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ENHANCING CREATIVE THINKING THROUGH COLLABORATIVE PROJECT-BASED LEARNING: A SYSTEMATIC REVIEW

Fiashriel Lundy^{1*}, Punaji Setyosari², Dedi Kuswandi³ and Yerry Soepriyanto⁴

¹Doctoral Program, Department of Educational Technology, Faculty of Education, State University of Malang, East Java, Indonesia. Email: fiashriel.lundy.2201219@students.um.ac.id

²Department of Educational Technology, Faculty of Education, State University of Malang, East Java, Indonesia. Email: punaji.setyosari.fip@um.ac.id

³Department of Educational Technology, Faculty of Education, State University of Malang, East Java, Indonesia. Email: dedi.kuswandi.fip@um.ac.id

⁴Department of Educational Technology, Faculty of Education, State University of Malang, East Java, Indonesia. Email: yerry.soepriyanto.fip@um.ac.id

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Corresponding Author: Fiashriel Lundy
(fiashriel.lundy.2201219@students.um.ac.id)

ABSTRACT

Collaborative project-based learning (CPBL) has been increasingly recognized as an effective pedagogical approach to foster creative thinking and related competencies in higher education. However, evidence regarding its effectiveness across different educational contexts remains fragmented. This systematic review aimed to synthesize current empirical evidence on the role of CPBL in enhancing creative thinking and associated learning outcomes. The review was conducted in accordance with PRISMA 2020 guide-lines. A comprehensive literature search identified studies published between 2017 and 2024, resulting in seven eligible studies involving a total of 364 participants from various educational settings in Asia and Turkey. Most included studies applied classroom action research or quasi-experimental designs, with interventions implemented in geography, STEM, and language education courses. Across the reviewed studies, CPBL consistently demonstrated positive effects on creative thinking, problem-solving abilities, collaboration, and professional development skills. Methodological quality was assessed using the Joanna Briggs Institute checklist for quasi-experimental studies. Four studies were rated as having low risk of bias, while three were categorized as moderate risk. Common methodological limitations included the absence of control groups, short follow-up periods, and reliance on self-reported or post-test-only measures. Overall, the evidence suggests that CPBL represents a promising learner-centered approach for fostering creativity and essential 21st-century competencies in higher education.

KEYWORDS: Collaborative Learning; Creative Thinking; Education; Project-Based Learning; Systematic Review.

1. INTRODUCTION

Collaborative Project-Based Learning (CPBL) has emerged as a promising pedagogical strategy that aligns with the demands of 21st-century education. Grounded in constructivist principles, CPBL emphasizes student-centered and experiential learning, where knowledge is actively constructed through engagement rather than passively absorbed (Nuraeni et al., 2025). Central to CPBL is the development of creative thinking, a competency increasingly regarded as essential in both educational and professional domains. By combining collaborative and project-based approaches, CPBL cultivates skills that prepare students to navigate complex challenges with adaptability and innovation.

Beyond general education, CPBL has demonstrated value in professional training contexts such as health care, where collaborative problem solving and interprofessional communication are critical. Teams and individuals work together to enhance the comprehensiveness of outcomes through ongoing dialogue, while students identify strengths and resolve project issues. These processes can significantly contribute to preparing health care workers to function effectively in rapidly evolving global health settings (Shah et al., 2021; Si, 2020; Ablah et al., 2014).

Creative thinking encompasses the ability to alternate between divergent and convergent modes of thought depending on task requirements (Yu, 2024). CPBL enhances this skill by encouraging students to generate multiple solutions through divergent thinking and refine them via convergent analysis. Fostering such creative capacities motivates learners to reframe problems from alternative perspectives and develop innovative products (Sabateen and Ghaziwat, 2024; Setyawarno et al., 2024; Pratama, 2024; Bharathi and Pande, 2024). CPBL thus provides a coherent framework for enhancing creativity across disciplines, prioritizing authentic and challenging projects that strengthen academic performance, communication, resilience, and professional readiness (Arisanty et al., 2020; Nurdin et al., 2021; Jay and Mortini, 2023). Therefore, this systematic review aims to synthesize empirical evidence on the effectiveness of CPBL in enhancing creative thinking across educational levels and disciplines, while also identifying contextual conditions that enable or limit its impact.

2. METHODS

2.1. Search Strategy

The 2020 guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) were adhered to in the execution and documentation of this systematic review (Page et al., 2021). A comprehensive literature search was conducted utilizing PubMed, Google Scholar, Cochrane Library, and ScienceDirect. The predetermined search string utilized was "(collaborative project-based learning OR Project based collaborative learning) AND (Learning OR creative thinking OR Ability)." During this stage, articles with relevant titles and abstracts were selected for further qualitative analysis and full-text examination. The studies included in this review were required to be published in English, released between 2000 and 2024, and have accessible full texts. Database-specific adjustments were applied where necessary to optimize search sensitivity. In addition, manual screening of reference lists (snowballing) was conducted to identify potentially relevant studies not captured in the initial search.

2.2. Selection Of Studies

All search results were pooled and managed using Google Sheets (<https://docs.google.com/spreadsheets/>) (Google LLC, Mountain View, CA, USA). Duplicate records were initially removed before the remaining articles were screened by title to assess potential relevance. Abstracts of the shortlisted studies were then reviewed, and those meeting the preliminary criteria were advanced to full-text evaluation. Only articles with accessible and complete full texts were included. The entire selection procedure was conducted independently by two reviewers (FL and PS), and any disagreements were resolved through discussion. When consensus was not achieved, a third reviewer (DK) was consulted to make the final decision.

2.3. Eligibility Criteria

The eligibility criteria were formulated using the Population, Intervention, Comparison, Outcome, and Study Design (PICOS) framework (Methley et al., 2014) [Table 1]. Studies were included if they involved student populations in formal education, implemented CPBL either as a primary pedagogical model or in blended formats, and evaluated outcomes directly related to creative thinking or associated educational competencies such as academic performance, communication, collaboration, resilience, or student satisfaction. Comparisons with traditional instructional approaches or other non-CPBL methods were

considered where available. Studies reporting outcomes related to creative thinking were prioritized, while additional relevant educational outcomes such as academic performance, communication skills, collaboration, resilience, and student satisfaction were also considered where they contributed to understanding the broader impact of CPBL.

Eligible studies comprised empirical research designs, including experimental, quasi-experimental, and case study approaches. Only articles published in peer-reviewed journals in

English between 2000 and 2024, with accessible full texts, were included. Studies were excluded if CPBL was not clearly defined or its independent effect could not be determined due to confounding with other pedagogical approaches, or if outcomes were not related to creative thinking or associated educational competencies. Non-empirical publications (e.g., reviews, editorials, commentaries, and conference abstracts), studies conducted outside formal educational settings, and those with inaccessible or incomplete full texts were also excluded.

Table 1: PICOS Framework.

Components of PICOS	Results
Population	Students enrolled in formal educational programs at any level.
Intervention	Implementation of CPBL, either as a standalone model or in combination with blended learning approaches.
Comparison	Traditional instructional methods or non-CPBL pedagogical approaches, where available.
Outcome	Creative thinking and related educational outcomes, such as academic performance, communication, collaboration, resilience, and student satisfaction.
Study Design	Empirical studies published between 2000 and 2024 with accessible full texts, including experimental, quasi-experimental, and case study designs.

CPBL: Collaborative Project-Based Learning; PICOS: Population, Intervention, Comparison, Outcome, and Study Design.

2.4. Data Extraction and Risk of Bias Assessment

Data extraction was independently conducted by two reviewers (FL and PS) using a standardized, pre-specified form developed in a spreadsheet. The form was pilot-tested on a subset of included studies to ensure consistency and completeness. Extracted data included first author, year of publication, country and continent, study design, research topic, sample characteristics, and key findings related to the role of CPBL.

Disagreements during data extraction were resolved through discussion until consensus was achieved. In cases of missing or unclear information, additional details were sought from supplementary materials or by contacting the corresponding authors. Most included studies employed classroom action research designs; for the purpose of methodological appraisal, these were treated as quasi-experimental single-group studies.

Methodological quality was independently assessed by two reviewers (FL and PS) using the revised Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies (Barker et al., 2024). The checklist consists of nine

domains, including clarity of cause-effect relationships, presence of a control group, comparability of participants, consistency of intervention delivery, pre- and post-measurement, reliability of outcome assessment, completeness of follow-up, and appropriateness of statistical analysis. Each item was rated as “Yes,” “No,” “Unclear,” or “Not applicable.” Discrepancies were resolved through consensus.

3. RESULTS

3.1. Overview Of Study Selection

Figure 1 presents the PRISMA-style flow of study selection. The database search identified 4,369 records from PubMed (3,112), Cochrane Library (283), and ScienceDirect (974). Titles and abstracts of all records were screened, and 4,354 were excluded. The remaining 15 records were checked for duplication and two duplicates were identified. Full texts of 15 articles were retrieved and assessed for eligibility. Six articles were excluded at this stage due to inappropriate participant characteristics or study design. Accordingly, the overall screening process led to the inclusion of 7 studies in the qualitative synthesis [Figure 1].

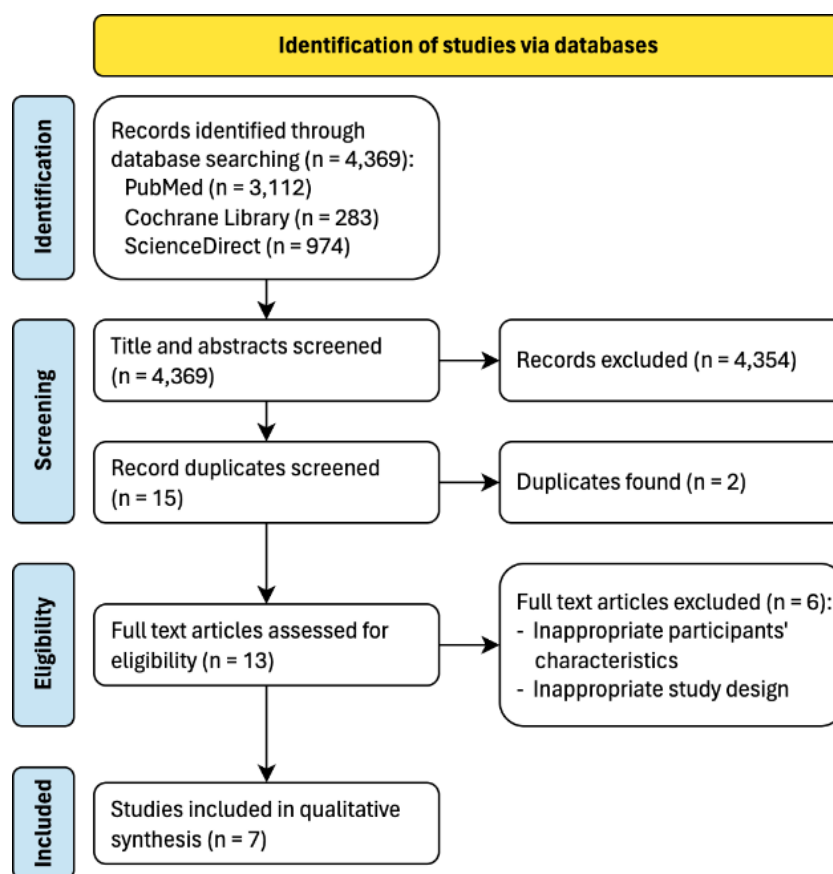


Figure 1: Diagram Flow of Literature Search Strategy for This Systematic Review.

3.2. Characteristics And Outcomes of Included Studies

The characteristics of the included studies are summarized in Table 2. Seven studies met the inclusion criteria with a total sample of 364 students. Sample sizes ranged from 15 to 150 participants (median 36). All studies were conducted in Asia, with five from In-donesia, one from Thailand, and one from Turkey. Study designs comprised classroom or action research approaches ($n = 4$) and quasi-experimental designs ($n = 3$). Topical contexts included education ($n = 4$), STEM ($n = 2$), and geography ($n = 1$). All studies implemented CPBL. Several applied CPBL within structured comparison groups or blended formats, while classroom or action

re-search studies employed single-group cyclic implementations. Reported outcomes clustered around two domains. First, creative and higher-order thinking: gains were documented for creative thinking skills, concept-application ability, and reflective writing or presentation performance. Second, supporting academic and professional competencies: improvements were noted in academic achievement, resilience, communication and collaboration, and technological skills. Across studies, CPBL was consistently associated with positive changes on the targeted outcomes, with quasi-experimental studies providing the strongest comparative evidence and action research studies demonstrating iterative improvements within authentic classroom settings.

Table 2: Study Characteristics.

Author, Year	Country, Continent	Study Design	Topic of study	Sample size (n)	Intervention	Study Outcome	Results
Andini, et al., 2024	Indonesia, Asia	Classroom Action Research	Geography	35	CPBL	Creative thinking skills	The application of the CPBL model via the 3D diorama project has demonstrated an enhancement in students' creative thinking abilities.

							This is evidenced by a notable rise in the scores obtained from creative thinking assessments.
Wicaksono, et al., 2022	Indonesia, Asia	Classroom Action Research	STEM	20	CPBL	Development of students, collaboration aspect, and professional development	Following the increased engagement of the lecturer in both forum discussions and live conferences, students have shown a greater level of participation in collaborative sessions. The lecturer's presence serves as a motivational factor and acts as a "guardian," particularly with the implementation of the new reward and penalty system. Notably, the collaborative sessions focused on (PBL) have demonstrated significant improvement compared to earlier sessions.
Rupavijetra, et al., 2022	Thailand, Asia	Action Research	Education	40	CPBL	The level of satisfaction of students, writing and presenting reflections on students' learning	The current study encompasses two primary objectives, resulting in outcomes that are not only effective and advantageous but also pertinent to real-world applications. This relevance is particularly significant given the increasing population of older adults who require ongoing education and seek affection and engagement from the younger generation.
Baser, et al., 2017	Turkey, Asia	Action Research	STEM	15	CPBL	Technological and collaborative skills	Collaborative project-based learning proved effective in improving students' advanced technological and teamwork abilities, while also familiarizing them

							with methods for incorporating technology into scientific practices.
Darmuki, et al., 2023	Indonesia, Asia	Quasi-experimental	Education	36	CPBL	Students' learning achievement in Indonesian language course	The results of the comparison of post-test means between the experimental and control groups indicated that the scores of students in the experimental group were significantly higher than those in the control group.
Sulastrri, et al., 2023	Indonesia, Asia	Quasi-experimental	Education	68	CPBL	Resilience and Student Learning Outcomes	The study revealed variations in resilience and English learning outcomes, indicating that students who engaged in the collaborative project-based blended learning model achieved superior results. Consequently, it can be concluded that the collaborative project-based blended learning model is an effective approach for enhancing both resilience and academic performance among junior high school students.
Sukmawati, et al., 2023	Indonesia, Asia	Quasi-experimental	Education	150	CPBL	Concept-Application ability	CPBL significantly contributes to the concepts understanding in learners' daily lives.

CPBL: Collaborative Project-Based Learning; PBL: Problem-Based Learning; STEM: Science, technology, engineering, and mathematics.

3.3. Risk Of Bias Assessment

Figure 2 summarizes the JBI appraisal. Overall, five studies were rated low risk and two moderates, with none high. Two studies achieved 100 percent Yes (Baser 2017; Darmuki 2023). Andini 2024 was also low risk; Sulastrri 2023 was low risk despite no pre-post measurement; Sukmawati 2023 was low risk with unclear follow-up. Wicaksono 2022 and Rupavijetra 2022 were moderate due to single-group classroom or action research designs without control groups and limited or undefined statistical analysis. Across items, cause-effect was clear in all; control

groups were absent in three, rendering comparability items not applicable; six studies used pre and post measurements and one used post-test only; outcome measurement was consistent and reliable across all; follow-up was complete or adequately reported in five, not applicable in one, and unclear in one; appropriate statistical analysis was used in five studies, absent in one, and unclear in one. The median proportion of Yes responses was 87.5 percent (range 71.4 to 100), indicating generally sound methods with vulnerabilities centered on the lack of comparators and analytic rigor.

	 Yes  No  Unclear  Not applicable	Is it clear what is the "cause" and what is the "effect"?	Was there a control group?	Were participants included in any comparisons similar?	Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Were the outcomes of participants included in any comparisons measured in the same way?	Were outcomes measured in a reliable way?	Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Was appropriate statistical analysis used?		
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	%Yes	Risk of Bias
Andini et al., 2024											85.7	Low
Wicaksono et al., 2022											71.4	Moderate
Rupavijetra et al., 2022											71.4	Moderate
Baser et al., 2017											100	Low
Darmuki et al., 2023											100	Low
Sulastri et al., 2023											87.5	Low
Sukmawati et al., 2023											88.9	Low

Figure 2: Risk Of Bias Assessment of Included Studies Using the JBI Critical Appraisal Tool.

4. DISCUSSION

The findings of this review reinforce the effectiveness of collaborative project-based learning and are consistent with previous evidence on project-based and collaborative pedagogies (Guo et al., 2020; Chen and Yang, 2019). Across the included studies, CPBL was associated with a range of positive outcomes. In several contexts, project-based approaches outperformed traditional instruction on academic achievement (Chen and Yang, 2019). Because PBL is inquiry oriented and positions learners as active problem solvers, students identify issues, generate solutions, and refine products, which strengthens motivation and skill development (Kokotsaki et al., 2016; Lee et al., 2024; Shin et al., 2015). Although much of the prior literature derives from professional fields, evidence in this review indicates that CPBL is also valuable for health promotion students. By engaging students with authentic problems and tangible products, CPBL can build professional readiness and transferable skills for real-world settings (Rohm et al., 2021). These

benefits, however, depend on enabling conditions such as supportive classroom climates, institutional backing, and equitable access to resources.

The reviewed courses implemented project-based learning within explicit collaborative structures, enabling students to coordinate roles, negotiate ideas, and co-produce deliverables. Collaboration and partnership are central competencies in global health, where interprofessional cooperation is routine (Ablah et al., 2014; Rafiola et al., 2020). Empirical work shows that collaborative learning improves academic performance and student engagement (Rania et al., 2015; Han et al., 2014), and it nurtures cooperative skills and effective communication, which are critical for health promotion professionals (Sheldon et al., 2015). Evidence from nursing practicums further indicates that collaborative learning can strengthen clinical competencies (Hanklang and Sivasan, 2021; Yunus et al., 2021). These patterns suggest that global health and health promotion curricula benefit from integrating structured collaborative elements to

cultivate communication and teamwork. For instance, in undergraduate nursing education, CPBL has been shown to significantly improve global health competencies, communication, and problem-solving skills, which are essential for interprofessional collaboration in clinical settings (Lee et al., 2024). These findings indicate that CPBL can prepare health care students not only for academic success but also for the collaborative demands of professional practice.

Recent studies also highlight the contribution of project-based approaches to creative thinking. Wicaksono et al. (2022) showed that combining PBL with design thinking in a mobile application course improved students' creative capacities by linking technical work with ideation and iteration. Complementary evidence from visual arts has emphasized the importance of creative diversity and individuality, principles that are inherent in PBL and that can be scaffolded through studio-like critique and reflection (Lee et al., 2018). Together, these findings indicate that PBL can create conditions where learners generate many ideas, evaluate alternatives, and develop distinctive solutions.

When embedded in routine teaching, collaborative learning tends to increase engagement, deepen retention, and yield better out-comes than individual work (Nisa et al., 2018). Effective implementation benefits both students and instructors by clarifying expectations, building a supportive classroom culture, and improving communication skills needed to navigate academic discourse communities. Because collaborative learning foregrounds group dynamics and the emotional texture of teamwork, instructors should monitor and respond to shifts in participation and cohesion as projects unfold (Nuramalina et al., 2019). Active learning strategies remain central for participation, and CPBL offers structured opportunities for students to articulate ideas with peers, which can bolster confidence, including in English speaking skills.

In particular, the predominance of studies conducted in Asian educational settings suggests that cultural and institutional contexts may shape the outcomes of CPBL. Asian classrooms are often characterized by hierarchical teacher-student relationships and exam-oriented curricula, which may influence how students engage with collaborative and inquiry-based tasks (Fabris et al., 2023; Maknuunah et al., 2021). Root-ed in Confucian philosophy, Eastern schooling emphasizes obedience to authority, rigorous effort, and competitive, exam-oriented learning (Cortina et al., 2017; Surahman et

al., 2018). By contrast, Western systems are more strongly influenced by Socratic traditions, where learning is framed as an enjoyable process that fosters critical thinking and questioning of authority. Cultural variables also affect classroom relationships: in collectivist and hierarchical contexts, students may be less inclined to challenge peers or teachers, while in more egalitarian and individualist societies, cooperation, open dialogue, and pro-social interactions are more common (Hofstede et al., 2010). These contrasts suggest that CPBL may require more scaffolding in Asian settings compared with Western classrooms, and future research should examine how such cultural differences moderate its effectiveness.

Furthermore, the lack of control groups and reliance on heterogeneous outcome measures limit the capacity to establish causal inferences regarding CPBL's effects on creative thinking. Without consistent comparison groups, improvements may partly reflect maturation or instructor effects rather than the intervention itself. Similarly, varied and sometimes unvalidated outcome instruments hinder cross-study comparability and reduce the strength of accumulated evidence. Future research would benefit from adopting standardized and validated measures of creativity, such as the Torrance Tests of Creative Thinking (TTCT), to ensure methodological consistency and enable stronger causal conclusions (Alabbasi et al., 2022).

To the best of our knowledge, this is the first systematic review dedicated to CPBL as a strategy for enhancing creative thinking across educational levels. The review follows PRISMA 2020 procedures and applies a structured JBI appraisal, with independent screening and extraction. Limitations include the predominance of single-group classroom or action research designs without control groups, one post-test-only study, short or unreported follow-up, heterogeneous outcome instruments and scoring, and the concentration of studies in Asian contexts that may limit generalizability. These factors counsel caution in causal interpretation and cross-study comparison. Even so, the direction of effects was consistently positive, underscoring the need for controlled, longitudinal studies using standardized creativity measures in more diverse settings.

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