

A Systematic Review of Flipped Classroom Pedagogy and Students' Cognitive and Affective Results

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Abstract:

The flipped classroom is a well-researched pedagogical approach that uses in-person time for guided practice, discussion, problem solving, teamwork, and other forms of active learning while shifting the initial exposure to instructional content outside of the classroom. Verified empirical and review-level data on two major categories of student outcomes are summarised in this systematic review: affective outcomes, which include motivation, engagement, attitudes, self-efficacy, and satisfaction, and cognitive outcomes, which include academic achievement, retention, knowledge acquisition, knowledge application, and higher-order learning. Overall, research points to the benefits of flipped instruction; however, the extent of these benefits varies greatly among disciplines, educational levels, study designs, and implementation features. While reviews of more rigorous or discipline-specific studies have indicated little to no difference from traditional lecture-based training, large-scale syntheses have reported beneficial effects on academic performance. There is also generally favourable evidence for affective consequences, with flipped contexts frequently showing improvements in motivation, self-efficacy, satisfaction, and attitudes. However, significant causal findings are not possible due to heterogeneity, methodological flaws, conflicting definitions of the flipped model, and confounding of "flipping" with extra active-learning enrichment. According to the review's conclusion, flipped pedagogy shouldn't be seen as a one-size-fits-all solution or as an inherent enhancement over traditional instruction. The quality of pre-class learning resources, student preparation, instructor facilitation, and the planning of in-class learning activities all play a major role in its efficacy. Stronger experimental designs, standardised outcome measures, extended follow-up, and more transparent reporting of implementation fidelity should all be used in future studies.

Keywords- Flipped learning, academic success, motivation, self-efficacy, cognitive and affective effects, and systematic review

1. Introduction

The conventional order of teaching and learning is rearranged in the flipped classroom. Instead of allocating the majority of class time for teacher presentations and assigning individual practice as homework, students learn new material before class (usually through readings, quizzes, recorded

lectures, or other digital content) and utilise class time for practice and interaction under supervision. Because it offers additional chances for active engagement during in-person education, this arrangement has drawn attention (DeLozier & Rhodes, 2017).

Flipping has a pedagogical justification that goes beyond technology. Reallocating class time to activities where students explain, apply, evaluate, discuss, practise, and receive feedback could be beneficial. Additionally, many "flipped" solutions incorporate additional pedagogical enrichment with the inversion of material distribution, according to recent research. It can be difficult to determine if the flipped sequence, the active-learning exercises added to the course, or a combination of the two are responsible for the reported advantages (Bintz et al., 2024).

Research on the efficacy of flipped education has generally shown encouraging but inconsistent results. For instance, Cheng et al. (2019) identified a statistically significant beneficial overall effect on learning outcomes after synthesising 55 studies. Tatal and Yazar (2021) examined 177 academic achievement studies and discovered that flipped instruction had a beneficial impact on retention and attitude. On the other hand, Gillette et al. (2018) reported no statistically significant benefit for final test or final course results in a study of pharmacy education. These variations imply that conclusions should be interpreted in accordance with discipline, educational attainment, study quality, outcome type, and implementation.

The necessity of a differentiated approach is further supported by recent data. Another three-level meta-analysis of K-12 research synthesised 129 studies, 399 effect sizes, and 12,727 students. It discovered favourable effects on cognitive and affective domains as well as overall performance, but it also found significant variation across methodological and contextual characteristics (Li et al., 2024/2025). Similar to this, a second-order meta-analysis of evidence from higher education conducted in 2026 found a moderate overall effect, emphasising that the effects differ depending on the discipline, location, research design, sample size, and number of primary studies included in the underlying syntheses (Uzun et al., 2026).

2. Examine the objectives and questions

The following goals served as the framework for the review:

1. To compile data regarding how flipped classroom instruction affects students' cognitive performance.
2. To review data pertaining to affective outcomes, namely self-efficacy, motivation, engagement, attitudes, and satisfaction.
3. When the evidence allows, to compare results across topic areas and educational levels.
4. To investigate implementation and methodological aspects that could account for variation in reported effects.
5. To determine the boundaries and avenues for further study on the flipped classroom approach.

The review's questions were:

1. What effects has flipped classroom pedagogy been shown to have on students' cognitive outcomes?
2. What impacts on pupils' affective outcomes have been documented?

3. Which methodological and contextual elements seem to regulate these results?

4. What aspects of the current evidence limit the interpretation of causality?

3. Approach

The present amended publication follows PRISMA 2020 reporting guidelines and uses a systematic evidence-synthesis strategy (Page et al., 2021). Crucially, the original file had placeholder numbers (X, Y, Z, etc.) and unsupported screening counts like "~500 records" and "~50 included studies." These numbers were removed because there was no auditable search record to support them. For instance, the fact that two independent reviewers conducted the screening is not mentioned in the amended publication because the source file cannot confirm this. This is a crucial fix for research integrity.

3.1 Acknowledgement and acceptance of evidence

Scholarly databases and publisher/abstract-page verification of peer-reviewed research and research syntheses on flipped learning or classrooms were used to locate the evidence base. Combinations of "flipped classroom," "flipped learning," "inverted classroom," "academic achievement," "learning outcomes," "retention," "motivation," "engagement," "attitude," "self-efficacy," and "satisfaction" were among the search terms. Systematic reviews, meta-analyses, and empirical research that directly compared flipped and non-flipped/traditional education or offered quantitative evidence that was otherwise pertinent to the review topics were given priority.

- Studies that were pertinent included those that
- Investigated a flipped or flipped-learning approach to teaching;
- Reported affective and/or cognitive outcomes of students;
- Presented scientific, quantitative, or methodically synthesised evidence; and
- Was published with sufficient bibliographic data to enable verification in a peer-reviewed scholarly journal.

The substantive synthesis did not include studies that did not concentrate on student outcomes, were solely conceptual without empirical support, or did not include enough bibliographic data to support the claimed findings.

3.2 Outcome classification

The term "cognitive outcomes" refers to discernible variations in academic performance on tests and exams, as well as in knowledge acquisition, application, retention, conceptual understanding, and other higher-order learning. Motivation, engagement, attitudes toward the course and learning, self-efficacy, and learning satisfaction were all affective outcomes. This distinction was upheld because, even in cases when variations in conventional achievement metrics are negligible, flipped pedagogy may have an impact on students' experiences and motivating processes.

3.3 Synthesis technique

The current paper uses a narrative and comparative synthesis instead of a new pooled effect estimate due to the significant variation in demographics, fields, definitions of outcomes, study design, and

statistical models among the available synthesis. Only when stated clearly in the referenced source are effect sizes disclosed. Based on incomplete data, no effect magnitude has been calculated.

4. Findings: Integration of Evidence

4.1 Cognitive outcomes

Academic accomplishment is the cognitive outcome that has been examined the most in the literature on flipped classrooms. Chen et al. (2018) revealed that flipped instruction significantly improved exam scores and course grades after combining 46 controlled experiments with 9,026 students in higher education. However, the study also discovered that the majority of the included research had a significant risk of bias and that randomised controlled trials did not consistently show the benefit. These findings imply that the overall positive correlation should not be taken as compelling proof of a significant causal effect.

Cheng et al. (2019) identified a tiny but statistically significant overall effect in favour of flipped instruction in their meta-analysis of 55 studies (Hedges' $g = 0.193$). The comparatively small pooled estimate is significant because it illustrates how results can vary based on study selection and analytical methodology and contrasts with some greater effects from broader syntheses. Tatal and Yazar (2021) discovered advantages for learning retention in addition to a greater favourable impact on academic accomplishment. However, the heterogeneity of primary studies must also be taken into consideration when interpreting their results.

Reviews that are discipline-specific provide evidence of this variety. There was no statistically significant difference in final exam or final course results between flipped and lecture-based instruction, according to Gillette et al. (2018), who conducted a qualitative synthesis of six studies and a quantitative synthesis of five studies in pharmacy education. The limited prospective randomised comparisons were highlighted by the authors. Therefore, we cannot simply assert that flipping improves exam performance overall based on the findings.

More recent studies provide additional evidence for positive cognitive impacts. Bintz et al. (2024) observed increased information acquisition, knowledge application, and metacognitive monitoring under flipped lecture settings compared to non-flipped lecture conditions in two controlled trials including psychology students ($N=306$ and $N=413$). This is particularly significant since it implies that the cognitive advantages may extend beyond the conventional metrics of test results. However, the study also highlights the necessity to distinguish between the subsequent instructional enrichment and the structural flip.

129 trials, 399 impact sizes, and 12,727 students were combined by K-12 Li et al. (2024–2025). Flipped classrooms significantly improve student performance overall, with advantages in the cognitive and affective domains, according to their three-level meta-analysis. Additionally, factors related to area, outcome measure, instructor equivalency, publication type, educational context, and research methodology were identified by the authors. This does not support a universal treatment effect, but rather a context-sensitive interpretation.

4.2 Higher Cognitive Learning and Retention

While learning retention is more difficult to measure than immediate accomplishment, the available syntheses are generally positive. Learning retention showed a positive pooled effect (Tutal and Yazar, 2021). Theoretically, students are exposed to the content outside of the classroom before being given the chance to recover, expand upon, discuss, and apply it in class. Cross-study comparisons are made more difficult by the wide diversity in assessments of higher order outcomes like critical thinking, problem solving, transfer, and metacognitive monitoring.

Because Bintz et al. (2024) examined knowledge acquisition, knowledge application, and metacognitive monitoring independently, their findings are helpful in this regard. Although their results show that flipping can support more than simple memory, the evidence is still not as strong as that based on exam outcomes. Thus, standardised measures of higher order learning and explicit cognitive frameworks should be used in future research.

4.3 Affective Outcomes

Compared to the evidence for conventional achievement, the affective evidence is generally more consistently positive. Students' views about the course were significantly improved, according to Tutal and Yazar (2021). According to their synthesis, students might be open to the more opportunities for engagement and active learning that come with flipped learning.

In a meta-analysis of flipped physical education, Wu et al. (2025) discovered that it improved learning satisfaction, self-efficacy, and intrinsic motivation. Intrinsic motivation =.65, self-efficacy =.42, and satisfaction =.68 were the pooled standardised mean differences. Although these estimations show significant affective advantages in the context of physical education, it is not appropriate to automatically extrapolate the results to all subjects and age groups.

According to the larger body of research, using class time for practice, discussion, teamwork, and feedback may also boost student engagement and satisfaction. However, self-report questionnaires are typically used to measure affective outcomes, which increases the possibility of response bias and makes the extent of effects susceptible to the measuring tools. As a result, assertions of emotive superiority should be interpreted in light of objective metrics like attendance, learning analytics, participation records, and behavioural observations.

4.4 Evidence in various situations and moderators

Heterogeneity is the most recurring result of modern syntheses. Flipped learning is not a single, standardised approach. Educational level, discipline, location, class size, length, instructor equivalency, student readiness, and the kind of pre-class and in-class activities can all affect the results. Tutal and Yazar (2021) discovered moderator effects for subject domain, duration, class size, and educational level. Additionally, Li et al. (2024/2025) discovered that methodological and contextual factors accounted for significant heterogeneity in K–12 outcomes.

A second-order meta-analysis of 25 first-order meta-analyses in higher education was carried out by Uzun et al. (2026). In addition to considerable heterogeneity and moderation by discipline, geographic location, research design, sample size, and number of primary studies, they discovered

an overall moderate effect ($ES = 0.75$, 95% CI [0.62, 0.87]). The outcome lends credence to the idea that flipped pedagogy can be both highly context-sensitive and effective.

The distinction between flipping and enrichment is particularly crucial because many flipped implementations concurrently include interactive or otherwise enriched activities (Bintz et al., 2024). It is not possible to assume that the observed benefit is only attributable to the flip if the intervention group receives a different sequence and more active learning. Future studies should especially address this methodological problem.

5. Conversation

A favourable judgement about flipped classroom pedagogy is qualifiedly supported by the research examined here. Flipped training frequently outperforms traditional lecture-based instruction in extensive meta-analyses, K–12 evidence, higher education evidence, and a few discipline-specific research. However, the advantage's strength and consistency vary greatly.

The best way to define the cognitive evidence is as varied but positive. The null results in Gillette et al. (2018), the greater impacts reported by Tatal and Yazar (2021) and Uzun et al. (2026), and the tiny pooled effect provided by Cheng et al. (2019) all show that "the effect of flipped classrooms" cannot be summed up in a single figure. Variation is probably related to variations in the quality of the study, the educational environment, evaluation, and execution.

Particularly encouraging are the emotional results. Particularly when class time is truly engaged, motivation, self-efficacy, contentment, and attitudes appear to tilt toward reversed conditions. One explanation is that students' engagement opportunities are altered by the model. Students can spend more supervised time practicing knowledge and engaging with peers and teachers rather than just passively taking in the majority of the material in class. However, limited intervention times and self-report measures are drawbacks.

The review also identifies a conceptual issue. A flipped classroom does not substitute a lecture with a video. The learning activities that are predicated on pre-class preparation determine the approach's educational usefulness. The theoretical benefits of flipping will not be realised if students arrive at class unprepared or if class time is not reconsidered. On the other hand, well-designed active learning can offer substantial advantages that make it challenging to isolate the flipped sequence's unique contribution.

6. Consequences for Teaching Methods

- Pre-class materials should be concise, easily accessible, and include accountability tools like guided questions or low-stakes tests.
- A deliberate rethinking of classroom time should center on application, problem-solving, discussion, teamwork, feedback, and formative assessment.
- Teachers should not think that a flipped classroom can be successfully implemented using recorded lectures alone.
- Since meaningful participation before class is essential to the model's success, students need specific help for self-regulated preparation.

- Institutions must take access, digital competency, workload, and technological limitations into account when implementing flipped learning.
- Exam results should not be the only factor considered in assessment; cognitive and affective signs should also be considered.

7. Limitations of this Review and the Evidence

There is a great deal of methodological heterogeneity in the underlying literature. Some syntheses report a high risk of bias, and the majority of primary studies are observational or quasi-experimental. Flipped classroom definitions vary, and results are frequently not standardised. Novelty effects and publication bias could have further consequences. Self-report tools are frequently used to examine affective outcomes, whereas locally created examinations are typically used to measure cognitive outcomes. The nature of this rewritten manuscript is another drawback. The original document lacked an auditable study selection record, a full screening log, and a reproducible database export. As a result, unsubstantiated claims about the quantity of records reviewed or research included have been purposefully eliminated. Unless the researcher performs and documents a replicable database search, screening procedure, risk-of-bias assessment, and study-level extraction, a PRISMA-compliant systematic review should not be described as a freshly conducted systematic review. Based on published reviews and validated empirical research, the current version ought to be regarded as a straightforward evidence synthesis.

8. Research gaps and future directions

- Particularly in school instruction, more thorough randomised or tightly controlled experiments are required.
- Future research should distinguish between the effects of flipping and extra active-learning enrichment.
- To determine if improvements in motivation, self-efficacy, and retention are sustained after the intervention, longitudinal designs are necessary.
- Cross-study comparability would be enhanced by common and validated measures of higher order thinking, engagement, metacognition, and self-efficacy.
- Fidelity of implementation, student preparation rates, instructor equivalency, class size, duration, and the particulars of pre-class and in-class activities should all be detailed by researchers.
- The relationship between affective alterations and cognitive outcomes, as well as the reasons why some students gain more than others, may be clarified via mixed-methods research.
- Equity concerns such as unequal access to gadgets, internet connectivity, quiet study spaces, and digital learning abilities should be taken into account in later evaluations.

9. Synopsis

The evidence that is now available suggests that flipped classroom pedagogy has a significant potential to improve students' cognitive and affective outcomes, but its efficacy is neither consistent

nor automatic. In big syntheses, cognitive consequences are minor to moderate and typically good. Motivation, self-efficacy, satisfaction, and attitudes are examples of affective outcomes that are frequently positive. However, strong general assertions are inappropriate due to the considerable heterogeneity, methodological limitations, and diversity in implementation. Therefore, the most reasonable conclusion is that flipped pedagogy is a context-sensitive teaching strategy that relies on intentional course redesign, student preparation, active in-class learning, and strong teacher support. Rigorous methodology and a clearer distinction between the "flip" and the active-learning techniques that frequently go along with it should be the main goals of future research.

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