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A Systematic Literature Review of Flipped Classroom Assisted by Microlearning and Self-Efficacy on Learning Outcomes

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ABSTRACT

Low learning outcomes reported in conventional teacher-centered instructional settings have motivated researchers to explore technology-enhanced and student-centered learning approaches. This study aims to synthesize empirical evidence regarding the relationship between flipped classroom implementation, microlearning design, self-efficacy, and students' learning outcomes.

A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 framework. Literature searches were performed in Scopus, Web of Science, ERIC, SINTA/Garuda, and Google Scholar for publications between 2016 and 2025. The search process identified 1,321 records, and 42 empirical studies were included after applying the predefined eligibility criteria. Data were analyzed using thematic analysis and narrative synthesis, with reported effect sizes compared descriptively across studies.

The findings indicate that flipped classroom implementation is generally associated with positive learning outcomes across the reviewed studies, although the magnitude of effects varies depending on educational level, discipline, and implementation design. Studies incorporating microlearning elements suggest that short, focused, and structured pre-class materials may enhance student engagement and learning performance; however, the evidence remains heterogeneous and does not support statistical aggregation. Self-efficacy consistently emerges as an important psychological factor associated with students' participation, self-regulation, and academic achievement, although direct evidence supporting its mediating role remains limited.

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1. INTRODUCTION

Digital transformation in the 21st-century education system demands a paradigm shift from teacher-centered, knowledge-transmission models toward student-centered, knowledge-construction models. Conventional learning practices that still dominate classrooms in Indonesia place students in a receptive position, with face-to-face time fully absorbed by content delivery, leaving very limited space for higher-order thinking activities. This condition has a direct implication for low learning outcomes, particularly in the dimensions of conceptual understanding and application ability. Various studies show that active learning strategies consistently produce higher academic achievement than traditional lectures (Buhl-Wiggers et al., 2023; Strelan et al., 2020).

One of the most widely adopted pedagogical innovations in response to this problem is the flipped classroom model. This model reverses the conventional sequence of learning: the delivery of basic content is moved outside the classroom through digital media, while face-to-face time is utilized for applicative activities, discussion, problem-solving, and concept reinforcement (van Alten et al., 2019). Theoretically, the flipped classroom is grounded in Bloom's Taxonomy, where lower-order cognitive processes which are remembering and understanding, are completed independently, while higher-order processes such as analyzing, evaluating, and creating, are facilitated together with teachers and peers. Several meta-analyses confirm the superiority of this model, albeit with varying magnitudes. Van Alten et al. (2019) reported a small-to-medium effect size ($g = 0.36$) from 114 studies, Wagner et al. (2021) found $d = 0.42$ at the secondary level, while a three-level synthesis in the K–12 context reported a larger effect ($g = 0.53$) for both cognitive and affective domains (Zhang et al., 2024).

Nevertheless, the literature also notes non-negligible inconsistencies. A number of studies have reported non-significant effects and even student resistance to the implementation of the flipped classroom (Buhl-Wiggers et al., 2023). The root of the problem lies in the implicit assumption of this model that all students are able and willing to complete pre-class learning activities independently. In fact, pre-class materials that are lengthy and dense often create excessive cognitive load and reduce student compliance. It is here that microlearning offers a design solution. Microlearning presents content in small, focused, and short-duration units that align with working memory capacity and the information consumption patterns of the digital generation (Alias & Abdul Razak, 2024; Leong et al., 2021). Empirical evidence shows that microlearning significantly improves academic performance compared to conventional long-duration learning (Senadheera et al., 2024) and strengthens knowledge retention and learning engagement (Silva et al., 2025).

However, instructional design factors alone are insufficient to explain variations in learning outcomes. The psychological dimension of learners, particularly self-efficacy, is a determining variable that is often overlooked. Self-efficacy is an individual's belief in his or her own capability to organize and execute the actions required to achieve a certain attainment (Bandura, 1997). In the academic context, the systematic review by Honicke and Broadbent (2016) confirmed a consistent positive relationship between academic self-efficacy and academic performance, with effort regulation and deep-processing strategies as moderating variables. Talsma et al. (2018), through a longitudinal meta-analysis, demonstrated a reciprocal relationship: self-efficacy predicts achievement, and achievement in turn strengthens self-efficacy. In a flipped classroom environment that demands high autonomy, students with low self-efficacy tend to procrastinate, avoid pre-class materials, and ultimately fall behind (Yılmaz, 2022).

A gap analysis of the existing literature reveals three fundamental problems. First, systematic studies on the flipped classroom generally treat pre-class content as a black

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box without distinguishing its duration and granularity characteristics, so the specific contribution of microlearning remains unmapped. Second, reviews on microlearning tend to stand alone and are rarely placed within the framework of a larger learning model (Alias & Abdul Razak, 2024; Silva et al., 2025). Third, the self-efficacy variable is more often positioned as a secondary outcome rather than as an explanatory mechanism for implementation success. The present review complements and corrects the assumption that the advantage of the flipped classroom is inherent in the model itself; this study argues that this advantage is conditional on content design and students' psychological readiness.

A gap analysis of the existing literature reveals several areas requiring further investigation. First, previous reviews on flipped classroom have primarily focused on overall effectiveness, while the characteristics of pre-class content design, including microlearning elements, remain less explored. Second, reviews on microlearning have generally examined its implementation independently rather than within broader instructional models such as flipped classroom. Third, self-efficacy has frequently been examined as an individual psychological factor or learning outcome, while its role in supporting students' engagement and self-regulated learning within flipped learning environments remains insufficiently synthesized.

The contribution of this study is to synthesize empirical evidence regarding flipped classroom implementation, microlearning design, and self-efficacy within a systematic literature review framework. Although previous studies have investigated these constructs separately, few reviews have explicitly examined their interrelationships in relation to students' learning outcomes. Based on the above description, this study aims to:

(i) map the trends and characteristics of research related to flipped classroom implementation, microlearning design, and associated learning factors;
(ii) synthesize evidence regarding the relationship between flipped classroom, microlearning design, and students' learning outcomes; and
(iii) explore the role of self-efficacy in relation to students' engagement, self-regulation, and learning outcomes within flipped learning environments.

2. METHODS

This study used a qualitative approach with the Systematic Literature Review (SLR) method, namely a procedure for identifying, evaluating, and interpreting all research evidence relevant to the research questions. The research questions were formulated using the PICOS framework. Population refers to students at the primary, secondary, and tertiary education levels. Intervention refers to the application of the flipped classroom and/or microlearning. Comparison refers to conventional learning conditions, alternative instructional approaches, or comparison conditions when available. Outcome refers to cognitive learning outcomes along with the self-efficacy variable. Study design includes experimental, quasi-experimental, correlational, and mixed-methods studies. Based on this framework, three research questions were formulated: (RQ1) What are the trends and characteristics of research on microlearning-assisted flipped classrooms in the period 2016–2025? (RQ2) How do studies describe the relationship between flipped classroom implementation, microlearning design, and students' learning outcomes? And (RQ3) What role does self-efficacy play in relation to flipped classroom implementation, microlearning design, and students' learning outcomes?

Literature searches were conducted in five databases, namely Scopus, Web of Science, ERIC, SINTA/Garuda, and Google Scholar, in the period from January to March

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2026 The search strategy was developed based on the three main constructs of this review: flipped classroom, microlearning, and self-efficacy, combined with learning outcome-related terms. Because these constructs have been studied independently in educational research, the search strategy was adapted across databases to identify relevant studies containing at least one primary construct associated with learning outcomes. The final search strings for each database are provided in Supplementary Material, following recommended practices in systematic reviews in the field of education.

The inclusion criteria were: (a) articles published in reputable scientific journals indexed by Scopus, Web of Science, or SINTA, as well as proceedings of international conferences; (b) publications from 2016–2025; (c) in Indonesian or English; (d) empirical research reporting quantitative data on learning outcomes; and (e Articles were included when they investigated at least one of the three primary constructs (flipped classroom implementation, microlearning design, or self-efficacy) and reported outcomes related to students' learning performance or academic achievement. Exclusion criteria included opinion articles, editorials, articles without full text, studies without measurement of learning outcomes, and duplicate studies.

Methodological quality assessment was carried out using an adapted Critical Appraisal Skills Programme (CASP) instrument containing five assessment items: clarity of research objectives, appropriateness of design, clarity of data collection procedures, appropriateness of statistical analysis, and clarity of reporting of findings. Each item was scored 0–2, so the total score range was 0–10; articles with a score below 6 were excluded from the synthesis. The selection and assessment process was carried out independently by two reviewers, with inter-rater agreement measured using Cohen's Kappa coefficient of 0.84, which is classified as very good; differences in assessment were resolved through discussion.

Data extraction was carried out using a structured extraction sheet containing author identity, year, country, education level, subject, research design, sample size, form of intervention, measurement instruments, effect size, and main findings. Data analysis used the thematic analysis technique of Braun and Clarke, which includes data familiarization, initial coding, searching for themes, reviewing themes, defining themes, and reporting. Quantitative findings reported by individual studies were extracted and descriptively compared. Where available, reported effect sizes were presented using Hedges' g metric to facilitate qualitative cross-study comparison, with interpretation following Cohen's criteria (small ≤ 0.20; medium ≈ 0.50; large ≥ 0.80). Reference management was carried out with the Mendeley application, while duplicate screening was assisted by the Rayyan software

3. RESULTS AND DISCUSSION

3.1. Selection Process (PRISMA 2020)

The search process produced 1,284 records from databases and 37 additional records through manual searches. After removing duplicates, 968 records remained and were screened based on titles and abstracts. A total of 781 records were excluded because they were irrelevant, leaving 187 full-text articles for eligibility assessment. A total of 145 articles were excluded for detailed reasons, so that 42 articles were declared to meet the inclusion criteria and were synthesized. The complete selection flow is presented in Figure 1.

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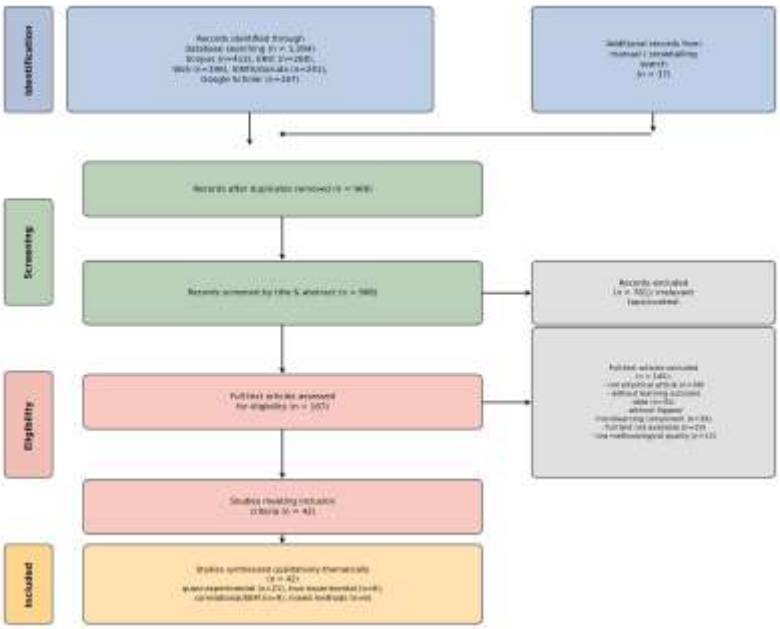


Figure 1. PRISMA flow diagram of the study selection process.

3.2. Characteristics of the Reviewed Studies (RQ1)

The distribution of the 42 selected studies shows a sharp increase in publication trends since 2020, with a peak in 2024. This increase is closely related to the acceleration of learning digitalization post-COVID-19 pandemic, which encouraged educators to explore blended learning models. The characteristics of the reviewed studies are presented in Table 1.

Table 1. Characteristics of the reviewed studies (n = 42).

Category	Sub-Category	Count	Percentage
Educational level	Higher education	24	57.1%
	Secondary school	13	31.0%
	Primary school	5	11.9%
Research design	Quasi-experimental	21	50.0%
	True experimental	6	14.3%
	Correlational / SEM	9	21.4%
	Mixed methods	6	14.3%
Subject area	Mathematics, Science & Technology	18	42.9%
	Languages	9	21.4%
	Social Sciences & Religious Studies	8	19.0%
	Health & Vocational	7	16.7%
Region	Asia	23	54.8%
	Europe & Americas	13	31.0%
	Others	6	14.3%

Table 1 shows the dominance of the higher education context (57.1%) and quasi-experimental designs (50.0%). The dominance of higher education can be understood

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due to the availability of digital infrastructure and the relatively higher level of independent learning among university students. Conversely, the limited number of studies at the primary school level (11.9%) leaves an important research gap, given that the synthesis by Zhang et al. (2024) found the largest effect size at the primary education level. The temporal distribution of studies and the average effect size per finding cluster are presented in Figure 2.

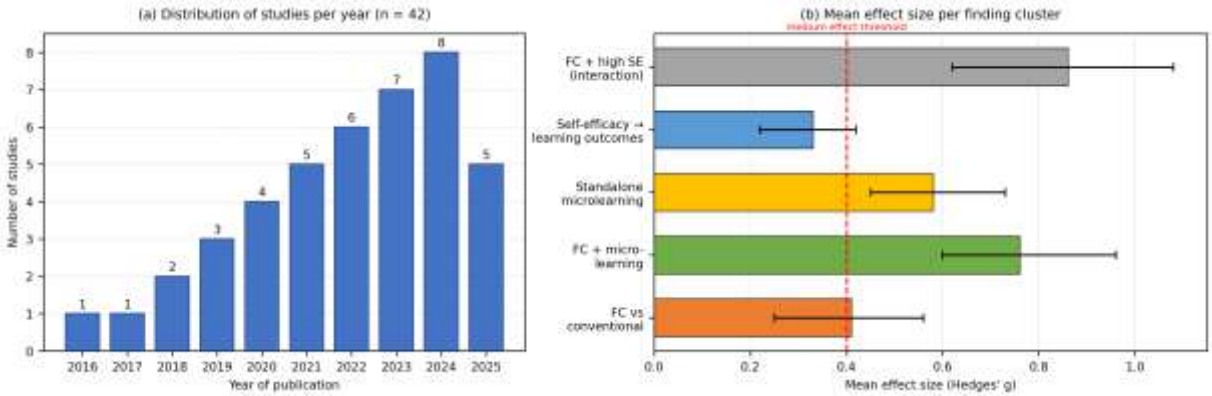


Figure 2. Distribution of studies per year and average effect size per finding cluster.

3.3. Contribution of Microlearning-Assisted Flipped Classroom to Learning Outcomes (RQ2)

The synthesis of studies comparing the flipped classroom with conventional learning shows consistent superiority, albeit with varying magnitudes. Van Alten et al. (2019), through a meta-analysis of 114 studies, reported an effect size of g = 0.36 on measured learning outcomes, but found no effect on learning satisfaction (g = 0.05). This finding was reinforced by Wagner et al. (2021) at the secondary level (d = 0.42) and by Strelan et al. (2020), who found consistent benefits across disciplines. In the context of STEM higher education, Gong et al. (2024) reported a smaller effect size (g = 0.26), while the synthesis on K–12 yielded a larger figure (g = 0.53) (Zhang et al., 2024). This variation confirms that the flipped classroom is not a uniform intervention but is highly dependent on implementation quality.

Analysis of moderator variables provides an explanation for this variation. Van Alten et al. (2019) found that learning outcomes were higher when face-to-face time was not reduced and when quizzes were added to the learning design. Gong et al. (2024) emphasized the importance of a link activity at the beginning of class to verify independent learning outcomes, a combination of group and individual activities during class, and a combination of quizzes and post-class exercises. Thus, merely reversing the order of activities does not guarantee improved learning outcomes; what matters is the instructional architecture that bridges the pre-class and face-to-face phases.

At this point, microlearning makes a substantive contribution. As an approach that presents complex information in small and focused units, Microlearning may support cognitive processing by presenting learning materials in smaller and more focused units, although the direct measurement of cognitive load remains limited among the reviewed studies (Sweller et al., 2019). Senadheera et al. (2024), through a systematic review and meta-analysis of 12 studies, found a mean difference in academic achievement of 12.6 points (95% CI: 1.2–23.9; p = 0.03) favoring the microlearning group compared to macro-learning, with explanatory mechanisms including cognitive load reduction, learning environment flexibility, promotion of independent learning, and timely feedback. A similar finding was reported by Leong et al. (2021) through a scoping review that

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confirmed the effectiveness of microlearning in optimizing working memory and learning efficiency.

The integration of the two produces a mutually reinforcing effect. When the pre-class materials of the flipped classroom are designed as micro-content with a duration of 3–7 minutes equipped with specific objectives, interactive elements, and short quizzes, the level of pre-class task completion increases and the gap in readiness among students narrows. Silva et al. (2025) found that presenting content in short modules facilitates knowledge retention while connecting concepts to real-world situations. Alias and Abdul Razak (2024) identified that the combination of short content, mobile learning, video, and social learning is the most effective strategy for improving learning outcomes. Studies that explicitly incorporated both flipped classroom and microlearning reported relatively larger effect sizes compared with studies implementing either approach separately. However, these findings were based on individual study reports and were not statistically aggregated, higher than either the conventional flipped classroom or standalone microlearning. This finding addresses the first gap identified in the introduction, namely that the granularity of pre-class content is a determining variable that has so far been treated as a black box.

3.4. The Role of Self-Efficacy in the Relationship Between Learning Design and Learning Outcomes (RQ3)

The synthesis results indicate that The reviewed studies suggest that self-efficacy is an important psychological factor associated with learning outcomes, student engagement, and self-regulated learning processes in flipped classroom environments of the successful implementation of the flipped classroom. As a predictor, the systematic review by Honicke and Broadbent (2016) of 53 studies confirmed a consistent positive relationship between academic self-efficacy and academic performance, with effort regulation, deep-processing strategies, and goal orientation as moderating variables. Talsma et al. (2018) strengthened this finding through a longitudinal meta-analysis that proved a reciprocal relationship between the two. Zhao et al. (2023) found that learning engagement mediates the relationship between academic self-efficacy and academic achievement among university students.

As a mediator, the role of self-efficacy becomes crucial because the architecture of the flipped classroom shifts the responsibility for the initial stage of learning to students. Yılmaz (2022) found a positive and significant correlation between academic achievement and the dimensions of self-efficacy, satisfaction, and perceived usefulness of the learning environment in the flipped classroom, as well as a negative correlation with the anxiety dimension. This means that students who believe in their ability to manage independent learning will be more diligent in completing pre-class materials and will come to class with adequate readiness. Conversely, students with low self-efficacy are vulnerable to procrastination and resistance. This phenomenon is empirically documented in the randomized controlled trial by Buhl-Wiggers et al. (2023), who found an overall non-significant effect that became substantial when student participation was controlled as a mediator.

The reviewed literature suggests a potential interaction between microlearning design and self-efficacy, although direct evidence confirming a reciprocal relationship remains limited. Short-duration micro-content creates repeated and scaffolded mastery experiences, which according to Bandura (1997) are the most powerful source in the formation of self-belief. Each successfully completed micro-unit functions as small-scale evidence of success that cumulatively strengthens students' confidence. Nikou and

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Maslov (2021) found positive student acceptance of microlearning technology, while Sathiyaseelan et al. (2024) showed improvements in satisfaction and retention. Thus, a positive cycle is formed: micro-content reduces cognitive load, task completion increases self-efficacy, and strengthened self-efficacy encourages perseverance in the next learning cycle, which ultimately leads to improved learning outcomes. Based on the entire synthesis, this study proposes a modification to the prevailing theoretical framework of the flipped classroom. The resulting conceptual model positions microlearning as a strengthening variable on the input pathway (quality and granularity of pre-class content) and self-efficacy as a mediating mechanism on the process pathway (perseverance and self-regulation), both of which simultaneously determine learning outcomes as the output. This framework explains why flipped classroom implementations with low effect magnitudes generally neglect one or both of these components.

The practical implication is that educators who wish to implement the flipped classroom need to take at least three minimal steps: break down pre-class materials into micro-units with a duration of less than seven minutes with one learning objective per unit; include short formative quizzes as a trigger for the testing effect and immediate feedback; and design a linking activity at the beginning of face-to-face sessions to verify readiness while providing a successful experience that strengthens students' self-confidence.

4. CONCLUSION

This systematic literature review of 42 empirical studies indicates that flipped classroom implementation is generally associated with positive learning outcomes, although the magnitude of reported effects varies across educational contexts, disciplines, and implementation designs. The integration of microlearning elements appears to support flipped classroom implementation by improving the structure, accessibility, and engagement potential of pre-class materials. However, the available evidence remains heterogeneous and does not allow statistical aggregation.

Self-efficacy emerges as an important psychological factor associated with students' engagement, self-regulation, and academic achievement in flipped learning environments. Nevertheless, further empirical studies using longitudinal and mediation-based designs are needed to clarify the mechanisms underlying the relationship between self-efficacy, learning design, and learning outcomes.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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