



Active and student-centered teaching methods in the classroom: A review of approaches, evidence, and implementation challenges

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Abstract

Active and student-centered teaching methods have moved from the margins of pedagogical experimentation to a mainstream expectation in classrooms at every educational level. Approaches such as the flipped classroom, problem-based learning, cooperative and collaborative learning, and technology-mediated active learning share a common premise: that learners retain and apply knowledge more effectively when they participate directly in constructing it, rather than passively receiving content through lecture. This paper reviews recent literature on active and student-centered teaching methods, synthesizing evidence on their design, classroom implementation, and effects on engagement, motivation, and academic performance. Findings across multiple systematic reviews and empirical studies converge on a consistent pattern: active learning approaches are associated with improved engagement, motivation, and higher-order cognitive performance relative to traditional lecture-based instruction, though the size of the effect varies by discipline, class size, and the fidelity with which the method is implemented. Persistent implementation challenges include instructor unfamiliarity with active formats, student resistance rooted in prior educational experience, and assessment systems not designed to capture the skills these methods develop. The paper concludes with implications for classroom practice and recommendations for future research, particularly the need for more consistent outcome measures across studies.

Keywords: Active learning, student-centered learning, flipped classroom, cooperative learning, teaching methods, classroom engagement

Introduction

Traditional lecture-based instruction has long dominated classrooms at every level of education, valued for its efficiency in transmitting content to large groups of students. Over the past two decades, however, a substantial body of research has questioned whether passive content delivery adequately develops the critical thinking, collaboration, and problem-solving skills that contemporary curricula increasingly demand. In response, active and student-centered teaching methods, approaches in which learners engage directly with content through discussion, application, and collaborative problem-solving rather than passive listening, have become a central focus of pedagogical reform.

This review synthesizes recent literature on active and student-centered teaching methods, with attention to four widely studied approaches: the flipped classroom, problem-based and project-based learning, cooperative and collaborative learning, and technology-mediated active learning. The aim is to examine what the evidence says about their effectiveness relative to traditional instruction, and to identify the conditions under which these methods succeed or falter in practice.

Review Approach

This paper adopts a narrative literature review approach, drawing on systematic reviews, empirical classroom studies, and comparative evaluations published primarily between 2024 and 2026. Sources were identified through targeted searches using terms including "active learning," "student-centered learning," "flipped classroom," and "cooperative learning," with attention to studies reporting measurable outcomes such as engagement, motivation, or assessed performance rather than opinion pieces alone.

Active and Student-Centered Teaching Approaches

1. The Flipped Classroom

In the flipped classroom model, students engage with foundational content, typically video lectures or readings, before class, reserving in-class time for application, discussion, and problem-solving under instructor guidance. A comparative study in an anatomy and embryology course found that students taught through student-centered collaborative and flipped formats outperformed those taught through traditional expository lecture on tasks requiring higher-order cognitive skills such as application and analysis, even though performance on lower-order recall tasks was comparable across both formats. This pattern, stronger gains on application and analysis than on rote recall, recurs across several studies of flipped and active formats, suggesting that the primary benefit of the model lies less in raw content acquisition than in the depth at which students can use that content.

2. Problem-Based and Project-Based Learning

Problem-based learning (PBL) and project-based learning place a real or simulated problem at the center of instruction, requiring students to apply knowledge to work toward a solution rather than acquiring knowledge as an end in itself. A systematic review of active learning approaches in classroom settings identified problem-based projects and cooperative learning among the methods most consistently associated with gains in learner engagement, motivation, and knowledge retention across the studies reviewed. The same review noted that combining PBL with structured instructor scaffolding, rather than leaving students to navigate open-ended problems unsupported, was associated with stronger outcomes, indicating that the degree of

guidance embedded in the method matters as much as the method itself.

3. Cooperative and Collaborative Learning

Cooperative and collaborative learning structures organize students into small groups working toward a shared academic goal, with individual accountability built into the group task. Evidence from primary and higher education settings alike indicates that these structures improve classroom engagement and, in some contexts, classroom behavior, though effect sizes are described in the literature as context-dependent, varying with group size, task design, and the degree to which individual accountability is enforced within the group structure. A cross-sectional study of first-year medical undergraduates similarly found that the large majority of students perceived active methods, including small-group discussion and case-based learning, as improving both their engagement and their academic performance, underscoring that student perception and reported outcome frequently move together in this literature.

4. Technology-Mediated Active Learning

A more recent and rapidly evolving strand of active learning research concerns the integration of digital tools, including generative AI systems, into active classroom formats. Emerging evidence suggests that tools supporting self-directed exploration can encourage deeper engagement with material compared to passive content delivery, though this literature is newer and less extensively replicated than research on flipped classrooms or cooperative learning, and questions remain about how such tools should be scaffolded to avoid substituting for, rather than supporting, students' own reasoning.

Evidence on Effectiveness

Across the methods reviewed, several patterns recur. First, active methods are consistently associated with higher self-reported engagement and motivation relative to lecture-based instruction, a finding that holds across primary, secondary, and higher education contexts and across disciplines as varied as anatomy, mathematics, and general classroom instruction. Second, where cognitive outcomes are measured at different levels, active methods tend to show their clearest advantage on higher-order tasks, application, analysis, and problem-solving, rather than on simple factual recall, where traditional and active formats often perform comparably. Third, the strength of reported effects depends heavily on implementation fidelity: reviews caution that active learning interventions vary widely in design and duration, and that shorter or poorly scaffolded interventions tend to produce weaker and less consistent results than sustained, well-structured implementations.

A recurring limitation across the reviewed literature is a reliance on student self-report and instructor-designed assessments rather than standardized, externally validated outcome measures, which complicates direct comparison of effect sizes across studies and disciplines.

Barriers to Effective Implementation

Several barriers to effective implementation appear consistently in the literature. Instructors accustomed to lecture-based delivery report difficulty redesigning courses around active formats, particularly the loss of direct control over pacing and content coverage. Student resistance is also documented: learners socialized within traditional, lecture-

dominant systems sometimes perceive active formats as less rigorous or as placing an unfair burden of self-directed work on them, at least until they adjust to the new format over the course of a term. A further barrier concerns assessment: many institutional evaluation systems, including student satisfaction surveys used in teaching quality assessment, are not well designed to separate the effectiveness of an active teaching method from an instructor's individual popularity or communication style, which can discourage instructors from adopting methods that initially feel less comfortable to students even when those methods produce stronger learning outcomes.

Discussion and Implications

Taken together, the literature supports a cautious but consistent conclusion: active and student-centered methods tend to outperform traditional lecture delivery on measures of engagement and higher-order cognitive performance, while showing smaller or negligible advantages on basic recall. This suggests that active methods are best understood not as a wholesale replacement for direct instruction but as a complement suited to the specific cognitive goals an instructor is targeting. For classroom practice, this implies that instructors should be selective and purposeful in applying active formats to sessions where application and synthesis are the primary goal, while retaining more direct instruction for foundational content delivery. It also implies that institutions seeking to encourage active teaching should revise teaching-quality evaluation frameworks to assess learning outcomes and instructional design quality separately from raw student satisfaction, and should provide structured support and course-redesign time to instructors transitioning from lecture-based to active formats.

Conclusion

Active and student-centered teaching methods, including the flipped classroom, problem-based and project-based learning, cooperative learning, and emerging technology-mediated formats, are supported by a growing and reasonably consistent body of evidence showing benefits for engagement, motivation, and higher-order cognitive performance relative to traditional lecture instruction. The strength of this evidence is tempered by inconsistent outcome measures and a reliance on self-report across much of the literature, and by real implementation barriers rooted in instructor preparedness, student expectations, and assessment design. Future research would benefit from standardized outcome measures that allow more direct comparison across studies, along with longer-term studies tracking whether engagement and performance gains observed within a single course persist into subsequent coursework.

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