagement	2	(Boateng et al., 2022; Chang, 2023)
Enhanced retention	1	(Kadioglu & Oskay, 2023)
Critical thinking skills	2	(Astawa et al., 2022; Namaziandost & Çakmak, 2020)
Improved reflection	2	(Li & Yang, 2021; Namaziandost & Çakmak, 2020)
Improved attitude	1	(González-Gómez et al., 2022)
Learning flexibility	1	(Aksoy & Pasli Gurdogan, 2022)
Decreased anxiety	1	(Chang, 2023)
Increased satisfaction	1	(Zhao et al., 2021)
Increased competence	1	(Yorganci, 2020)
Active learning	1	(Zhu et al., 2020)
Self-regulated	1	(Zhu et al., 2020)
Enhanced student knowledge	1	(Boateng et al., 2022)

In summary, most studies used a pre-post-study design to evaluate the effect of the intervention and an audio-visual mode of intervention. The in-class activities used for evaluation were usually group discussions with peers and teachers and quizzes for younger students. In contrast, older students were required to submit assignments or task-based assessments. The most frequently used subjects in flipped classrooms were science-related. Most students reported increased student self-efficacy for

their subjects when they were taught using the flipped classroom method compared with the traditional teaching method. Improved student self-efficacy in flipped classrooms did not differ according to the learning subject. This method was mainly used to teach science and English, as they are considered more difficult subjects. Although the flipped learning method improved student self-efficacy irrespective of student age, younger students were more flexible and accepted this unique method of teaching faster than older students.

DISCUSSION

This systematic review highlighted the significant effects of flipped learning environments on student self-efficacy. Flipped classrooms enable students to take greater control and ownership of their educational journey by shifting from traditional learning models to active, self-regulated learning. Switching from a passive to an active learning paradigm strengthens students' self-confidence as academic learners while creating deeper engagement with the material. Future studies should investigate the long-term effects of flipped learning by examining its influence on student self-efficacy and long-term academic results.

This review summarizes the effects of the flipped classroom teaching method on students of different age groups from 17 countries and different subject domains. It evaluated the effect of flipped classrooms on students' self-efficacy, as it is believed that the effect of flipped classrooms on student engagement, learning, and learning outcomes is better described using the concept of student self-efficacy. A previous review by Y. L. Sun et al. (2023) evaluated the quantitative effects of flipped classrooms on student self-efficacy by measuring it through a compilation of self-efficacy scores generated through a systematic review. We believe that narrative synthesis is better suited to describe the effect because student self-efficacy has been measured using different scales in previously published studies. The heterogeneity of measurement in these scales may contribute to incorrect estimates of the effect of flipped classrooms on student self-efficacy.

GEOGRAPHICAL DISTRIBUTION

Studies have reported the effects of flipped classrooms on student self-efficacy in 17 countries. When digital literacy in these countries was compared using the components of the Digital Skill Gap Index, Taiwan, China, and Saudi Arabia were the most digitally literate, whereas Ghana, Iran, and Turkey were the least literate. This score is important in the context of this review because digital literacy is directly related to the acceptability and ability of students to participate in flipped classrooms. A digitally literate population will be able to access and view videos and submit assignments in an electronic format better than a less digitally literate population. Despite these varying literacy levels, problems in watching videos because of Internet issues surprisingly emerged in Cyprus and Saudi Arabia, which are more digitally literate. Future studies should document problems arising from technical limitations when studying the effects of flipped classrooms.

Table 2. Digital skills score in the population of countries

Countries	Malaysia	United States	Saudi Arabia	Taiwan	Canada	Australia	Korea	Cyprus	China
Digital skill score in the population	8.6	8.5	8.5	8.1	7.8	7.6	7.5	7.1	6.5
Countries	Indonesia	France	India	Spain	Vietnam	Ghana	Iran	Turkey	
Digital skills among the population	6.1	6	5.9	5.6	5.3	5.2	4.9	3.2	

SUBJECTS

Various subjects were taught using flipped classrooms, mainly in the science and arts streams. We observed that topics that were generally difficult to understand caused anxiety and had less acceptance were taught in flipped classrooms. Our findings challenge previous assertions that the effectiveness of flipped learning is limited to technical subjects (Y. L. Sun et al., 2023). Mathematics students reported that they were able to understand mathematical concepts by repeatedly rewatching videos, whereas dance students were able to enhance reflections and exchange opinions with their peers (Algarni & Lortie-Forgues, 2023; Hsia & Hwang, 2020). Students of English learning began appreciating the global value of the language in terms of access to learning and holistic knowledge, in comparison with the limited knowledge available when there are language barriers (Ökmen & Kılıç, 2020). In particular, students of English learning reported an improvement in their confidence, ability to interact, and subsequently, their student self-efficacy (Namaziandost & Çakmak, 2020; Ökmen & Kılıç, 2020).

MONITORING AND OUTCOME ASSESSMENT

Monitoring the implementation of an intervention is necessary for understanding its acceptability and uptake. Monitoring of flipped classrooms was conducted through in-class activities. Most studies ensured constant teacher guidance using a universal messaging application or messaging application on the teaching/educational platform. This resulted in immediate answers to questions and facilitated discussions with peers and teachers at the end of the sessions. Peer interactions on these platforms were conducted either through shared assignments or discussion forums. This finding aligns with a systematic review reporting that improved self-regulation results in better learning outcomes with the availability of online help in flipped classrooms (Rasheed et al., 2020). In-class activities differed by the age of students, with younger age groups generally having quizzes, task-based assignments, and discussions, whereas older age groups had discussions with their peers and teachers.

Different assessment methods were used to evaluate the participants' understanding. Notably, 67% of the studies relied on self-developed methods of assessment compared to 25% that used standard evaluation methods, such as scholastic achievement tests or published assessment scales. This measurement heterogeneity makes direct comparisons challenging and may affect the reliability of our conclusions. Future studies should prioritize the use of published scales to better understand the impact of flipped classrooms on learning outcomes and, consequently, inform readers about the true effect of flipped classrooms.

EFFECT OF FLIPPED CLASSROOMS ON STUDENT SELF-EFFICACY

All studies showed a significant positive effect on student self-efficacy when the flipped classroom method of teaching was compared to the traditional method of teaching. Some studies reported a significant negative effect or no effect on student self-efficacy compared with flipped classrooms. These studies compared flipped classrooms with a modified flipped classroom method, such as the peer-teaching flipped classroom method (Ramadoni, 2023) or the gamified flipped classroom method (Ahmed & Asiksoy, 2021). The consensus from the studies was that flipped classrooms improve subject understanding by maintaining student engagement with the subject, which in turn increases student self-efficacy.

Receiving the course material before the session enabled the students to self-pace and regulate their learning, wherein the basic concepts of the course were understood. This maximized class time for discussions, solving and clarifying difficult concepts, collaborative activities, and analyzing test-case scenarios, creating a dynamic environment for active learning, as previously reported (Algarni, 2023; Bond, 2020). Maximized class time improved learning outcomes and student self-efficacy. Students of all ages positively responded to the flipped classroom method. The most important benefits of flipped classrooms are their ability to revisit videos and their flexibility in teaching methods. This allowed teachers to be creative when explaining concepts in comparison with traditional classrooms,

resulting in better understanding. Rewatching videos resulted in self-paced and individualized learning experiences, increasing enjoyment and satisfaction.

Positive outcomes for student self-efficacy were reported by the students and teachers who participated in the intervention. The students reported that they were excited to see the videos and could access them whenever needed. Since younger students are technologically adept, they found the process of flipped classrooms easy to use and adapt. They responded positively to peer and teacher discussions, where they were able to learn not only from their teachers but also understand, debate, and build upon different viewpoints from their peers. This ensured information retention and conceptual clarity. Discussions help dispel anxiety and increase student confidence and, ultimately, student self-efficacy (Aksoy & Pasli Gurdogan, 2022; Algarni & Lortie-Forgues, 2023; Boateng et al., 2022; Chang, 2023; Chyr et al., 2017; Dickenson, 2016; Kadioglu & Oskay, 2023; Y. N. Lin et al., 2021).

Teachers responded positively to the flipped classroom teaching method, stating that students studying concepts before class freed up time for concept clarification, discussion, and doubt resolution during class time. In-class activities enhance students' understanding of concepts, curiosity, critical-thinking skills, and decision-making abilities. This encouraged students to take responsibility for their learning and increased peer-to-peer and peer-teacher interactions, which increased their satisfaction with both teachers and students. Students felt accomplished when they completed in-class activities, increasing their sense of competence and their student self-efficacy (Aksoy & Pasli Gurdogan, 2022; Algarni & Lortie-Forgues, 2023; Astawa et al., 2022; Boateng et al., 2022; Namaziandost & Çakmak, 2020; Yorganci, 2020).

The challenge of flipped learning is to manage students' negative behaviors, such as the procrastination of watching videos, distraction, and laziness, when participating in class activities. This creates a sense of burden among the peers, particularly during group assignments. There may be difficulties in understanding the subject or topic, and immediately addressing these difficulties may not be possible. Hence, teachers need to integrate online discussion tools within their flipped classrooms in order for this to be an accepted teaching method (Akçayır & Akçayır, 2018). Teachers also believe that flipped classrooms will increase their workload when the topic must be converted into an audio-visual aid. Classrooms with topics of discussion and in-class and out-of-class activities must be planned so that information can be conveyed effectively. Teachers and students must be technologically competent and have access to supportive technological resources in order for the classroom to be effective. Supportive technological resources include universities that provide a dedicated team to assist teachers in converting lectures into videos or other audio-visual aids (Ahmed & Asiksoy, 2021; Algarni & Lortie-Forgues, 2023; Bond, 2020; Kadioglu & Oskay, 2023; Sockalingam et al., 2016; Zhu et al., 2020).

Bandura defined self-efficacy as the belief that an individual must accomplish tasks in a particular situation. He listed four sources of self-efficacy: enactive mastery experiences, vicarious experiences, social persuasion, and psychological status. Flipped classrooms address all these sources. Enactive mastery experiences are related to students' accomplishments and the confidence gained by successfully completing more complex assignments. This can be addressed by gradually increasing the complexity of course materials, where videos of basic materials are available when learning complex concepts. Vicarious experiences indicate peer successes and failures. Peer and teacher interactions through various modes during the sessions motivated the students to improve their capabilities. Social persuasion refers to the influence of family, teachers, and peers on learning. An open discussion forum for teachers and students held during the flipped classroom sessions addressed this component. Students' psychological states are triggered during this learning process; a positive learning experience increases self-efficacy, whereas difficulty understanding can make students anxious and reduce self-efficacy. A positive learning experience can be created through active learning during regular class time, thereby increasing conceptual understanding. Thus, flipped classrooms are ideal tools for increasing students' self-efficacy. Empowerment provided by this approach plays a pivotal role in strengthening students' belief in themselves and positively shaping their academic journeys.

STUDY LIMITATIONS AND FUTURE RESEARCH

This review has several important limitations. The use of only four databases may have excluded relevant studies, particularly those from regions underrepresented in major academic indices. Studies vary significantly in intervention duration (1-18 weeks) and implementation quality, making it difficult to isolate the specific components that most effectively enhance student self-efficacy. Most studies focused on individual subjects rather than on comprehensive curriculum implementation, leaving unanswered questions about the sustainability of flipped learning across multiple courses. In addition, the predominance of short-term studies limits our understanding of the impact of flipped learning on student self-efficacy and academic achievement.

Future research should pursue longitudinal studies to investigate long-term effects on student self-efficacy and academic performance through a multiyear follow-up. Developing and validating standardized tools to measure student self-efficacy in flipped learning contexts will enable reliable comparisons across studies. A systematic examination of implementation factors such as duration, technology integration, and teacher training could help identify the best practices for maximizing effectiveness. Additionally, expanded research in diverse cultural and socioeconomic contexts would enhance our understanding of how different educational systems best adapt to flipped learning.

CONCLUSION

This systematic review makes several unique contributions to our understanding of the impact of flipped learning on student self-efficacy. First, unlike previous reviews that focused solely on technical subjects or traditional versus flipped classroom comparisons, our analysis of 44 studies encompassing 5,434 participants across 17 countries provides the first comprehensive examination of the effects of flipped learning across diverse educational contexts, age groups, and subject domains. Second, our findings challenge the prevailing notion that flipped learning is primarily effective for technical subjects, demonstrating that it can enhance student self-efficacy across a broad spectrum of disciplines, from mathematics and science to language learning and arts education.

The mode of intervention was the method and medium used to teach students in the flipped classroom, which included educational videos, clips, or podcasts. To address our first research question regarding how flipped classrooms affect student self-efficacy, our review revealed that 93% of the studies reported positive effects on student self-efficacy. This improvement appears to be driven by several key mechanisms: the ability to self-pace learning through rewatchable content, enhanced peer-to-peer interaction during class, and increased opportunities for individualized teacher support. However, our analysis also revealed important nuances, with three studies showing no significant impact and one showing a negative effect compared to peer teaching methods, highlighting the importance of implementation quality and context.

For our second research question, which examined variations by subject domain and student age, we found that the effectiveness of flipped learning transcended traditional subject boundaries. While particularly strong effects were observed in traditionally challenging subjects, such as mathematics and science, significant improvements in student self-efficacy were also documented in language learning and arts education. Age-related differences emerged primarily in implementation preferences rather than in overall effectiveness, with younger students generally adapting more readily to the technological aspects of flipped learning.

The practical implications of these findings are substantial for educational institutions considering implementing flipped learning. Success requires a three-pronged approach: a robust technological infrastructure to support content delivery, comprehensive teacher training in both the technical and pedagogical aspects of flipped learning, and careful attention to student readiness and support needs. Institutions should focus on developing strong support systems for content creation and ensuring reliable Internet access, as these have emerged as critical success factors.

However, several important gaps in the current understanding require further investigation. Future research should prioritize longitudinal studies examining the sustainability of student self-efficacy improvements over time, as most current evidence comes from relatively short-term interventions. The standardization of self-efficacy measurement tools is crucial because the predominance of self-developed assessment instruments (67% of studies) currently limits direct comparisons across contexts. Additionally, research is needed to better understand how flipped learning can be effectively scaled across an entire curriculum, as most existing studies have focused on individual subjects.

Specific recommendations for future research include examining the optimal duration and intensity of flipped learning interventions, investigating how different types of pre-class content affect student self-efficacy outcomes, exploring the role of student characteristics in determining effectiveness, and conducting cost-benefit analyses to guide institutional implementation decisions. Cross-cultural studies are required to understand how different educational systems and cultural contexts best adapt to flipped learning approaches.

In conclusion, this review demonstrates that flipped learning is a powerful tool for enhancing student self-efficacy across diverse educational contexts; however, its effectiveness depends heavily on thoughtful implementation and adequate support structures. The shift from traditional to flipped learning environments offers promising opportunities for transforming educational experiences and outcomes, particularly when institutions pay careful attention to both technical infrastructure and pedagogical quality. As educational technology continues to evolve, understanding how to optimize the implementation of flipped learning will become increasingly crucial for institutions seeking to enhance students' self-efficacy and academic success.

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APPENDIX: CHARACTERISTICS OF STUDIES

Adult students (9 studies, n=872)

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Candaş & Altun, 2023)	Turkey	Multi-method research model	180	General chemistry laboratory	Flipped classroom vs traditional classroom	NA	13 weeks	Group discussions	NA	NA	Significant positive effect
(Kizkapan, 2023)	Turkey	Multi-method research (pre-post design + correlational design)	33	Research self-efficacy	Flipped classroom vs traditional classroom	Lecture videos	16 weeks	Group discussions with teacher	End of term grades, posttest	Scientific Research Self-Efficacy Scale (SRSES) (Akçöltekin, 2020)	Significant positive effect
(Kadioglu & Oskay, 2023)	Turkey	Pre-post design intervention study	25	Teaching methods	Flipped classroom vs traditional classroom	Educational videos using a teaching platform	NA	Weekly meetings	Technological Pedagogical Content Knowledge Scale	Technological Pedagogical Content Knowledge (TPACK) scale (Horzum et al., 2014)	Significant positive effect
(Bi et al., 2023)	Iran	Quantitative randomized controlled trial	374	English language	Flipped classroom vs traditional classroom (before intervention)	Videos, clips, podcasts	NA	Task-based assessment	Assessments	Foreign language self-efficacy scale (Bachman, 1990; Karnchanachari, 2019)	Significant positive effect
(González-Gómez et al., 2022)	Spain	Pre-post interventional study design	68	General science course	Flipped classroom vs traditional classroom	Video lessons	15 weeks	Quizzes, online questionnaires	Pretest and posttest questionnaires	Questionnaire adapted from self-efficacy questionnaire (Bandura, 2001) and Science Teaching Efficacy Belief Instrument- Preservice (STEBI-B) (Riggs & Enochs, 1990)	Significant positive effect

The Impact of Flipped Learning on Student Self-Efficacy

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Zhao et al., 2021)	China	Quasi-experimental study	77	Modern education technology	Flipped classroom vs traditional classroom	Educational video	6 weeks	QQ messaging; practice assignment and transfer assignment	Pretest/posttest questionnaires of learning satisfaction, learning motivation (Cho, 2019; Wang, 2010; Hwang, 2013)	Self-efficacy questionnaire (Cho et al., 2019; Hwang et al., 2013, Sergis et al., 2018, Wang & Chen, 2010)	Significant positive effect
(Jin & Harp, 2020)	United States	Pre-post research design	32	Teacher education	Flipped learning vs team based flipped learning	Educational videos using a teaching platform	NA	Online quizzes, discussion forums and activities	TPACK survey and computer attitude scale	Computer Attitude Scale (CAS) (Selwyn, 1997) and pre-service teachers' ICT competencies (Tondeur et al., 2017)	Significant positive effect
(Raman et al., 2019)	Malaysia	Quasi-experimental non-equivalent groups design	35	Mathematics in information technology	Flipped classroom vs traditional classroom	Videos on padlet	6 weeks	Moodle-activities such as quizzes, forums, assignments, reflection	Questionnaire	Self-efficacy scale (Greene et al., 2004).	Significant positive effect
(Dickenson, 2016)	United States	Randomized controlled trial	48	Teacher education	Flipped classroom vs traditional classroom	Pre-recorded lectures	5 months	Discussion boards and quick writes, peer evaluation	Posttest questionnaire	Ohio State Teacher Efficacy Scale (OSTES) (Tschannen-Moran & Hoy, 2001)	Significant positive effect

University students (24 studies, n=3430)

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Ramadoni, 2023)	Indonesia	Quantitative descriptive study	70	Mathematics	Flipped classroom vs peer teaching flipped classroom	Educational videos	8 weeks	NA	Essays and questionnaires	Self-efficacy questionnaire and sheet (self-designed)	Significant negative effect
(H. C. Lin et al., 2023)	Taiwan	Quasi-experimental design	76	Neurology	Virtual reality flipped classroom vs traditional classroom	Powerpoint slides, videos, quizzes	30 mins	Worksheets, VR content	Pretest, posttest and skills set questionnaire	Self-efficacy questionnaire (Wang & Hwang 2012)	Significant positive effect
(Hsiao et al., 2023)	Taiwan	Quasi-experimental study design	102	Tourism for English	Flipped classroom vs traditional classroom	YouTube videos and pre-viewing vocabulary using Moodle	18 weeks	Group discussion, short oral presentations using Socrative and Kahoot!	Pretest and posttest questionnaire, semi-structured interviews, mid-term and final exam	The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)	Not calculated correctly
(Ramadoni & Mustofa, 2022)	Indonesia	Pre-post design intervention study	70	Mathematics	Flipped classroom vs peer teaching flipped classroom	Educational videos	8 weeks	Group discussions	Pretest and posttest questions in the form of essays	Self-designed questionnaire	Significant negative effect (spurious)
(Cecilia Latorre-Coscolluela et al., 2022)	Spain	Descriptive study	376	Education	Flipped classroom approach description using online or offline platforms	Audio-visual material	3 weeks	Online activities designed by teacher	Quiz type questions, elaboration of mind maps or design of questions to exchange with other classmates	The General Self-Efficacy (GSE) scale (Baessler & Schwarcer, 1996)	Significant positive effect
(Aksoy & Pasli Gurdogan, 2022)	Turkey	Single-blind randomized controlled trial (true as described)	94	Nursing	Flipped classroom vs traditional classroom	Videos and web-based learning	4 weeks	Discussions with instructor	Theoretical and skill exam	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)	Significant positive effect

The Impact of Flipped Learning on Student Self-Efficacy

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Ahmed & Asiksoy, 2021)	Cyprus	Randomized trial + qualitative inquiry of experimental group only	70	Physics	Gamified flipped classroom vs flipped classroom	Gamified learning, videos	10 weeks	Moodle, in-class discussions	Questionnaires assessing innovation skill, quizzes	Self-designed self-efficacy questionnaire	No effect
(Y. N. Lin et al., 2021)	Taiwan	Randomized trial + qualitative	75	Billiard skills (physical education)	SQIRC-based mobile flipped classroom vs conventional flipped classroom	SQUIRC-based videos, Annotation, Summarizing, Questioning and Interflow (ASQI) mobile conventional FC	10 weeks	Peer discussion and evaluation	Posttest of striking strategies, learning motivation and self-efficacy	Questionnaire modified from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)	Significant positive effect
(Zheng et al., 2020)	China	Quantitative randomized controlled trial	92	News photography course (digital media)	Flipped classroom vs traditional classroom	Use of a mind mapping tool in the regional language	3 weeks	Drawing of a mind map individually and with peers	Test and questionnaire	Self-efficacy questionnaire adapted from Hsia et al. (2016) and Wang and Hwang (2012)	Significant positive effect
(Yorganci, 2020)	Turkey	Pre-post research design	163	Mathematics	Flipped classroom vs e-learning classroom vs blended learning	Lecture videos, lecture articles, interactive exercises on Moodle, Khan Academy platform	8 weeks	Short interactive questions	Online self-regulated learning questionnaire (Barnard 2009)	Mathematics self-efficacy scale (Umay, 2001)	Significant positive effect
(Zhu et al., 2020)	China	Pre-post interventional study design	200	Ophthalmology courses	Flipped classroom vs traditional classroom	Online videos	8 and 6 weeks (classes had different periods of intervention)	Quiz, discussion and PowerPoint presentation	Skill exams	Self-constructed questionnaire from Qi (2015), Chen and Chen (2014), and Zhang and Li (2009)	Significant positive effect
(Croy et al., 2020)	Australia	Pre-post research design	148	Nursing	Flipped learning classroom vs traditional classroom	Compressed learning	3 weeks	Reflective activities	Not mentioned	General Self-Efficacy scale (GSE) (Schwarzer & Jerusalem, 1995)	Not significant

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Hsia et al., 2022)	Taiwan	Pre-post design intervention study+ qualitative research	129	Dance	ASQI based flipped classroom vs traditional flipped classroom	Instructional videos	4 weeks	Teacher periodically examined	Worksheets, dance performance evaluation rubric	Self-efficacy questionnaire adapted from Pintrich (1991)	Significant positive effect
(Thai et al., 2020)	Vietnam	Mixed methods	106	Animal and Human Physiology	Traditional classroom vs e-learning vs blended learning vs flipped classroom	Video clips on the Dokeos educational platform	5 weeks	Group discussions with teacher	Self-designed questionnaire	The self-efficacy questionnaire (Zajacova et al., 2005)	Not significant
(Y. N. Lin et al., 2019)	Taiwan	Mixed methods	114	Dance	Mobile peer assessment-based flipped classroom vs conventional flipped classroom vs traditional classroom	Online videos and peer -assisted learning	9 weeks	Teacher evaluation	Posttest of skills	Self-efficacy questionnaire (Pintrich et al., 1991)	Significant positive effect
(Liu et al., 2019)	France	Mixed methods	50	English language	Traditional flipped classroom vs blended learning vs fully e-based learning vs flipped classroom	Online videos and solving guided questions using the Moodle platform	4 weeks	Questions and answers	Self-designed pre-post questionnaire	Self-efficacy questionnaire (Wang & Hwang 2012)	Significant positive effect

The Impact of Flipped Learning on Student Self-Efficacy

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Z. Sun et al., 2018)	United States	Pre-post interventional study	151	Mathematics	Pre-class internet-based learning environment vs in-class collaborative learning environment	Online lesson and recitation lessons using Desire2Learn Management software	14 weeks	Group practice problems, quiz or assignment	Homework (online or assignment)	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993) and knowledge differentiation scale from Internet self-efficacy scale (Kim et al., 2013)	Significant positive effect
(Özyurt & Özyurt, 2018)	Turkey	Quasi-experimental study	46	Software programming	Adapted flipped classroom vs flipped classroom	Animations, videos on Facebook group	8 weeks	Discussions with instructor	Scale of Attitude toward Computer Programming (SAatCP), Computer Programming Success Test (CPST), and Practice Control Chart (PCC)	Computer Programming Self-Efficacy Scale (CPSS) (Altun & Mazman, 2012)	Significant positive effect
(Chyr et al., 2017)	Taiwan	Quasi-experimental study	102	Applied information technology	Online academic help seeking vs flipped classroom vs traditional classroom	Online videos	1 semester	Quizzes, screenshots of online discussions, help-seeking, problem solving	Word and PowerPoint examinations as conducted by Computer Skills Foundation, Taiwan	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)	Significant positive effect
(AlJaser, 2017)	Saudi Arabia	Quantitative randomized controlled trial	52	Classroom management	Flipped classrooms vs traditional classroom	Videos	NA	NA	Achievement test	Self-designed self-efficacy questionnaire	Significant positive effect
(Sockalingam et al., 2016)	Canada	Pre-post interventional study design	156	Delirium care	Flipped classroom delirium, train the trainer session	Videos, delirium e-learning module	3 hours	Video case exercise, case-based learning	Moore framework, delirium knowledge test	Self-designed self-efficacy questionnaire	Significant positive effect

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(D'Souza & Rodrigues, 2015)	India	Quantitative randomized controlled trial	100	Computer science and engineering	Flipped classrooms vs traditional classroom	Video lectures from YouTube programming sessions	14 weeks	Programming exercises and quiz	Performance in national examination	C Programming Self-Efficacy Scale (CPSES) (Ramalingam & Wiedenbeck, 1998)	Significant positive effect
(Doo & Bonk, 2020)	Korea	Observational study	425	Philosophy of consideration	Effect of flipped classroom	Online pre-sessions	16 weeks	Face-to-face team discussions	Engaged Learning Index (ELI)	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993)	Significant positive effect
(Li & Yang, 2021)	China	Observational study	463	Not mentioned	Effect of flipped classroom	No intervention. analysis of students who participated in flipped classroom teaching	NA	NA	NA	General self-efficacy scale (GSES)	Significant positive effect

K-12 students (11 studies, n=1132)

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Larsari & Abouabdelkader, 2024)	Iran	Quasi-experimental study design	100	English grammar literature development	Flipped classroom vs traditional classroom	PowerPoint presentations, videos and electronic materials on Shad platform	8 weeks	PowerPoint presentations to be prepared and peer-reviewed	Grammar test	NA	Significant positive effect
(Algarni & Lortie-Forgues, 2023)	Saudi Arabia	Pre-post design intervention study and qualitative research	281	Mathematics	Flipped classroom vs traditional classroom	Educational videos and quizzes	6 weeks	Moodle	Pre-posttest algebra proficiency test, scholastic achievement admission test conducted	Sources of Self-Efficacy in Mathematics questionnaire (SSEM) (Usher & Pajares, 2009)	Significant positive effect

The Impact of Flipped Learning on Student Self-Efficacy

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Chang, 2023)	East Asia	Pre-post design intervention study and qualitative inquiry	52	English language	Flipped classroom vs traditional classroom	Instructional clips, guiding worksheets, in-class activities	7 weeks	Peer evaluation	Pre-post grammar and writing test	Self-efficacy questionnaire (Lin, 2016)	Significant positive effect
(Boateng et al., 2022)	Ghana	Quasi-experimental pre-post design and qualitative research	44	Visual arts	Flipped classroom vs traditional classroom	Multimedia content (text, graphics, video, audio, animation) using Adobe Captivate (interactive multimedia app)	10 weeks	Adobe Edge Animate	Learning achievement test	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993)	Significant positive effect
(Astawa et al., 2022)	Indonesia	Pre-post design intervention study	60	Disaster mitigation	Flipped classroom vs traditional classroom	Disaster map visualizations, exercises and assignments	Not mentioned	Not mentioned	Questionnaires	Self-efficacy questionnaire (self-developed building on Bandura's (1997) dimensions)	Significant positive effect
(J. C. Y. Sun & Lin, 2022)	Taiwan	Quantitative randomized controlled trial	87	Anti-phishing course	Non-Interactive response system (IRS) vs individual IRS vs shared IRS	Videos using 1Know platform	One time	Group discussions with teacher and answering questions, video recording with cell phone and a video camera	NA	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)	Significant positive effect
(Marina & Ridlo, 2021)	Indonesia	Quantitative non-randomized study	69	Biology (circulatory system)	Flipped classroom vs traditional classroom	Virtual classrooms	Not mentioned	Not mentioned	Not mentioned	Self-efficacy questionnaire (self-designed)	Significant positive effect
(Namaziandost & Çakmak, 2020)	Iran	Quantitative randomized controlled trial	58	English language	Flipped classroom vs traditional classroom	Audio-visual material (vodcasts, study materials)	14 weeks	Edmodo through worksheets and assignments	Oxford placement test	Self-efficacy scale (Greene et al., 2004)	Significant positive effect

Study	Country	Study design	Sample size	Subject	Type of classrooms	Mode of intervention	Period of intervention	In-class activities	Outcomes assessment	Measurement of self-efficacy	Effect of intervention on self-efficacy
(Ökmen & Kılıç, 2020)	Turkey	Action research	18	English language	Flipped learning model vs traditional classroom	Quizzes and games	9 weeks	Letter to teacher	Self-regulation and attitude interview forms, focus group interviews, student journals, self-assessment forms	Self-regulation interview questions (Dembo & Seli, 2008; Pintrich et al., 2000a)	Significant positive effect
(Ye et al., 2019)	Taiwan	Quasi-experimental design	56	Natural science course	Problem-posing guiding-based flipped vs. conventional flipped learning mode	Digital learning material (instructional videos)	6 weeks	Discussion and revision of problems	Posttest questionnaire	Self-efficacy questionnaire (Wang & Lin 2007)	Significant positive effect
(Lai & Hwang, 2016)	Taiwan	Quasi-experimental study	44	Mathematics	Self-regulated FC vs traditional FC	Quizzes and e-books	3 weeks	Self-regulated learning system and quizzes	Self-developed pre-post test	Self-efficacy questionnaire (Wang & Hwang, 2012)	Significant positive effect

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