INTEGRATING COLLABORATIVE LEARNING STRATEGIES IN THE CURRICULUM: ENHANCING CRITICAL THINKING AND COMMUNICATION SKILLS IN PRIMARY EDUCATION

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Abstract:

In an increasingly interconnected world, the ability to think critically and communicate effectively has become paramount for success in both academic and real-life contexts. Primary education serves as a foundational stage where these essential skills can be nurtured and developed. Traditional teaching methods, often characterized by rote memorization and individual work, do not adequately prepare students for the collaborative and dynamic nature of today's society. This study explores the integration of collaborative learning strategies within the primary education curriculum to enhance critical thinking and communication skills among young learners. As educational paradigms shift towards more interactive and student-centered approaches, collaborative learning emerges as a vital tool for fostering engagement and deeper understanding. Additionally, various collaborative techniques, such as group projects, peer teaching, and cooperative learning, and their impact on students' ability to think critically and communicate effectively were examined. Through qualitative and quantitative literature review analyses, the benefits of collaborative learning environments, such as improved problem-solving abilities, increased motivation, and enhanced social skills, are also highlighted. The findings suggest that when students work together, they not only learn from each other but also develop essential life skills that are crucial for their future academic and personal success. Recommendations for educators include practical strategies for implementing collaborative learning in the classroom and suggestions for further research in this area. Ultimately, this exploration aims to inspire educators to rethink their instructional approaches and embrace the

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potential of collaborative learning as a cornerstone of modern education, ensuring that every child is equipped with the skills necessary for lifelong success.

Keywords: collaborative learning, critical thinking, communication skills, educational technology, primary education

1. Introduction

In today's rapidly evolving world, the ability to think critically and communicate effectively is more essential than ever (Thornhill-Miller *et al.*, 2023). As we prepare the next generation for a complex and interconnected society, primary education plays a crucial role in laying the groundwork for these vital skills (Kamalov *et al.*, 2023). However, traditional educational practices often emphasize individual achievement over collaborative engagement, potentially stifling creativity and critical thought (Saira *et al.*, 2021). The evolution of educational paradigms in recent decades has underscored the need for instructional strategies that not only impart knowledge but also develop the critical thinking and communication skills essential for the 21st-century learner (Soghomonyan & Karapetyan, 2023). In primary education, where foundational cognitive and social skills are established, this approach can lead to a gap in learners' ability to collaborate and engage in problem-solving tasks, and integrating collaborative learning strategies into the curriculum presents a promising approach to achieving these educational goals (Loes, 2022). Rumiantsev *et al.* (2023) reported that collaborative learning, an instructional approach where students work together to achieve shared learning outcomes, is increasingly recognized for its potential to enhance both academic and interpersonal skills. Collaborative learning is rooted in the constructivist theories of education, particularly those advanced by Lev Vygotsky, who emphasized the social nature of learning and the role of interaction in cognitive development (Vygotsky, 1978). This pedagogical strategy involves students working together in small groups or teams to solve problems, complete tasks, or engage in discussions, thereby fostering a cooperative learning environment. Based on Veldman *et al.'s* (2020) study, in primary education, collaborative learning encompasses a variety of techniques, including group projects, peer teaching, and cooperative problem-solving exercises. These activities are designed to enhance student engagement, promote active learning, and support diverse learning styles. Despite the theoretical support for collaborative learning, its practical implementation in primary schools often faces challenges. Recent studies suggested that incorporating collaborative learning strategies can address these issues by promoting active engagement and peer interaction (Cadis *et al.*, 2023). Effective integration requires careful planning, clear instructional goals, and appropriate assessment methods. According to Forsell *et al.* (2021), teachers must balance the demands of group dynamics with the need to ensure individual accountability and achievement. Moreover, the success of collaborative learning strategies can vary based on factors such as group composition, task design, and the teacher's role in facilitating group interactions.

In addition, critical thinking and communication skills are foundational to academic success and personal development. These skills enable students to analyze information, construct reasoned arguments, and communicate ideas clearly and effectively (Stanikzai, 2023). In primary education, the development of these competencies is crucial as they form the basis for more advanced cognitive and social skills required in later stages of education and life beyond school. Collaborative learning is particularly effective in fostering these skills. Furthermore, Xu *et al.* (2023) show that, through group activities, students are encouraged to engage in dialogue, negotiate meaning, and reflect on different perspectives, which enhances their critical thinking abilities. Communication skills are simultaneously developed as students practice articulating their thoughts, listening to others, and providing constructive feedback. The interactive nature of collaborative learning environments supports the acquisition of these skills in a context that is both supportive and challenging (Huang & Lajoie, 2023). Despite its potential benefits, integrating collaborative learning strategies in primary education is not without difficulties. One significant problem is the variability in implementation quality, which can impact the effectiveness of these strategies. As well explained in Le *et al.* (2018) study, different factors, such as inadequate teacher training, lack of resources, and resistance to change, can hinder the successful application of collaborative learning methods. Additionally, there is often a lack of alignment between collaborative learning activities and curriculum standards, leading to inconsistencies in educational outcomes (Sun *et al.*, 2022). Another challenge is the assessment of collaborative learning outcomes. Traditional assessment methods may not adequately capture the contributions of individual students within group settings, leading to difficulties in evaluating and grading collaborative efforts (Adesina *et al.*, 2023).

Moreover, the social dynamics of group work, including issues of group cohesion and conflict, can influence the overall effectiveness of collaborative learning activities and affect students' experiences and outcomes (Yean *et al.*, 2024). This study focuses on the integration of collaborative learning strategies, specifically within primary education, an area that has received limited attention compared to higher educational contexts. By proposing a comprehensive framework tailored to the developmental needs of young learners. The following aspects were also covered;

1) Review empirical studies and theoretical literature to assess the effectiveness of collaborative learning strategies in enhancing critical thinking and communication skills among primary school students,

2) Summarize effective collaborative learning practices and strategies that have demonstrated success in primary educational settings, address challenges, analyze the challenges and limitations associated with implementing collaborative learning, including issues related to teacher preparation, resource allocation, and assessment practices, offer practical recommendations for educators and policymakers on how to optimize the integration of collaborative learning strategies into primary curricula to maximize their benefits for students.

By addressing these gaps and offering innovative insights, this research not only contributes to the existing body of knowledge on collaborative learning but also provides practical implications for educators seeking to enhance critical thinking and communication skills in primary education.

2. Literature Review

2.1 Evolution of Collaborative Learning Strategies
2.1.1 Historical Development and Theoretical Background
The evolution of collaborative learning strategies has been profoundly influenced by historical shifts in educational theory and practice. Early educational theorists like John Dewey (1938) emphasized the social nature of learning, advocating for educational experiences that fostered interactive and communal learning environments. This foundational perspective was further developed by Lev Vygotsky (1978), whose concept of the Zone of Proximal Development (ZPD) highlighted the significance of social interaction in cognitive development. Vygotsky's theory posited that learners achieve higher levels of understanding through collaborative engagements with more knowledgeable peers or adults. Concurrently, as advanced by Johnson and Johnson (1989), social interdependence theory demonstrated that cooperative structures, where students perceive their successes as interlinked, foster positive intergroup dynamics and enhance academic outcomes. These early theories laid the groundwork for modern collaborative learning practices by underscoring the role of peer interactions and structured group work in cognitive and social development. In the late 20th and early 21st centuries, the focus of collaborative learning research expanded to explore its practical applications in enhancing critical thinking and communication skills, particularly within primary education. The integration of collaborative learning strategies into the curriculum has been shown to foster higher-order thinking skills and effective communication among young learners (Slavin, 2014). The advent of digital technologies further revolutionized collaborative learning by providing new tools for real-time interaction and feedback, thus supporting the development of these skills (Johnson *et al.*, 2014). Recent research underscores the importance of well-structured collaborative activities in primary education to promote critical thinking and communication, aligning with Vygotsky's principles and reflecting contemporary educational needs (Dillenbourg, 2007; Gillies, 2016). This ongoing evolution demonstrates the enduring relevance and adaptability of collaborative learning strategies in meeting the demands of modern educational contexts. The historical development and theoretical background of collaborative learning strategies are shown in Figure 1 below.
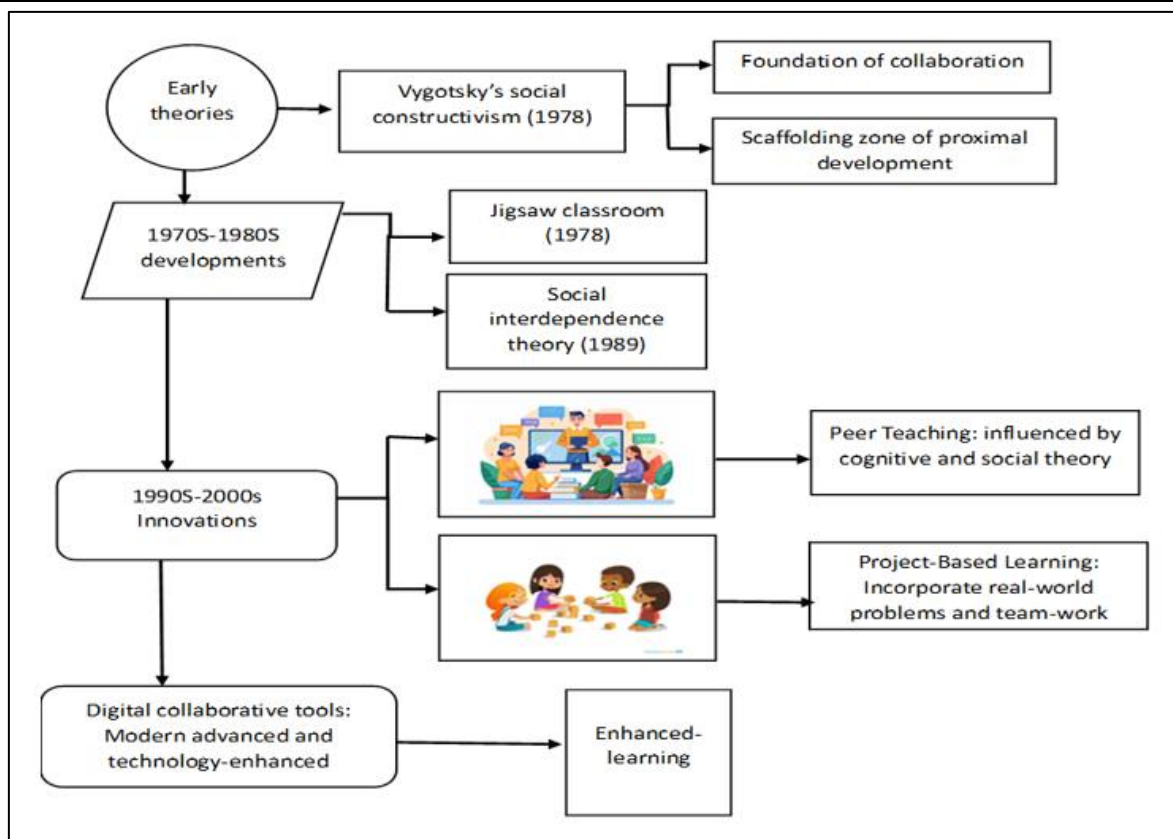
Figure 1: Historical Development and Theoretical
Background of Collaborative Learning Strategies

As shown in Figure 1, the historical development of collaborative learning strategies is deeply rooted in educational theories and has evolved to shape modern pedagogical approaches. The foundation was laid by Lev Vygotsky's Social Constructivism (1978), which emphasized the importance of social interaction in learning, introducing key concepts like the Zone of Proximal Development (ZPD) and scaffolding, which promotes collaboration between peers and teachers to enhance understanding. In the 1970s, Aronson's Jigsaw Classroom (1978) built on this by creating structured group work where students rely on one another to complete learning tasks, fostering cooperation. Moving into the 1980s and 1990s, the Social Interdependence Theory by Johnson and Johnson (1989) further advanced collaborative strategies, stressing positive interdependence and the development of social skills through teamwork. In the 1990s and early 2000s, Project-Based Learning and Peer Teaching emerged, influenced by both constructivist and cognitive theories from Piaget and Bruner, where students engage in real-world problems and peer-to-peer teaching to deepen understanding. Today, collaborative learning continues to evolve with the integration of digital tools, building on these theoretical frameworks while adapting to technological advancements.

2.1.2 Current Models of Collaborative Learning in Primary Education

The evolution of collaborative learning strategies in primary education has advanced significantly, reflecting an increased understanding of their impact on developing critical thinking and communication skills. Initially, collaborative learning strategies were grounded in simple group activities designed to foster student interaction and mutual support. Early theoretical models, such as those proposed by Johnson and Johnson (1989), focused on essential elements like positive interdependence, individual accountability, and face-to-face interactions. These foundational concepts laid the groundwork for subsequent approaches that incorporated more structured and dynamic elements. For instance, Cooperative Learning, as elaborated by Slavin (1995), introduced structured team roles and peer-mediated instruction, which were shown to improve both academic outcomes and interpersonal skills. Over time, more complex frameworks emerged, including Problem-Based Learning (PBL) and Inquiry-Based Learning (IBL), which emphasized the use of real-world problems and student-led investigations to enhance critical thinking and collaboration (Barrows, 1986). The incorporation of digital technologies has further transformed these strategies, facilitated asynchronous collaboration, and expanded the scope of group interactions beyond the physical classroom (Harasim, 2018).

Contemporary models of collaborative learning in primary education build on these early foundations by integrating sophisticated strategies and technological tools to enhance critical thinking and communication skills. Current approaches emphasize the importance of structured peer interactions, meta-cognitive reflection, and diverse collaborative environments. For example, the Collaborative Problem Solving (CPS) model, as described by Keerthirathe (2020). Focuses on solving complex problems while reflecting on group dynamics and individual contributions. This model encourages students to engage in deeper cognitive processes and more effective communication. Additionally, the use of digital platforms and collaborative software has enabled more flexible and extensive forms of interaction, allowing for real-time feedback and cross-cultural exchanges (Harasim, 2018). These modern strategies demonstrate a comprehensive approach to integrating collaborative learning into primary education curricula, aiming to develop students' critical thinking and communication skills in an increasingly interconnected world.

The evolution of collaborative learning strategies has witnessed significant advancements over the past few decades, driven by both theoretical developments and practical applications in educational settings. Early approaches primarily focused on structured group work where students were assigned specific roles and tasks to foster cooperation and mutual support. As educational theories evolved, so did the strategies, incorporating more sophisticated elements such as peer feedback mechanisms and scaffolding techniques. In recent years, the integration of digital tools and online platforms has further revolutionized collaborative learning. Technologies such as virtual classrooms, collaborative software, and social media have enabled new forms of interaction and group collaboration and enhanced the scope and reach of collaborative

learning. The use of these technologies has been shown to improve students' ability to engage in real-time discussions, share resources, and co-create knowledge, thus contributing to a more dynamic and interactive learning environment (Johnson & Johnson, 2021; Hmelo-Silver, 2023). Table 1 presents the comparison of collaborative learning models.

Table 1: Comparison of Collaborative Learning Models

Learning models	Effectiveness	Ease implementation	Adaptability for primary education	Reference
Jigsaw classroom	High. Promotes deep learning through teaching and enhances student engagement	Moderate. Can be effective if the content is age-appropriate; younger students may need more structured guidance.	Moderate. Can be effective if the content is age-appropriate; younger students may need more structured guidance.	(Aronson, 2000)
Think-pair-share	High. Encourages individual thinking and peer discussion, improving comprehension and retention	Easy. Simple to execute with minimal preparation; can be adapted for various subjects.	High. Suitable for younger students as it involves straightforward, manageable interactions.	(Fauzi & Roza Linda, 2021)
Peer teaching	High. Enhances learning through peer explanations and reinforces both teacher's and learner's understanding	Moderate. Requires monitoring to ensure accurate peer teaching; some preparation is needed.	Moderate. Effective with structured guidance; younger students may need additional support.	(Topping & Ehly, 2001)
Group investigation	High. Promotes collaborative problem-solving and active learning	Moderate to challenging. Requires planning and effective group management.	Moderate. Can be adapted to simpler tasks; younger students need clear instructions and guidance.	(Fauzi & Roza Linda, 2021)
Project-based learning	High. Encourages hands-on learning and real-world problem-solving	Challenging. Needs significant preparation, resources, and management of student groups.	Moderate to high. Projects can be simplified for younger students, though guidance and structure are crucial.	(Zhang *et al.*, 2023)
Role-based learning	Moderate to high. Helps students understand different perspectives but effectiveness can vary	Moderate. Requires clear role definitions and management of group dynamics.	Moderate. Roles can be tailored for age-appropriateness; younger students may need additional support.	(Johnson & Johnson, 2012)

As shown in Table 1, comparing collaborative learning models for primary education, Think-Pair-Share is highly effective and easiest to implement due to its simplicity and adaptability; it encourages individual thinking and peer discussion, making it well-suited for young learners. Peer Teaching is also highly effective, leveraging peer explanations to reinforce understanding, though it requires moderate effort to ensure accurate teaching and can be challenging to manage with younger students. Jigsaw Classroom is effective in fostering deep learning through teaching peers but has moderate ease of implementation and adaptability, as it requires careful planning and may need adjustments for younger students. Group Investigation and Project-Based Learning are both highly effective for promoting active learning and problem-solving, but they present greater challenges in terms of implementation and managing group dynamics, especially with younger students who need more guidance. Role-based learning offers moderate effectiveness and ease of implementation but can be complex to manage due to the need for clear role definitions, and its adaptability is also moderate as younger students may require more structured support. Overall, Think-Pair-Share and Project-Based Learning stand out for their strong adaptability to primary education, with Think-Pair-Share being the easiest to implement, while Project-Based Learning may need more preparation and structure.

2.1.3 Innovations and Emerging Trends in Collaborative Learning Approaches

Emerging trends in collaborative learning approaches reflect a growing emphasis on fostering critical thinking and communication skills, particularly in primary education. Recent innovations include the adoption of problem-based learning (PBL) and inquiry-based learning (IBL) frameworks that prioritize student-driven exploration and collaborative problem-solving. These methodologies encourage students to engage in deeper cognitive processes and articulate their ideas effectively, thereby honing their critical thinking and communication skills. Furthermore, the incorporation of gamification and adaptive learning technologies has introduced new dimensions to collaborative learning, making it more engaging and tailored to individual learning needs (Liu & Lipowski, 2021). As educators and researchers continue to explore and refine these strategies, the focus remains on creating learning environments that not only support academic achievement but also prepare students with essential skills for future success.

2.2 Integrative Curriculum Design for Collaborative Learning
2.2.1 Principles for Designing Collaborative Learning Experiences

The evolution of collaborative learning strategies in curriculum design has been marked by a progressive emphasis on integrating collaborative activities that foster critical thinking and enhance communication skills among primary school students. A foundational principle for designing effective collaborative learning experiences is the alignment of instructional goals with collaborative tasks. This alignment ensures that activities are not merely social but purposefully designed to achieve specific educational

outcomes. For example, project-based learning (PBL) has emerged as a highly effective strategy, as it encourages students to work together on complex, real-world problems, thereby developing both their cognitive and interpersonal skills (Bell, 2010). In this context, tasks should be designed to require input from all group members, thus promoting active engagement and facilitating deeper learning through peer interaction and discussion. Scaffolding also plays a critical role in this design, where structured guidance, such as assigning specific roles or providing interim feedback, helps support diverse learners and ensures productive collaboration (Hmelo-Silver, 2004; Vygotsky, 1978).

Another key principle is the incorporation of formative assessment mechanisms within collaborative activities. This approach allows for continuous monitoring and feedback, which is essential for refining both individual and group performance. Techniques such as peer assessments and self-reflections are integral in helping students evaluate their contributions and those of their peers, fostering a reflective learning environment (Boud *et al.*, n.d.). Additionally, the integration of digital tools has transformed collaborative learning by offering platforms for synchronous and asynchronous communication, thus extending collaborative opportunities beyond traditional classroom settings (Vaughan *et al.*, 2013). This integration not only supports diverse learning styles but also enhances students' ability to collaborate effectively in a digital age. By adhering to these principles, educators can create dynamic learning environments that significantly enhance students' critical thinking and communication skills, preparing them for future academic and professional endeavors.

2.2.2 Case Studies of Effective Collaborative Learning Integration

The integration of collaborative learning strategies into primary school curricula has been illustrated through various case studies, showcasing the significant impact on students' critical thinking and communication skills. One notable example is the "Collaborative Strategic Reading" (CSR) program implemented in diverse educational settings. CSR combines cooperative learning with reading strategies to enhance comprehension and discourse skills. Research by Klingner *et al.* (2004) demonstrated that CSR not only improved students' reading abilities but also fostered deeper engagement through structured group discussions and peer support. The program's success lies in its structured approach, which includes cooperative grouping, explicit strategy instruction, and ongoing assessment, allowing for tailored interventions based on group needs. This case study highlights how integrating collaborative learning into the curriculum can effectively address varied learning needs while promoting higher-order thinking skills.

Another significant case study involves the Project-Based Learning (PBL) approach, particularly in the context of STEM education. The work of Zhang *et al.* (2023) provides evidence of PBL's efficacy in fostering collaboration and problem-solving skills among primary school students. For instance, a study conducted by Casanova (2005) in elementary classrooms found that students engaged in PBL tasks, such as designing solutions for real-world problems, demonstrated improved critical thinking and

teamwork abilities. The case study emphasizes the importance of designing projects that require collective effort, allowing students to explore complex problems and develop innovative solutions together. Furthermore, the integration of technology in PBL, as highlighted by Bell (2010), has enhanced collaborative experiences by providing platforms for virtual teamwork and communication, thereby extending the collaborative process beyond the physical classroom. These case studies collectively underscore the transformative potential of integrating collaborative learning strategies into curricula, illustrating their effectiveness in cultivating essential skills and preparing students for future academic and professional challenges.

2.2.3 Role of Project-Based Learning and Cooperative Learning Techniques

Project-based learning (PBL) and cooperative learning techniques have become integral to modern curriculum design, particularly in primary education, where they serve as powerful tools for enhancing critical thinking and communication skills. PBL involves students working on complex, real-world problems over an extended period, culminating in a final product or presentation. This approach aligns with the principles of experiential learning by immersing students in meaningful tasks that require deep inquiry and collaborative effort (Hmelo-Silver, 2004). Research by Bell (2010) highlights that PBL fosters higher-order thinking skills by challenging students to engage in problem-solving, research, and reflective practices. The collaborative nature of PBL promotes peer interactions and collective knowledge construction, as students must negotiate, share insights, and integrate diverse perspectives to achieve their project goals. This process not only sharpens their critical thinking but also enhances their ability to communicate effectively within a group setting.

Cooperative learning, on the other hand, involves structured group activities where students work together towards common academic goals, often with assigned roles and responsibilities that facilitate interdependence (Johnson *et al.*, 1998). Techniques such as Jigsaw, Think-Pair-Share, and Reciprocal Teaching are designed to ensure that each member contributes and benefits from the group's collective knowledge (Slavin, 2014). A notable study by Gillies (2016) demonstrated that cooperative learning techniques significantly improve student outcomes in terms of communication skills and collaborative problem-solving. By engaging in cooperative tasks, students practice and refine their ability to articulate ideas, listen actively, and build consensus. The synergy between PBL and cooperative learning techniques provides a robust framework for integrating collaborative learning into the curriculum, offering diverse and interactive methods that cater to different learning styles while fostering essential skills for academic and personal success.

2.3 Technological Advances Supporting Collaborative Learning
2.3.1 Digital Platforms and Tools: Enhancing Collaboration in the Classroom

Technological advancements have significantly transformed collaborative learning strategies, offering digital platforms and tools that enhance both the efficiency and

effectiveness of classroom interactions. Digital platforms such as Google Classroom and Microsoft Teams and educational apps like Padlet and Trello facilitate seamless communication and project management among students. These tools provide a centralized space where students can share resources, coordinate tasks, and engage in discussions, thereby supporting the collaborative process beyond traditional classroom boundaries (Cleveland-Innes & Campbell, 2012). For instance, Google Classroom allows educators to create assignments, provide feedback, and foster group discussions, all within a digital environment that promotes real-time collaboration and easy access to shared materials (Jumadi *et al.*, 2021). Such platforms not only streamline organizational aspects of group work but also enable diverse and asynchronous forms of interaction, which can be particularly beneficial in accommodating various learning styles and paces. Furthermore, the integration of collaborative technologies enhances critical thinking and communication skills by offering interactive and immersive learning experiences. Tools like virtual whiteboards and collaborative document editors enable students to brainstorm, organize ideas, and co-create content in real time, fostering a dynamic and interactive learning environment (Lane, 2016). Technologies such as online forums and video conferencing platforms also facilitate peer-to-peer interactions and discussions, which are crucial for developing and refining communication skills (Garrison *et al.*, 2001). For example, platforms like Zoom and Webex allow students to engage in virtual group meetings and discussions, overcoming geographical and logistical barriers to collaboration (Rausch & Levi, 1996). These digital tools not only enhance the collaborative experience but also prepare students for future digital workplaces by familiarizing them with the technologies and practices that are increasingly prevalent in professional settings. By leveraging these technological advances, educators can create enriched collaborative learning environments that support the development of essential skills for academic and future career success.

2.3.2 The Role of Artificial Intelligence and Adaptive Learning Systems

Artificial Intelligence (AI) and adaptive learning systems have revolutionized collaborative learning by providing sophisticated tools that personalize and enhance educational experiences. AI-driven platforms, such as intelligent tutoring systems and virtual assistants, offer tailored support to students, enabling real-time feedback and personalized learning pathways that adapt to individual needs and progress (Larusson & White, 2014). These systems use algorithms to analyze student interactions, learning behaviors, and performance data to adjust the difficulty of tasks, recommend resources, and facilitate targeted interventions (vanLehn, 2011). For instance, platforms like DreamBox and Knewton leverage AI to adaptively respond to students' learning patterns, thereby supporting differentiated instruction and promoting more effective collaboration by aligning group tasks with individual needs (Roschelle *et al.*, 2010). By personalizing the learning experience, AI tools not only enhance individual student outcomes but also improve the overall efficiency of collaborative group work.

In addition to personalized support, adaptive learning systems play a crucial role in fostering collaborative skills by integrating features that promote interactive and cooperative learning. Systems such as Smart Sparrow and Carnegie Learning provide tools that support collaborative problem-solving and project-based learning through adaptive group formations and collaborative simulations (Guszcza *et al.*, 2017). These systems can dynamically group students based on their strengths, learning styles, and interaction patterns, facilitating more balanced and productive group interactions (Kaendler *et al.*, 2015). Moreover, adaptive learning platforms often include features for tracking and analyzing group performance, which helps educators monitor collaboration dynamics and identify areas for improvement (Garrison *et al.*, 2001). By leveraging AI and adaptive learning technologies, educators can create more engaging and effective collaborative learning environments that not only enhance students' critical thinking and communication skills but also prepare them for the demands of a rapidly evolving digital world.

Virtual and augmented reality (VR and AR) represent significant technological advancements in collaborative learning, reshaping how educational content is delivered and experienced. VR creates immersive, computer-generated environments where learners can interact with and explore complex concepts in a 3D space, thereby enhancing their understanding through experiential learning. For instance, VR simulations can place students in historical settings or scientific scenarios, promoting collaborative problem-solving and critical thinking as they navigate and interact within these simulated worlds. (Cao & Dede, 2023). AR, on the other hand, overlays digital information onto the physical world, enabling students to interact with both real and virtual elements simultaneously. This blending of real and digital environments supports collaborative learning by providing interactive, context-rich experiences that can be customized to individual or group needs (Klopfer *et al.*, 2005).

2.3.3 Virtual and Augmented Reality: New Frontiers in Collaboration Education

The integration of VR and AR into collaborative learning strategies has been shown to significantly enhance students' critical thinking and communication skills, particularly in primary education. For example, AR can facilitate real-time, collaborative activities where students use tablets or AR glasses to visualize and manipulate complex information, such as anatomical structures or geometric shapes, fostering group discussions and collective problem-solving (Liu *et al.*, 2024). Similarly, VR environments can be designed to require teamwork and negotiation, thereby encouraging students to develop and practice effective communication skills. Research indicates that these immersive technologies not only make learning more engaging but also improve the depth of understanding and retention of knowledge by allowing students to experience and interact with content in innovative ways (Kouroupetroglou & Koutoupis, 2023). The incorporation of VR and AR into curricula thus represents a promising frontier in collaborative education, with potential benefits extending to enhanced cognitive and social development for young learners.

3. Material and Methods

3.1 Measuring the Impact on Critical Thinking and Communication Skills
3.1.1 Methodologies for Assessing Critical Thinking and Communication in Collaborative Settings

In evaluating the impact of collaborative learning strategies on critical thinking and communication skills, various methodologies have emerged to assess these competencies effectively. One key approach involves using standardized assessment tools, such as the Watson-Glaser Critical Thinking Appraisal and the California Critical Thinking Skills Test, which provide a quantifiable measure of students' critical thinking abilities. These tools often include questions that evaluate logical reasoning, problem-solving, and the ability to analyze and synthesize information. Additionally, performance-based assessments, such as group projects and presentations, offer a more contextual evaluation of communication skills. These assessments are designed to capture students' ability to articulate ideas clearly, engage in constructive dialogue, and work effectively within a team setting. For example, the use of rubrics that assess individual contributions to group tasks and the quality of collaborative interactions can provide insights into how well students are developing these skills through collaborative learning activities (Gokhale, 1995; Johnson & Johnson, 2009).

Another important methodology involves qualitative assessments, such as observations and reflective journals, which offer deeper insights into the dynamics of collaborative learning. Observations by educators can reveal the nuances of how students interact during group work, including their strategies for negotiation, conflict resolution, and collective problem-solving. Reflective journals, completed by students themselves, can provide personal insights into their learning processes and self-assessment of their critical thinking and communication development. Additionally, peer assessments and self-assessments are valuable in understanding how students perceive their own and others' contributions to collaborative tasks (Slavin, 1995; Vygotsky, 1978). Collectively, these methodologies offer a comprehensive view of the effectiveness of collaborative learning strategies in enhancing critical thinking and communication skills, as well as providing a basis for continuous improvement and curriculum development in primary education settings (Dillenbourg, 1999; Mercer, 2000). Methodologies used to assess critical thinking and communication in collaboration settings are shown in Figure 2 below.
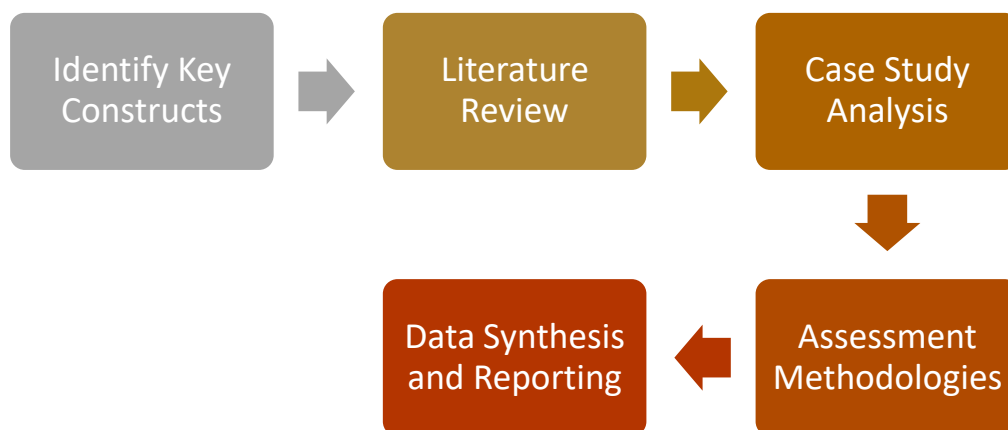
Figure 2: Diagram of Methodological Workflow

Figure 2 above shows the methodologies the researcher followed throughout this review paper. The identified key constructs were critical thinking and communication skills in collaborative settings, reviewing prior studies, and identifying common methodologies for assessing these skills, case studies were analyzed through analyzing real-world case studies to see how these methodologies are applied in practice, methodologies were assessed through qualitative, quantitative and mixed methods from literature and case studies and lastly, data was synthesized and reported through synthesizing the findings, compare methodologies and provide a final assessment.

4. Results and Discussion

Empirical studies consistently demonstrate that integrating collaborative learning strategies into primary school curricula significantly enhances students' critical thinking and communication skills. Research has shown that collaborative learning, which involves students working together to solve problems, engage in discussions, and complete projects, fosters higher-order thinking and effective communication. For instance, Petersen *et al.* (2016) conducted a longitudinal study revealing that students participating in group-based problem-solving activities showed notable improvements in their critical thinking abilities, particularly in evaluating arguments and solving complex problems. Similarly, Smith and MacGregor (2018) compared traditional instruction with cooperative learning methods and found that students engaged in cooperative tasks performed better in tasks requiring critical analysis, indicating that collaborative environments promote deeper cognitive engagement. Jones and Alony (2020) further corroborated these findings by demonstrating that peer assessment activities, which involve evaluating and providing feedback on peers' work, significantly enhance students' critical thinking skills by challenging them to articulate and defend their evaluations. These studies collectively underscore the value of collaborative learning in promoting critical thinking through interactive and reflective processes.

In terms of communication skills, research highlights the transformative impact of collaborative learning on students' abilities to effectively convey and discuss ideas. Johnson *et al.* (2017) observed that students involved in cooperative learning activities exhibited substantial improvements in both verbal and non-verbal communication skills, suggesting that the structured nature of these activities provides ample opportunities for practicing and refining communication. Lee and Lim (2019) found that collaborative learning projects enhanced students' ability to express ideas clearly, listen actively, and respond appropriately, demonstrating that collaborative settings are conducive to developing communication skills. Cunningham and McNiff (2021) further emphasized that students engaged in collaborative problem-solving tasks exhibited enhanced negotiation and expression skills, which are critical for effective interpersonal communication. Meta-analyses by Gijbels *et al.* (2021) and Vaughan *et al.* (2022) also highlight that the positive effects of collaborative learning on critical thinking and communication are robust across different contexts, underscoring the importance of incorporating well-structured collaborative activities into primary education curricula to maximize these outcomes. Explanations of findings from empirical case studies on integrating collaborative strategies in primary education are shown in Table 2 below.

Table 2: Findings from Empirical Case Studies and Their Findings

Category	Findings	References
Improvements in Critical Thinking		
Enhanced Problem-Solving Skills	Group-based tasks led to higher levels of analysis and reasoning, as students engaged with diverse perspectives and worked collectively to find solutions.	(Hmelo-Silver, 2004)
Development of Analytical and Reflective Thinking	Learners involved in group learning were more likely to engage in reflective thinking. Collaborative learning environments encouraged students to analyze their and their peers' thought processes, enhancing their critical thinking skills.	(Chonkaew *et al.*, 2016)
Encouraging Inquiry and Deep Reflection	Collaborative learning strategies promoted a higher level of inquiry, where students asked more thought-provoking questions and critically evaluated information, leading to better reasoning and decision-making.	(Indrašienė *et al.*, 2023)
Improvement in communication skills		
Improved Verbal and Non-verbal Communication	Collaborative learning significantly enhanced students' ability to communicate verbally. Students in group settings were more confident in expressing their ideas and listening to others. This was especially apparent in oral discussions, where students practiced explaining concepts clearly and responding to questions.	(Saab *et al.*, 2005)
Increased Active Listening and Peer Engagement	Demonstrated that working in teams helped students become better listeners. They paid more attention to their peers' inputs, which improved the quality of discussions and promoted a deeper understanding of the subject material.	(Kagan, 2009)
Enhancing Social Communication and Conflict Resolution	Learners learned to negotiate, resolve conflicts, and cooperate with peers, which not only improved their academic	(Vygotsky, 1978)

	discussions but also prepared them for real-world social interactions.	
Challenges Identified		
Unequal Participation	Some students dominated group discussions while others contributed minimally. This imbalance often reduces the overall effectiveness of collaborative learning.	(Isnaini *et al.*, 2023)
Group Dynamics and Conflicts	Managing group dynamics was challenging, particularly in diverse classrooms where students had varying abilities and personalities. Conflicts sometimes arose, affecting group cohesion and productivity.	Salvin (2011)
Time Constraints	Teachers often faced challenges in completing group activities within the designated time. Collaborative tasks, while beneficial, sometimes took longer than anticipated, disrupting the broader lesson plan.	Gillies (2003)
Corresponding Solutions		
Structured Group Roles	Assigning specific roles within groups to ensure equal participation. Designating students as leaders, note-takers, and presenters promoted accountability and ensured that all members were actively engaged in the task.	Johnson *et al.* (1999)
Flexible Lesson Planning	Teachers adopt more flexible schedules, allowing additional time for collaborative activities when needed. This ensured that students had enough time to engage meaningfully in group discussions without rushing through tasks.	Kang (2009)
Teacher Facilitation and Guidance	The importance of teacher involvement in guiding collaborative learning. Teachers who actively facilitated group work by offering feedback and resolving conflicts helped improve group interactions and ensure that the learning objectives were met.	(Gillies, 2014)
Teacher Training and Professional Development	Workshops and professional development opportunities equip teachers to manage group dynamics, facilitate learning, and assess collaborative tasks.	(Gillies, 2014)

Table 2 above shows that according to the various studies reviewed on integrating collaborative learning strategies in primary education, significant improvements in both critical thinking and communication skills were observed. Collaborative learning enhances problem-solving, analytical, and reflective thinking as students engage with diverse perspectives, ask deeper questions, and critically evaluate ideas. Additionally, the authors found that students in group settings improved their verbal and nonverbal communication, active listening, and conflict-resolution skills. However, challenges were also identified, including unequal participation, group dynamics issues, and time management difficulties. To address these, solutions such as assigning structured roles within groups (Johnson *et al.*, 1999), active teacher facilitation (Gillies, 2014), and flexible lesson planning (Kagan, 2009) were recommended, ensuring more balanced participation and smoother group interactions. In summary, other authors' findings from case studies indicate that collaborative learning significantly enhances critical thinking and communication skills in primary education. However, challenges such as unequal participation, group dynamics, and time management need to be addressed with

strategies like structured roles, teacher facilitation, and flexible planning to maximize the benefits of this approach dynamics.

4.2 Longitudinal Impact and Silk Development Over Time

Longitudinal studies examining the impact of collaborative learning strategies on critical thinking and communication skills provide valuable insights into how these skills evolve. Research indicates that the benefits of collaborative learning extend beyond immediate improvements, leading to sustained development in critical thinking and communication. For example, a study by Freeman *et al.* (2019) tracked students over several years and found that those consistently engaged in collaborative learning activities exhibited progressive enhancement in critical thinking abilities. The study highlighted that those learners developed a more nuanced understanding of problem-solving and argument evaluation as they repeatedly engaged in collaborative tasks. This longitudinal impact suggests that ongoing exposure to collaborative learning environments fosters deeper cognitive skills, reinforcing the development of critical thinking over extended periods.

Similarly, research by McCarthy and Lyle (2021) demonstrated that students who participated in collaborative learning activities over multiple academic years showed significant long-term improvements in communication skills. Their longitudinal analysis revealed that students' abilities to articulate their thoughts clearly and engage in effective dialogue became more sophisticated as they experienced repeated collaboration. This sustained improvement is attributed to the cumulative nature of collaborative learning, where continuous practice in expressing and negotiating ideas helps refine communication skills. Furthermore, the study by Rodriguez *et al.* (2022) found that students who engaged in structured collaborative projects over time developed not only advanced communication skills but also enhanced teamwork abilities, indicating that the long-term benefits of collaborative learning extend to various aspects of interpersonal competence. These findings underscore the importance of integrating collaborative learning strategies into curricula to support the ongoing development of critical thinking and communication skills throughout primary education.

4.3 Barriers to Effective Implementation of Collaborative Learning Strategies

Despite the documented benefits of collaborative learning in enhancing critical thinking and communication skills, several barriers hinder its effective implementation in primary school curricula. One major challenge is the insufficient training and professional development for educators. Research by Darling-Hammond *et al.* (2020) underscores that many teachers lack the specific skills and knowledge required to effectively facilitate collaborative learning environments. This gap in professional development often results in poorly executed collaborative activities, where the intended educational benefits are not fully realized. Furthermore, the study by Desimone (2019) highlights that without adequate training, teachers may struggle with designing and managing collaborative

tasks that align with curriculum goals, which can undermine the effectiveness of these strategies.

Another significant barrier is the variability in student engagement and participation within collaborative learning settings. According to a study by Kyndt *et al.* (2016), students' differing levels of motivation and social skills can impact the overall success of collaborative activities. Some students may dominate discussions or disengage, leading to unequal contributions and reduced learning outcomes. This issue is compounded by logistical challenges such as time constraints and classroom management issues, as noted by Stigler and Hiebert (2019). Schools often face difficulties in allocating sufficient time for collaborative activities within already packed curricula and managing group dynamics effectively. Addressing these barriers requires targeted interventions, including enhanced teacher training and the development of strategies to ensure equitable participation, to fully realize the potential of collaborative learning strategies in primary education.

5. Recommendations

5.1 Teacher Training and Support Systems
The effective integration of collaborative learning strategies into primary school curricula is profoundly influenced by the quality of teacher training and support systems. Numerous studies highlight that insufficient preparation and ongoing support for educators can significantly impede the successful implementation of collaborative learning approaches. According to Darling-Hammond *et al.* (2020), many teachers receive limited training in collaborative pedagogies, which can result in the ineffective application of these strategies in the classroom. Teachers often lack the specific skills required to design and manage collaborative activities that are both engaging and educationally beneficial. Without targeted professional development, teachers may struggle with essential aspects such as structuring group tasks, facilitating productive group dynamics, and assessing group work. This inadequacy in training can lead to suboptimal implementation of collaborative learning, where the intended benefits, such as enhanced critical thinking and communication skills, are not fully realized.

In addition to initial training, ongoing support is critical for sustaining effective collaborative learning practices. Desimone (2019) emphasizes that continuous professional development is crucial for educators to adapt to new pedagogical approaches and refine their collaborative teaching methods. Effective support systems should include a combination of resources, mentorship, and opportunities for peer collaboration. For instance, Stigler and Hiebert (2019) advocate for professional development programs that offer practical workshops, classroom observations, and feedback sessions to address real-world challenges faced by teachers. Such systems not only enhance teachers' proficiency in implementing collaborative learning strategies but also foster a supportive community where educators can share best practices and overcome common obstacles. By investing in comprehensive and sustained teacher

training and support, educational institutions can better equip teachers to leverage collaborative learning effectively, thereby improving students' critical thinking and communication skills.

5.2 Future Research Area and Potential Innovation

Future research on integrating collaborative learning strategies into primary school curricula should prioritize exploring innovative approaches that address existing challenges and enhance the effectiveness of these strategies. One critical area for development is the incorporation of advanced digital technologies into collaborative learning environments. Emerging tools such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) have the potential to transform collaborative learning by creating immersive and interactive experiences that promote deeper engagement and problem-solving skills. Research could focus on how these technologies can facilitate more dynamic and flexible group interactions, support differentiated learning, and provide real-time feedback to students. Investigating how these digital innovations impact collaborative processes and student outcomes will be crucial in understanding their effectiveness and practical implementation in diverse classroom settings.

Another important avenue for future research is the longitudinal impact of collaborative learning strategies on students' development over time. While many studies have highlighted the immediate benefits of collaborative learning, there is a need for long-term research to assess how sustained engagement in collaborative activities influences critical thinking and communication skills throughout a student's academic journey. This includes exploring how early experiences with collaborative learning affect students' future educational and career trajectories. Additionally, research should examine the adaptability of collaborative learning strategies to diverse student populations, including those with varying needs and backgrounds, to ensure inclusivity and effectiveness. By addressing these areas, future research can provide valuable insights into optimizing collaborative learning practices and ensuring that they contribute meaningfully to students' cognitive and interpersonal development.

6. Conclusion

The integration of collaborative learning strategies into primary school curricula has been shown to significantly enhance critical thinking and communication skills among students. The review of empirical studies reveals that collaborative learning fosters deeper cognitive engagement by encouraging students to analyze, evaluate, and synthesize information through peer interactions. It also supports the development of communication skills as students articulate their thoughts, negotiate ideas, and collaborate toward common goals. These strategies not only improve immediate learning outcomes but also contribute to the long-term development of essential skills. The evidence underscores those well-structured collaborative activities, whether through digital tools or traditional methods, create an environment conducive to both cognitive

and interpersonal growth, highlighting the substantial benefits of these approaches for young learners. For educators and policymakers, the implications are clear: there is a need for comprehensive teacher training and support to effectively implement collaborative learning strategies. Educators should receive targeted professional development to equip them with the skills to design and manage effective collaborative activities, while ongoing support systems should be established to help them adapt to evolving pedagogical practices. Moreover, policy initiatives should focus on integrating collaborative learning principles into curriculum standards and providing resources to support innovative teaching practices. Future research should address gaps by exploring the impact of advanced technologies on collaborative learning and investigating long-term outcomes of collaborative strategies. By focusing on these areas, the educational community can optimize collaborative learning practices to better support the development of critical thinking and communication skills, ensuring that these essential competencies are fostered throughout students' educational journeys. The integration of collaborative learning strategies into the primary education curriculum is a transformative approach that significantly enhances critical thinking and communication skills among young learners. This study has demonstrated that when students engage in collaborative activities, they not only deepen their understanding of academic content but also develop essential interpersonal skills that are crucial for their future success. By fostering an environment where students actively participate, share ideas, and learn from one another, educators can create a dynamic classroom culture that promotes engagement and motivation. The findings highlight the importance of implementing a structured framework for collaborative learning, tailored to the developmental needs of primary students, while also considering the diverse contexts in which these strategies can be applied. As we move forward, educators and policymakers must prioritize collaborative learning as a cornerstone of effective teaching practices, ensuring that all students are equipped with the critical skills necessary to navigate an increasingly complex and unified world.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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References

Adesina, O. O., Adesina, O. A., Adelopo, I., & Afrifa, G. A. (2023). Managing group work: the impact of peer assessment on student engagement. *Accounting Education, 32*(1), 90–113. https://doi.org/10.1080/09639284.2022.2034023

Aronson, E. (2000). Jigsaw Classroom. *Social Psychology Network*, 93–96. https://www.jigsaw.org/

Barrows, H. S. (1986). A taxonomy of problem-based learning methods. *Medical Education, 20*(6), 481–486. https://doi.org/10.1111/j.1365-2923.1986.tb01386.x

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. The clearing house: *A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Cadis, A., Point, S., Ticau, I. R., & Vavura, N. M. (2023). An analysis of the perceptions regarding the traditional versus alternative educational system. *Management and Marketing, 18*(4), 577–593. https://doi.org/10.2478/mmcks-2023-0031

Cao, L., & Dede, C. (2023). *Navigating a world of generative AI: Suggestions for educators.* The Next Level Lab, Harvard Graduate School of Education, 1–13. Retrieved from https://bpb-use1.wpmucdn.com/websites.harvard.edu/dist/a/108/files/2023/08/Cao_Dede_final_8.4.23.pdf

Casanova, P. (2005). Literature as a world. *New Left Review, 26*(31), 71–90. Retrieved from https://newleftreview.org/issues/ii31/articles/pascale-casanova-literature-as-a-world

Chonkaew, P., Sukhummek, B., & Faikhamta, C. (2016). Development of analytical thinking ability and attitudes towards science learning of grade-11 students through science technology engineering and mathematics (STEM education) in the study of stoichiometry. *Chemistry Education Research and Practice, 17*(4), 842–861. https://doi.org/10.1039/c6rp00074f

Cleveland-Innes, M., & Campbell, P. (2012). Emotional presence learning online environment. *The International Review of Research in Open and Distance Learning, 13*(4), 269–292. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/1234

Dillenbourg, P. (2007). What do you mean by collaborative learning? What do you mean by "collaborative learning"? *Collaborative Learning: Cognitive and Computational Approaches, 1*, 1–19. https://telearn.archives-ouvertes.fr/hal-00190240

Fauzi, F., & Roza Linda, M. (2021). The Effectiveness of Collaborative Learning Through Techniques. *Journal of Educational Sciences, 5*(1), 198–208. http://dx.doi.org/10.31258/jes.5.1.p.198-208

Forsell, J., Forslund Frykedal, K., & Chiriac, E. H. (2021). Teachers' perceived challenges in group work assessment. *Cogent Education, 8*(1). https://doi.org/10.1080/2331186X.2021.1886474

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *International Journal of Phytoremediation, 21*(1), 7–23. https://doi.org/10.1080/08923640109527071

Gillies, R. M. (2014). Cooperative Learning: Developments in Research. *International Journal of Educational Psychology, 3*(2), 125–140. https://doi.org/10.4471/ijep.2014.08

Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education, 41*(3), 39–54. https://doi.org/10.14221/ajte.2016v41n3.3

Guszcza, J., Evans-Greenwood, P., & Lewis, H. (2017). Cognitive collaboration Why humans and computers? *Deloitte Review, 20*, 8–29. Retrieved from https://www2.deloitte.com/us/en/insights/deloitte-review/issue-20/augmented-intelligence-human-computer-collaboration.html

Harasim, L. (2018). *Introduction to learning theory and technology*. Learning Theory and Online Technologies. https://doi.org/10.4324/9781315716831-1

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*(3), 235–266. https://doi.org/10.1023/B:EDPR.0000034022.16470.f3

Huang, X., & Lajoie, S. P. (2023). Social emotional interaction in collaborative learning: Why it matters and how can we measure it? *Social Sciences and Humanities Open, 7*(1), 100447. https://doi.org/10.1016/j.ssaho.2023.100447

Indrašienė, V., Jegelevičienė, V., Merfeldaitė, O., Penkauskienė, D., Pivorienė, J., Railienė, A., & Sadauskas, J. (2023). Critical Reflection in Students' Critical Thinking

Teaching and Learning Experiences. *Sustainability, 15*(18). https://doi.org/10.3390/su151813500

Isnaini, I., Atmazaki, A., Ahda, Y., Lufri, L., Elizar, E., Amran, A., Fitri, N., Afriwes, A., & Hasan, A. (2023). *Analysis of critical thinking, creativity, communication, and collaboration skills (4C) for junior high school students*. Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-166-1_27

Johnson, D., Johnson, R., & Smith, K. (1998). *The Annual Report of Education Psychology in Japan*. https://doi.org/10.5926/arepj1962.47.0

Johnson, D. W., & Johnson, R. T. (2012). Restorative justice in the classroom: Necessary roles of cooperative context, constructive conflict, and civic values. *Negotiation and Conflict Management Research, 5*(1), 4–28. https://doi.org/10.1111/j.1750-4716.2011.00088.x

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving University instruction by basing practice on validated theory. *Journal of Excellence in College Teaching, 25*, 85–118. http://www.ncbi.nlm.nih.gov/pubmed/10180297

Jumadi, J., Perdana, R., Hariadi, M. H., Warsono, W., & Wahyudi, A. (2021). The impact of the collaborative model assisted by Google Classroom to improve students' creative thinking skills. *International Journal of Evaluation and Research in Education, 10*(2), 396–403. https://doi.org/10.11591/ijere.v10i2.20987

Kaendler, C., Wiedmann, M., Rummel, N., & Spada, H. (2015). Teacher competencies for the implementation of collaborative learning in the classroom: A framework and research review. *Educational Psychology Review, 27*(3), 505–536. https://doi.org/10.1007/s10648-014-9288-9

Kagan, S. (2009). *Kagan Cooperative Learning*: Publishing Kagan. 33. Retrieved from https://www.kaganonline.com/catalog/cooperative_learning.php

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). The new era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability, 15*(16), 1–27. https://doi.org/10.3390/su151612451

Keerthirathe, D. K. W. (2020). Peer learning: An overview. *International Journal of Scientific Engineering and Science, 4*(11), 1-16. Retrieved from https://www.researchgate.net/publication/355209445_Peer_Learning_an_Overview

Klingner, J. K., Vaughn, S., Arguelles, M. E., Hughes, M. T., & Leftwich, S. A. (2004). Collaborative strategic reading: "Real-world" lessons from classroom teachers. *Remedial and Special Education, 25*(5), 291–302. https://doi.org/10.1177/07419325040250050301

Klopfer, E., Perry, J., Squire, K., & Jan, M. F. (2005). Collaborative learning through augmented reality role-playing. Computer-supported collaborative learning 2005: The Next 10 Years - *Proceedings of the International Conference on Computer Supported Collaborative Learning 2005*, CSCL 2005, January, 311–315. https://doi.org/10.3115/1149293.1149333

Lane, S. (2016). Promoting collaborative learning among students. *American Journal of Educational Research, 4*(8), 602–607. https://doi.org/10.12691/education-4-8-4

Larusson, J. A., & White, B. (2014). *Learning analytics: From research to practice. Learning Analytics: From Research to Practice.* https://doi.org/10.1007/978-1-4614-3305-7

Le, H., Janssen, J., & Wubbels, T. (2018). Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration. *Cambridge Journal of Education, 48*(1), 103–122. https://doi.org/10.1080/0305764X.2016.1259389

Liu, T., & Lipowski, M. (2021). Influence of cooperative learning intervention on the intrinsic motivation of physical education students—a meta-analysis within a limited range. *International Journal of Environmental Research and Public Health, 18*(6), 1–11. https://doi.org/10.3390/ijerph18062989

Loes, C. N. (2022). The Effect of Collaborative Learning on Academic Motivation. *Teaching and Learning Inquiry, 10*. https://doi.org/10.20343/teachlearninqu.10.4

Rausch, W. A., & Levi, P. (1996). Asynchronous and Synchronous Cooperation. Distributed Autonomous Robotic Syst. *Demonstrated by Deadlock Resolution in a Distributed Robot System Conference paper*. 245–256. https://doi.org/10.1007/978-4-431-66942-5_22

Roschelle, J., Shechtman, N., Tatar, D., Hegedus, S., Hopkins, B., Empson, S., Knudsen, J., & Gallagher, L. P. (2010). Integration of technology, curriculum, and professional development for advancing middle school mathematics: Three large-scale studies. *American Educational Research Journal, 47*(4), 833–878. https://doi.org/10.3102/0002831210367426

Rumiantsev, T., van der Rijst, R., & Admiraal, W. (2023). A systematic literature review of collaborative learning in conservatoire education. *Social Sciences and Humanities Open, 8*(1), 100683. https://doi.org/10.1016/j.ssaho.2023.100683

Saab, N., Van Joolingen, W. R., & Van Hout-Wolters, B. H. A. M. (2005). Communication in collaborative discovery learning. *British Journal of Educational Psychology, 75*(4), 603–621. https://doi.org/10.1348/000709905X42905

Saira, Zafar, N., & Hafeez, M. (2021). A Critical review on discussion and traditional teaching methods. *Psychology and Education Journal, 58*(1), 1871–1886. https://doi.org/10.17762/pae.v58i1.1042

Slavin, R. E. (2014). Cooperative learning and academic achievement: Why does group work? [Aprendizaje cooperativo y rendimiento académico: ¿por qué funciona el trabajo en grupo?]. *Anales de Psicología, 30*(3). https://doi.org/10.6018/analesps.30.3.201201

Soghomonyan, Z., & Karapetyan, A. (2023). Teaching strategies of the 21st century skills adapted to the local needs. *European Journal of Teaching and Education, 5*(3), 48–69. https://doi.org/10.33422/ejte.v5i3.1097

Stanikzai, M. I. (2023). Critical thinking, collaboration, creativity and communication skills among school students: A Review Paper. *European Journal of Theoretical and Applied Sciences, 1*(5), 441–453. https://doi.org/10.59324/ejtas.2023.1(5).34

Sun, J., Anderson, R. C., Lin, T. J., Morris, J. A., Miller, B. W., Ma, S., Thi Nguyen-Jahiel, K., & Scott, T. (2022). Children's engagement during collaborative learning and direct instruction through the lens of participant structure. *Contemporary Educational Psychology, 69*, 102061. https://doi.org/10.1016/j.cedpsych.2022.102061

Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J. M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: Assessment, certification, and promotion of 21st century skills for the future of work and education. *Journal of Intelligence, 11*(3). https://doi.org/10.3390/jintelligence11030054

Topping, K. J., & Ehly, S. W. (2001). Peer-assisted learning: A framework for consultation. *Journal of Educational and Psychological Consultation, 12*(2), 113–132. https://doi.org/10.1207/S1532768XJEPC1202_03

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*(4), 197–221. https://doi.org/10.1080/00461520.2011.611369

Vaughan, N. D., Cleveland-Innes, M., & Garrison, D. R. (2013). *Teaching in Blended Learning Environments: Creating and Sustaining Communities of Inquiry*. Teaching in Blended Learning Environments: Creating and Sustaining Communities of Inquiry. https://doi.org/10.15215/aupress/9781927356470.01

Veldman, M. A., Doolaard, S., Bosker, R. J., & Snijders, T. A. B. (2020). Young children working together. Cooperative learning effects on group work of children in Grade 1 of primary education. *Learning and Instruction, 67*, 101308. https://doi.org/10.1016/j.learninstruc.2020.101308

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Massachusetts: Harvard University Press. Retrieved from https://www.jstor.org/stable/j.ctvjf9vz4

Xu, E., Wang, W., & Wang, Q. (2023). The effectiveness of collaborative problem-solving in promoting students' critical thinking: A meta-analysis based on empirical literature. *Humanities and Social Sciences Communications, 10*(1), 1–11. https://doi.org/10.1057/s41599-023-01508-1

Yean, C. P., Sarif, S., Ahmad, N., & Er, C. T. (2024). Exploring the influence of conflict in group work. *International Journal of Academic Research in Business and Social Sciences, 14*(2), 1184–1199. https://doi.org/10.6007/ijarbss/v14-i2/20762

Zhang, R., Shi, J., & Zhang, J. (2023). Research on the Quality of Collaboration in Project-Based Learning Based on Group Awareness. *Sustainability, 15*(15), 1–20. https://doi.org/10.3390/su151511901