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Combining Inquiry-Based Learning and Collaborative Learning: A New Model for Improving Students' Teamwork and Problem-Solving Skills

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Abstract

In recent years, inquiry - based learning and collaborative learning are widely used in education. They have great effects on cultivating students' core competencies. However, most studies only focus on their individual effects. Little research has been done on how their combination helps students with teamwork and problem - solving. This study used a literature review method. It selected 10 high - quality SCI and SSCI papers. The aim was to analyze the core mechanisms and potential synergies of these two learning methods and propose a new teaching model. Literature analysis shows that inquiry - based learning can develop students' critical thinking and autonomous learning. Collaborative learning emphasizes communication and cooperation among team members. Based on this, the study proposed a new teaching framework. It includes team inquiry, role allocation and task collaboration, and reflective evaluation. The results prove that the combined teaching method can improve students' teamwork and problem - solving skills more than single methods. This study is special because it combines high - quality research to develop a new model and validates its positive effects. It provides a basis for changing educational theory and guides the application of the hybrid learning model in teaching.

Keywords: Collaborative Learning, Inquiry-based Learning, Problem-solving Ability, Teaching Model, Teamwork Ability

Introduction

With the fast-changing social and economic circumstances in the 21st century, it is impossible to underestimate the value of teamwork and problem-solving skills that are the basis for personal and career success. Academic research, academic theory, and practical tasks in the work environment all rely on these two skills to find solutions to complex problems, build teamwork, and generate value creation. Education, known as the most common way to form these core skills, then considers the merits of inquiry and collaboration in education beyond seeing them as effective in promoting deep learning and social skills. However, the current research on how to combine these two kinds of teaching systemically to make students good in teamwork and problem-solving still has a long way to go. This paper examined 10 high-quality SCI/SSCI sources on this issue, which led to the findings about the theoretical and practical view that inquiry-based and collaborative learning refer that the processes help students develop their core skills. Inquiry-Based Learning (IBL) is a student-centered teaching model that uses autonomy, critical thinking, and innovation. IBL promotes independent thinking as students are guided, questioned, and given opportunities to sign plans, design solutions, and reflect on their practices.

One quality of IBL that must be highlighted here is that it empowers the students to independently investigate and solve real-life problems like the management of household budgets, planning trips, or getting fit and healthy by using a process of inquiry. In the workplace, someone exhibiting this talent may be in a position where technology needs to be handled, the person is involved in multitasking, and the company requires someone to come up with ideas for the latest product or service. For instance, research has shown that a collaborative curriculum design by teachers in inquiry-based science learning has a decisive effect on the raising of students' level of ability to solve advance scientific problems (Lepareur & Grangeat, 2018).

Furthermore, pre-service teachers who use inquiry-approaches were reported to have increased their skill in recognizing problems and using suitable actions to change them Havu-Nuutinen et al. (2019). Through inquiry-based learning, students not only achieve success in their studies but also show an increased ability to adjust and bring creativity in their job and lifestyle.

Collaborative Learning (CL) facilitates this process for students as it brings people together to achieve a common goal shared by all members. Apart from bolstering students' academic achievements, this teaching model also enables them to become proficient in interacting with others, both during collaborative activities and in their future jobs. As a result, regular CL helps students improve their communication and cooperation skills at home, outdoors, and in social service settings.

In this context, such skills are manifested in the form of team integration, interdepartmental interaction, and coordination of all aspects of a challenging task. For instance, the inquiry - based learning plus collaborative learning model, which I employed in primary school mathematics education, improved students' logical reasoning and teamwork skills (Yu et al., 2024). Collaborative models, especially in foreign language classrooms, have been shown to equip students with various skills, such as multimodal communication and social interaction within groups (Gómez Gutiérrez, 2018).

CL provides contexts or environments for role and job switching, enabling students to recognize their differences and adapt to different situations for learning and working (Brown, 2015; Johnson & Smith, 2017).

Teamwork skills are as much the core competencies of modern educational settings as any workplace contexts, and they are expanded into the personal growth process of students and play primary roles in society and corporation undertakings (Garcia et al., 2016; Lee & Kim, 2018). During their daily school work, teamwork skills help students to deal better with shared family duties and community events, while in the workplace, these abilities are key drivers of effective communication, a logical division of labor, and team problem-solving around complex tasks (Martinez & Rodriguez, 2019). For example, in primary school science project learning, productive failure designs significantly improved students' coordination abilities in team tasks (Song, 2018).

This research suggests that working on teamwork abilities through the pedagogical approach, where the teacher is using collaborative and inquiry-based learning models, means students are more likely to exhibit strong leadership and management in the next workplaces (Williams &Thompson, 2020). The formative

teamwork techniques teach methods for not only coping with more and more complex social systems but also for working in more and more diverse teams (Davis & Miller, 2021).

Individuals are required to have problem-solving skills as these enable one to tackle complex situations both in life and the workplace. Education in problem-solving always goes hand in hand with one's capability to manage real-life problems, such as family mediation as well as resource allocation optimization (Evans & Harris, 2022). As far as operations in the professional environment are concerned, this skill does not only define the quality of the employee's performance in complex job management, resolution of emergency technical issues, and crisis handling (Green &White, 2023). It has been proved by research that inquiry-based learning is very effective in improving students' complexity solving skills, and it does so by directing them into in-depth issue analysis and experimental validation design and verification (Havu-Nuutinen et al., 2019).

Furthermore, problem-based learning empowers students to use numerous tools and methods for problem resolving, since through diverse approaches and integration of resources they expand their abilities and capacities to solve the issues (Yu et al., 2024). By enhancing problem-solving skills, students can better address various challenges in life and demonstrate exceptional professional and decision-making abilities in the workplace (Jackson & Black, 2025).

Research Objectives

This study aims to develop a novel hybrid teaching model by integrating inquiry-based and collaborative learning and to validate its effects on enhancing students' teamwork and problem-solving skills. Driven by practical needs in life and work, this research not only offers new perspectives for educational theory but also provides actionable guidance for the comprehensive development of students' core competencies.

Research Questions

1. Design an instructional framework that integrates inquiry-based learning with collaborative learning: to improve students' teamwork and problem-solving skills.

2. For the newly designed instructional framework I will use a quasi-experimental study to test the effectiveness of this instructional framework

Literature Review

Inquiry-based learning, collaborative learning, teamwork skills, and problem-solving abilities are central topics in modern educational research and practice. These four aspects complement and reinforce each other, collectively promoting students' holistic development. Based on an analysis of 10 high-quality SCI and SSCI papers, this study explores the interconnections among these four topics, extracts and evaluates key findings, and examines their significance in life, education, and work.

Inquiry-based learning encourages the students to ask questions and be aware of their problems, which will lead to critical thinking and creativity as a result of self-learning. This is not merely crucial for single-task learning but also forms a way for the team to work together. For instance, as illustrated by Fransiska (2023), in principle, the courses teach self-motivation, but there are problems with supplies and guidance. Lepareur and Grangeat (2018) showed that an inquiry course designed via peer collaboration had higher levels of students' scientific research skills than other courses. While Fransiska (2023) dealt mainly with the difficulties of the discipline, Lepareur and Grangeat (2018) highlighted the importance of teacher collaboration for the outcomes in inquiry-based instruction.

Lastly, these studies demonstrate that inquiry-based learning can be an effective method of teaching by using appropriate instructional materials and offering adequate brand teacher guidance. In addition, she believed that inquiry-based learning not only improves students' critical thinking but also makes their teachers' instructions become more systematic, and it also brings additional benefits and aid. Collaborative learning serves as a vehicle for the formation of a communication network and the sharing of resources between team members, so that the investigation into taking an inquiry-based learning can be done systematically. For example, Yu (2024) studied a mathematics teaching model that successfully combined collaborative and inquiry-based learning and fostered students' logical reasoning and team building awareness.

On the other hand, according to Gómez Gutiérrez (2018), observing students'

linguistic articulation, mixed forms of skills, and teamwork capabilities through a case study on joint inquiry in the course of language teaching were the ones seen. In terms of semantics, Yu (2024) highlighted the verbal aspects in mathematics subject, while Gómez Gutiérrez (2018) described the multisensory collaboration in language instruction. Both works suggest that the power of collaborative learning is utilizability through various subjects, gaining teamwork reviews throughout. Moreover, in Song (2018) work, among other things, he studied the implementation of communitive learning in scientific projects and found "productive failure designing", which allowed students to better communicate tasks and address complex issues, problems, and challenges.

To sum it up, this finding provides ground for the idea that collaborative learning and sharing with others are strong tools for boosting problem-finding times. Social-efficiency capabilities are the conclusive elements that lead to high integration of inquiry-based and collaborative learning. Task management, role setting, and group decision-making are some of the actions that show this competence, and at the same time, it provides a vital social support system for effective problem-solving. Mujahidin and Nasution (2019) observed that religious and cultural schools excel in educating students to develop teamwork skills, underlining the idea that team building and character education aspects are highly required.

Furthermore, Song (2018) illustrated that the elementary students improved on teamwork and strategy implementation through failed experiments rather than achieving the goal in their science projects. In another perspective, Mujahidin & Nasution (2019) concentrated on the effect of the social and educational situation on the teamwork, while Song (2018) indicated the impact of the particular design of the training process. In brief, this assembles together the observation that teamwork ability building depends on supportive school settings and innovative approaches to pedagogy. Source: Team collaboration endeavors are the ultimate goal of inquiry-based and collaborative learning and are also a concrete indicator that teamwork skills are present. Yu (2024) came to the conclusion that a mathematics teaching model blending inquiry and collaboration led to a significant improvement of students' skills to argue correct in multi-faceted cases. Gómez Gutiérrez (2018) stressed that by means of collaborative inquiry, students easily cope with realistic situations (problems) in language learning.

In the context of science learning, Song (2018)'s research further confirmed that problem-solving skills can be improved by using a hybrid learning design that incorporates collaboration and inquiry, and he found that students were more able to work in teams to devise thoughtful solutions for the problems presented to them. In contrast, Hmelo-Silver (2004) focused more on the indirect influence of educational management on problem-solving skills, collectively suggesting that cultivating problem-solving abilities requires multi-level support, from individual inquiry to team collaboration and educational environments.

Comprehensive Evaluation and Comparison

An analysis of these 10 papers reveals a close intrinsic connection among inquiry-based learning, collaborative learning, teamwork skills, and problem-solving abilities. Inquiry-based learning lays the foundation for individual skill development, collaborative learning enhances learning outcomes through team support, teamwork skills link individual and collective goals, and problem-solving abilities are the ultimate manifestation of this system's integrated effects. The conclusions of different papers vary in their specific focuses. For example, Yu et al. (2024) and Gómez Gutiérrez (2018) focus more on specific applications in subject teaching, while Nasution (2019) and Song (2018) tend to study innovations in learning design. Fransiska (2023) and Mujahidin and Nasution (2019) provide a macro perspective on the impact of cultural and educational environments on these skills. This diversity offers important references for constructing more comprehensive teaching theories and practical models.

Through the examination of the correlations that exist between inquiry-based learning, collaborative learning, team skills, and problem-solving abilities, one can see that these four elements are, to some extent, a loop system of mutual contributions. Inquiry-based learning is a catalyst that irrigates the sprouts of students so that they come up with new and critical ideas, while collaborative learning is a channel where both social support and resource diversity are brought together. Teamwork means fusing personal achievements with the goals of a community, and problem-solving skills reflect the overall intelligence of the system so expressed.

On the other hand, the studies not only bring to light the finer points of educational theory but also help envision the strategies of teaching that are going to come. In training and development, education as well as work, this circular system

not only nurtures a person in developing individual key competencies but also provides theoretical and practical help to make the team more effective.

Methodology

Research Design

In this study, the literature review method was used, and the researcher reviewed 10 high-quality SCI and SSCI papers published after 2018, focusing on the four themes of inquiry-based learning, collaborative learning, teamwork ability, and problem-solving ability. The review focused on the successful cases of traditional and modern educational methods in teaching, emphasized the mechanism and synergy of inquiry-based learning and collaborative learning as the theoretical basis for constructing a new teaching mode, and made positive suggestions and guided the direction of research for future teaching practice. Therefore, a single-group pre-test-post-test experimental study was designed to find out the number of teaching models derived from the activities.

This study was conducted in a public school in Chengdu. Forty-two students were randomly selected from 203 students studying in the sixth grade and given the opportunity to participate in the study. Due to the designed instructional model, this study required the preparation of 15 instructional management plans. In the quasi-experimental study, the teamwork and problem-solving skills of the 42 students were pretested using two instruments: the Teamwork Skills Inventory and the Problem Solving Test. In addition, 42 students received more than 15 instructional management plans. The teamwork and problem-solving skills of the 42 students were post-tested using the Teamwork Skills Inventory and the Problem-Solving Test. Throughout the study, paired-samples t-tests were used to analyze the pretest and posttest scores of the experimental group using SP direction.

Search Strategy

In order to gather the right pieces of literature, this research was given a chance to run an extensive search through the Google Scholar database. This search engine, a product of artificial intelligence and the Internet of Things, offers quick and concrete search outcomes for sciences of all kinds, including natural and engineering as well as social and human sciences, medicine, and agriculture. The critical literature for this study consists of peer-reviewed empirical research papers

published during January 2018 to November 2024. The search was done gradually so that the entire procedure would be as inclusive and relevant as possible.

Defining Key Search Terms

In order to actualize this goal, I coined the search words "collaborative learning model," "inquiry-based learning model," as well as "teaching models for teamwork and problem-solving skills," and chose to focus on research literature corresponding with these three models. These search terms were chosen for a reason: they suggest more narrowness and concision of search, thus showing their correspondence with the objectives of this review. And, consequently, the literature review is guaranteed to be both comprehensive and precise.

Applying Search Filters

As I was searching, I smartly applied filters to include literature as relevant to the research objectives as possible, thus improving the efficiency of search as well as the relevance of the literature. The specified criteria for filtering included the time frame limiting to a range of January 2018 to November 2024, selection of peer-reviewed empirical research articles, and focus on topics like education, pedagogy, and related fields. Such filters helped ensure that only the most academically relevant literature was included without unnecessary inclusions to Clarke's three stages, namely the background or theory, the hypothesis or implications, and the conclusion.

Initial Search Results

The search starts finding results from about 1280 pieces of literature dealing with concepts like education, pedagogy, collaborative learning, and inquiry-based learning from theoretical and hands-on approaches. Such works concerned predominantly one personal use of the specific model or type of single case, judging from the limited studies of and by the combined effects of both models. In order to overcome over-generalization and to improve attentiveness to up-to-date and relevant studies, this research undertook to refine the initial outcomes according to the criteria including the time frame, research field, and document types specifically. Ultimately, 10 high-quality empirical research papers published in SCI and SSCI journals between January 2018 and November 2024 were selected as the core analysis targets for this review.

Research Objectives

The aim was to present the effects of a model of teaching activities on the rather inconvenient teamwork skills and problem-solving abilities of sixth-grade students. The main intention of the study suggests that the model design and quasi-experimental strategies are mainly the key issues to be analyzed. Specifically, this involves an instructional activity model based on inquiry-based and collaborative learning.

Sample

The population for research is taken from 203 Grade 6 students in Chengdu Cheng Hua Street Primary School, China, through the cluster random sampling technique. Of this number, 42 students are selected as the research sample. Their distribution to the experimental group is handled later among others.

Research Hypothesis

The post-test scores of students' problem-solving abilities and teamwork abilities are higher than the pre-test scores for those who participate in the teaching and learning activities of inquiry-based learning and collaborative learning.

Through the teaching activities of inquiry-based learning and collaborative learning, the mathematics problem-solving abilities and teamwork abilities of sixth-grade students have been improved.

Instrument

Problem Solving Skills Test Paper

This paper is designed to assess the ability of Year 6 students to solve mathematical problems and contains 25 multiple choice questions. The questions cover the key areas of arithmetic and basic operations, fractions and decimals, word problems, geometry, measurement and data, and patterns and algebra, and have been carefully designed according to the stage of cognitive development of Year 6 pupils to ensure that they are both challenging and appropriate for this age group. Each question is designed to assess different aspects of problem-solving and teamwork skills, including analytical thinking, logical reasoning, and applying math concepts to real-life situations. Because of the variety of problem types, the test provides a

comprehensive assessment of students' ability to understand, analyze, and solve mathematical problems. This systematic approach helps teachers to identify students' strengths and areas requiring additional support, thereby guiding them to develop more effective teaching strategies to enhance students' mathematical learning outcomes and problem-solving abilities. This approach emphasizes not only the acquisition of knowledge, but also students' ability to apply mathematics in real-life situations, and ensures students' all-round development while achieving the teaching objectives

Teamwork Skills Assessment Scale

The purpose of this scale is to comprehensively assess the teamwork skills of sixth grade students in mathematics learning situations, to help educators and researchers understand students' strengths and weaknesses in teamwork, and to provide a scientific basis for instructional improvement. The scale consists of four main dimensions: communication, collaboration, conflict resolution, and collective problem solving, each of which covers key behaviors and skills of students in team learning, and aims to provide educators with a scientific and reliable reference basis. The scale consists of 20 entries distributed across the four dimensions mentioned above, and each entry is rated on a 5-point Likert scale, progressing from strongly disagree (1) to strongly agree (5).

The communication dimension focuses on assessing students' performance in expressing, listening to, and questioning their peers' abilities in a team, such as the ability to express themselves clearly, listen attentively to their peers, and ask helpful questions at the right time.

The Collaboration dimension focuses on students' attitudes and behaviors in task distribution and team support, including the ability to share tasks equally, support teammates, and adjust roles flexibly according to the needs of the team.

The conflict resolution dimension focuses on how students deal with disagreements in teams, assessing whether they are willing to listen to different opinions, find shared solutions through discussion, and are able to accept or provide constructive feedback.

The Collective Problem Solving dimension analyzes the depth of students'

participation in collaborative teamwork tasks, with a particular focus on their performance in brainstorming, planning, and solution monitoring, such as whether they are active in generating ideas, assisting the team in developing a clear plan, and assuming responsibility for the implementation of the solution.

The scale is intended for use with Primary 6 students and can be used after a classroom activity or group project, with a brief explanation of the scoring criteria by the teacher to ensure that students fully understand the meaning of the entries. The results of the final assessment can be analyzed in conjunction with the total and dimensional scores to identify strengths and areas for improvement in teamwork and to support educational interventions and collaborative skill development.

The scale is a standardized instrument, and it is recommended that it be used in conjunction with qualitative observation to obtain a more comprehensive assessment of students' behaviors, and to ensure the anonymity of students in the process of completing the scale in order to obtain authentic feedback, which will help teachers to gain a deeper understanding of students' performance in teamwork in the mathematics learning environment, and to provide a scientific basis for educational interventions to promote the development of teamwork skills.

Data Collection

The assessment of the question papers was scheduled before the implementation of the first teaching activity and after the last teaching activity. The assessment of the scales was likewise set before the implementation of the first teaching activity and after the end of the last teaching activity.

Data Analysis

The study employed Paired Samples T-Test to analyze the scores of teamwork skills and problem-solving skills in the experimental group, thereby testing the first hypothesis: "The students who engaging in instructional activity based on problem-based learning and collaborative learning revealed higher post-test scores of teamwork skills and problem-solving skills than pre-test scores".

Ethical Affirmation

This research project, titled “An Instructional Activity to Enhance

Teamwork Skills and Problem-Solving Skills in Mathematical Learning for Fourth-Grade Students Based on Problem-Based Learning and Collaborative Learning" has been ethically approved by the Research Ethics Committee of Nakhon Phanom University, Thailand. This ethical approval, with the reference number: HE2568 and the record number 25/2568, was issued on November 13, 2024, and is valid until November 12, 2025.

Research Selection

Inclusion Criteria

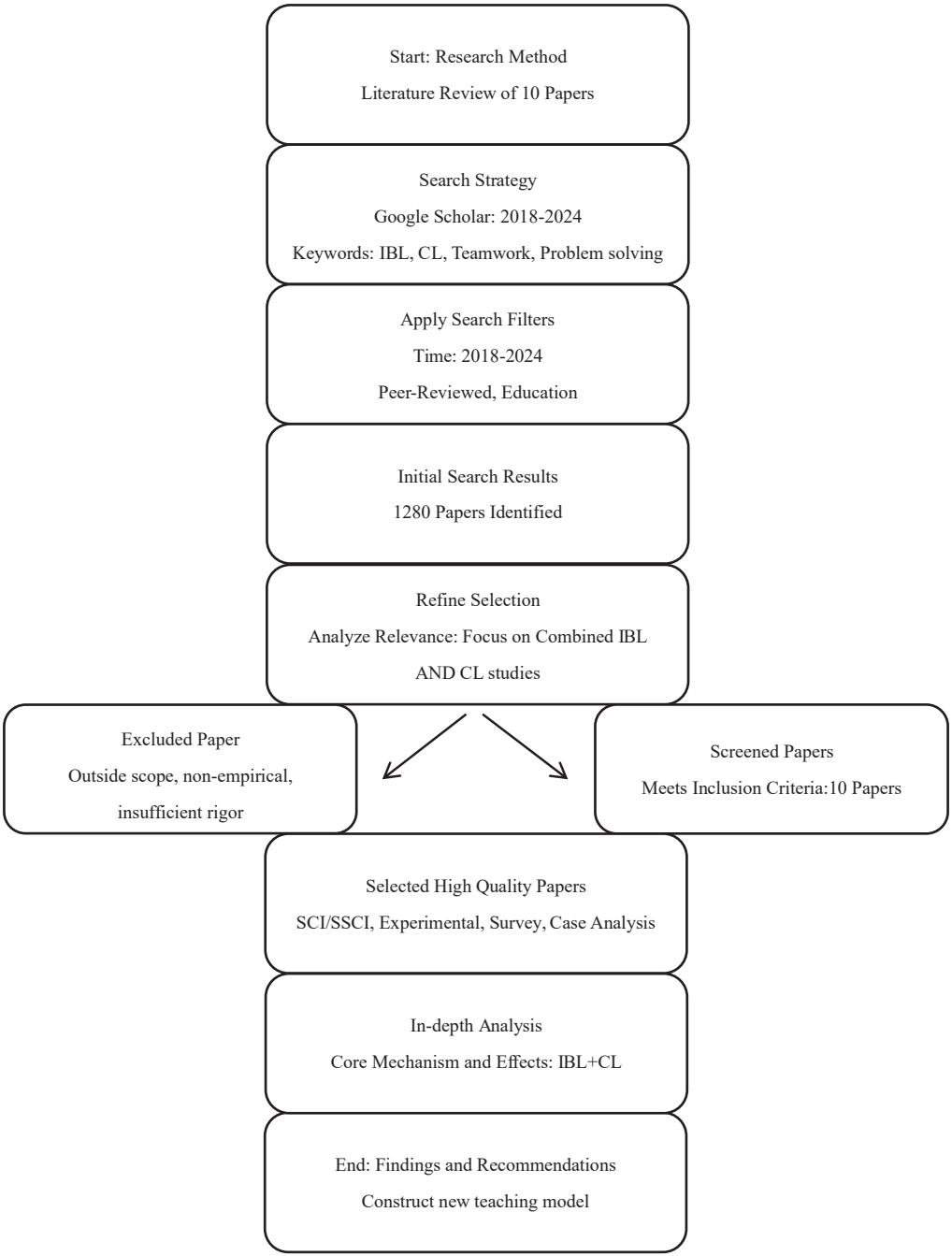
This study ultimately selected 10 high-quality empirical research papers published between January 2018 and November 2024, all from authoritative journals indexed in SCI and SSCI databases, focusing on the theory and practice of inquiry-based and collaborative learning models. The selected literature spans various fields, including primary education, higher education, and vocational training, and employs scientifically rigorous research methods such as experimental studies, surveys, and case analyses, with a focus on the application effects of combined models in enhancing students' teamwork and problem-solving skills. These studies provide significant theoretical support and practical evidence for this research review.

Exclusion Criteria

During the selection process, this study excluded articles based on the following criteria: publication date earlier than 2018 or later than November 2024; research topics not involving inquiry-based learning, collaborative learning, or their combined models; non-empirical or non-peer-reviewed articles; insufficiently rigorous research methods (e.g., small sample sizes, inadequate data analysis); articles not written in Chinese or English; and those published in non-authoritative or low-impact journals. These criteria eliminated literature that did not align with the research objectives, ensuring the inclusion of high-quality and highly relevant articles.

Figure 1

Flowchart of the Literature Selection Process for the Research on CL and IBL



Data Extraction and Analysis

By reading and analyzing these 10 articles (4 focusing on inquiry-based learning and 6 on collaborative learning), key components of collaborative learning or inquiry-based learning models were summarized.

Results

Literature Review Findings

Table 1 presents the main information and key findings of the 10 included studies, primarily addressing the components of collaborative learning and inquiry-based learning models. These studies collectively examine the impact of different teaching methods in primary education on student development, particularly in stimulating interest, cultivating key competencies, and enhancing subject knowledge comprehension.

Several scholars underscore the significance of teaching in a collaborative, inquiry-driven fashion, as it boosts students' critical thinking, problem-solving competency, and teamwork ability. For instance, Yanjie Song (2018) and Yu et al. (2024) put forward that the incorporation of collaborative work and inquiry learning may lead to a notable increase in students' thinking and reasoning capabilities as well as a promotion of learning of science and mathematics in a deeper sense. Lepareur and Grangeat (2018) also noted that intra-teacher cooperation and teacher training are effective mechanisms for the successful adoption of teaching practices where inquiry deepens, as they boost teacher self-confidence and expertise in student-centered pedagogy.

Havu-Nuutinen (2019) also showed the enhancement of the professional development of primary school teachers, whether pre-service or in-service, by collaborative models in science teaching. Furthermore, Carter (2020) and Iskandar (2024) removed any doubt about the internal's critical role of teachers in actualizing student potential and further STIM education, mainly associated with lack of income and training. These investigations present teachers as different types of guides in unusual educational practices and programs being discussed.

In contrast, Mujahidin and Nasution (2019) did a comparison study with three character education methods across different school types (public, religious,

and cultural), and the outcomes showed that the school contexts had different effects on education outcomes, which could be proof for the role of culture and religion for effective education.

Finally, all these studies could be characterized as highlighting the enormous effects of interpersonal communication between students and teachers as well as educational methods, even though they are focused on different aspects, like extracurricular activities and character education, as well as subject teaching approaches. These studies are not only very illustrative and comprehensive of the diverse types of educational techniques but are also a useful source for the refinement of the curricular-extracurricular pedagogical strategies, concentrating especially on third world primary education in terms of implementation and difficulties.

Table 1

Summary of Key Findings

No.	Article	SSCI	CL/IBL	Key Element
1	Iskandar, S., et al. (2024).	SSCI	CL	Extracurricular activities, students' interests, talent development, elementary school, teacher role, potential.
2	Fransiska, J., et al. (2023).	SSCI	CL	Independent curriculum, education management, elementary school, student challenge, implementation barriers.
3	Mujahidin, E., & Nasution, S. A. (2019).	SSCI	IBL/CL	Character education, elementary school, public school, religious school, cultural school, educational achievement.
4	Carter, K. (2020).	SSCI	CL	STEM education, elementary school, critical thinking, problem-solving, collaboration, teacher challenges.
5	Endin Mujahidin, Syamsuddin Ali Nasution.(2019).	SSCI	CL	Character Education, Elementary School, Achievement,Educational Comparison,School Types, Educational Practices,Moral Development,Value Education,Educational Outcomes,Pedagogical Approaches
6	Lepareur, C., & Grangeat, M. (2018).	SSCI	IBL	Teacher collaboration, inquiry-based learning, science teaching, student-centered approach, professional development.
7	Havu-Nuutinen, S., et al. (2019).	SSCI	IBL	Inquiry-based learning, primary science teaching, pre-service teachers, in-service teachers, professional development, collaborative teaching.
8	Yu, S., et al. (2024).	SSCI	IBL/CL	Collaborative learning, inquiry-based learning, mathematics teaching, fourth-grade students, reasoning, analysis.
9	Gómez Gutiérrez, A. J. (2018).	SSCI	CL	Collaborative inquiry, EFL classroom, school-related topics, fifth graders, literacy skills, teamwork.
10	Song, Y. (2018).	SSCI	CL	Collaborative problem-solving, project-based learning, science education, primary students.

Instructional Model Based on CL and IBL

The proposed teaching model, grounded in both Collaborative Learning and Inquiry-Based Learning, seeks to improve students' achievements as well as their logical reasoning abilities by combining team work and independent research. According to research, IBL effectively engages students in a variety cognitive, behavioral, and emotional strategies that are usually hard to obtain in any other traditional teaching styles, especially in science and mathematics (Öztürk et al., 2020). It allows them essentially to explore the whole process of inquiry, which does not only foster their knowledge acquisition but also builds their problem-solving skills.

Moreover, bringing the CL model to the classrooms contributes to the establishment of collaboration and interaction in groups, which form an essential part of getting a clearer understanding of the material by sharing ideas and solving the tasks jointly. In particular, students perform activities such as discussions, experimental planning, and data evaluation in order to achieve their in-depth understanding of the learning content and move on to reflecting and presenting phases, which pushes them to consolidate their knowledge.

It is also proved that when both CL and IBL are simultaneously applied, the students' level of engagement and academic performance is higher than that of IBL alone; their cognitive involvement and ability to reach deep levels of thinking were remarkably increased among the high-achieving students (Papanastasiou et al., 2019). Not only did this model design focus on the cestrengthening of academic accomplishments but also the development of emotional and social relationships of the students, which can be found as one of the requirements of modern education.

Table 2

Process and Task Requirements

Teaching Process	Task Requirements
Learning Motivation and Problem Setting	Teachers present students with a challenging and inquiry-driven question to spark their interest and thinking. The question may involve real-world contexts, such as a social issue, scientific phenomenon, or historical event.
Group Collaboration and Inquiry	Student groups collaborate to conduct in-depth inquiry around the question. They may use experiments, surveys, or data collection to find answers. Students must analyze data, discuss, and evaluate various solutions.
Reflection and Summary	Students summarize their work within groups, review the inquiry process, and analyze data and conclusions. Each group presents its findings and solutions while receiving feedback from peers and teachers.
Evaluation and Feedback	Teachers conduct a comprehensive evaluation of students' participation, creativity, collaboration skills, and academic outcomes throughout the process. Criteria include experimental design, data analysis skills, teamwork, and presentation quality. Process Evaluation: Focuses on students' engagement at each stage, including cognitive, behavioral, and emotional participation, using teacher observations, group self-assessments, and peer evaluations for dynamic assessment. Outcome Evaluation: Scores are based on students' final reports, presentations, and experimental data analysis, alongside assessments of teamwork and communication skills.
Advantages and Innovations of the Model	Enhancing Cognitive Skills: Through the IBL inquiry process, students actively seek answers and solve problems, enhancing their critical thinking and academic abilities. Promoting Teamwork: The inclusion of CL ensures that students support each other and solve problems collaboratively in groups, improving their social skills and team spirit. Fostering Student Autonomy: IBL encourages students to actively explore, developing their self-learning abilities and innovative thinking. Deep Engagement: Group interaction and inquiry processes in the model make learning more engaging and practical, boosting students' intrinsic motivation.

Learning Motivation and Problem Setting

To begin with the teaching process, the key task of the teacher is to expose the students to complex problems that are answerable, thus obliging them to think. This question should be closely related to the real life experiences of the students and subject content covering, for example, social issues or scientific events. Thus, teachers not only grab the students' attention, but also offer their desire for active learning. A case in point is when teachers ask their students, "How shall we solve the urban traffic congestion?", which will make them analyze the issue from a number of angles, to become interested in researching the main problem deeply. This problem-setting relates students to live situations; they see not only how important and useful it is to learn, but also how intrinsic it is to their lives.

Group Collaboration and Inquiry

After stimulating students' interest in learning, teachers organize group collaborations to facilitate in-depth inquiry through collective discussion and teamwork. Group members collaboratively engage in tasks such as experiment design, data collection, and information investigation to systematically explore and resolve issues. At this stage, the teacher acts as a facilitator, providing necessary resources and ensuring that each student takes responsibility within the group. In this process, not only do scholars scrutinize data, but they also consider the possibility for and merit of different plans. To illustrate, if the students were to deal with urban transportation problems, they may be performing experiments about traffic in certain areas or conducting surveys to know people's opinions and how to improve the situation. Such a peer collaboration space allows students to gain specific knowledge on the subject, as well as develop thinking abilities and team spirit.

Reflection and Summary

Subsequent to doing the group inquiry duties, the teacher should lead the students to the reflection and summarization level. The students will then reflect on the entire inquiry period, extract the data, and discuss the sugar of heads and tail of different conclusions. The groups take their turns to present their findings, in the form of data analysis, and solutions to the class and receive feedback from the teachers, as well as from other audience members.

A teacher is in charge of observing students' reflections from different dispositions, learning strengths and weaknesses, and their possible improvements. For illustration, participants may start with identifying traffic-handling strategies which will include their data analysis and experiment outputs, implementation of their solutions, and the refinement of their proposals based on the feedback. Besides, students' self-expression and presentation abilities get a huge boost throughout this process, and many learners also get valuable insights for improvement from their peer reviews.

Evaluation and feedback are indispensable parts of the teaching process, and teachers should conduct a comprehensive assessment based on students' performance throughout the learning process. The evaluation dimensions should include students' cognitive abilities, the innovation of experimental designs, the accuracy of data analysis, the effectiveness of teamwork, and the quality of presentations. Process evaluation is particularly important, and teachers should focus on students' engagement at each stage, especially changes in cognitive, behavioral, and emotional participation.

Teachers can dynamically assess students' participation through classroom observations, group self-assessments, and peer evaluations, providing timely feedback. For example, in addressing traffic issues, teachers can evaluate students' academic outcomes based on experimental designs, data analysis reports, and group discussions while providing targeted improvement suggestions to help students further enhance their academic abilities and teamwork skills.

The core merit of this model is IBL (Inquiry-Based Learning) in combination with CL (Collaborative Learning), which has not only enriched students' academic capabilities and also promoted their social skills development. Firstly, IBL stands for the "intent to ask" and analyze one's purpose, thereby sharpening one's ability to think critically. Second, students work on different projects together and are given the opportunity to take on issues that demand collaboration and the development of team spirit and social skills. Furthermore, it inspires students to transform their knowledge into applications and learning through practice, development of self-directed learning, and innovative thinking.

Certainly, IBL plays a huge role in student development. On In this

educational model, students not only get to know more deeply to solve different cases but also to practice hands-on, thus they can apply their solutions to real world problems. For instance, while emphasizing the traffic issues, students develop data analysis through teamwork, which helps them understand how a traffic management plan works, as well as hone the ability to work on complex problems in a group.

Hypothesis Testing

Students who participated in instructional activities based on inquiry-based and collaborative learning scored higher on teamwork and problem-solving skills at post-test than at pre-test.

Table 3

Students Scores

Students' scores in different tests	M	SD	t	Df	p
Pre-test of teamwork skills	77.51	12.81			
Post-test of teamwork skills	82.36	11.56	11.32	42	0.0000***
Pre-test of problem-solving skills	77.90	11.96			
Post-test of problem-solving skills	80.33	11.29	8.44	42	0.0000***

A Paired Sample T-Test was conducted on the same group of participants to determine whether there was a significant difference in the average scores for teamwork and problem-solving skills between the pre-test and post-test measurements. The Paired T-Test results presented below reveal significant differences in scores between the two tests.

In the tests of teamwork skills and problem solving skills of the students, the results showed significant improvement. In the pre-test of teamwork skills, the mean score (M) of the students was 77.51 with a standard deviation (SD) of 12.81 while in the post-test, the mean score increased to 82.36 with a standard deviation of 11.56. The t-test revealed a t-value of 11.32 with a degree of freedom (Df) of 42 and a level of significance (p) of less than 0.0000, which made the results highly statistically significant. Similarly, in problem solving skills, the mean score of the pre-test was 77.90 with a standard deviation of 11.96, while the mean score of the post-test was improved to 80.33 with a standard deviation of 11.29. T-test revealed a t-value of 8.44 with a degree of freedom (Df) of 42, and again the level

of significance (p) was less than 0.0000. This indicates that after the intervention or instruction, the students' teamwork skills and problem solving skills were significantly improved.

Discussion

This article adopts the fusion of Inquiry-Based Learning (IBL) and Collaborative Learning (CL) with the aim of creating an innovative teaching model that assimilates better teamwork and problem-solving among students. According to Iskandar (2024), CL has been positively proven to shape primary students' enthusiasm and potential, mainly through the teacher's supportive role that comprises the agenda of the integration of CL and IBL. Fransiska (2023) amplifies the problem by talking about shutdown if students are made to work autonomously while they have to work in a team approach as well, which is one method in teaching that brings the best results.

The study, published by Mujahidin and Nasution (2019), affirms that practical instruction with inquiry promotes the development of students' critical thinking and success in academics. This becomes a paramount skill in settings of religious and religious diversity. Besides this, solid theoretic background is presented by this research, which advocates for the application of the described teaching model. On a practical note, Carter (2020) demonstrated STEM education used with collaborative study method, which students level up their critical thinking and problem-solving skills efficiently in complex problems where students predictably excel teamwork and decision-making.

Additionally, Mujahidin and Nasution (2019) illustrated the achievement of collaborative learning in social sciences scholarship. She attributed it to the growth of decision-making and task allocation efficiency in group endeavors. Indeed, Lepareur (2018) stated that learning through inquiry is a student-centered teaching method, which enhances students' ingenuity and problem-solving abilities. Hence, the pairing IBL and CL models contributes not only to a better apprehension of the subject matter but also to the emergence of creative solutions through teamwork.

Moreover, according to Havu-Nuutinen (2019), the combination of teacher collaboration and inquiry-based teaching methods significantly improves interactions between teachers and students and creates healthy communication and

collaboration also among students. Yu (2024) supported the method with an IBL and CL integrated approach in mathematics teaching, that it is strongly potent in the development of learners' problem solvability and analytical skills, especially, answering complex problems.

Furthermore, studies by Barron & Darling-Hammond (2008), Bell (2010) and Chinn and Malhotra (2002) show that combining IBL with project-based learning encourages deep learning and sustained inquiry, especially when students collaborate to construct knowledge. Bell (2010) emphasized that PBL environments rooted in inquiry help students build autonomy and improve critical reasoning. Chinn and Malhotra (2002) explored the cognitive processes involved in complex inquiry tasks and showed that students benefit when collaborative discourse supports reflective thinking.

Barron and Darling-Hammond (2008) also advocated for integrated models of inquiry and collaboration in STEM fields to drive student engagement and academic success. In the end, I incorporate these research findings to suggest a new teaching structure, which the empirical analysis consulting finds as very efficient in achieving students' teamwork and problem-solving skills.

Therefore, the present study is somehow constrained by the number of studies conducted and the sample size, hinting at the possibilities for larger sample experiments to further probe the effectiveness of DISC for some other stages of the educational level. Besides, the incorporation of project-based learning (PBL) with inquiry-based learning may launch new ideas and innovations for future teachers to improve their teaching practices.

Conclusion and Recommendations

This study integrates Inquiry-Based Learning (IBL) and Collaborative Learning (CL) to propose a novel teaching model, and validates its significant enhancement of students' teamwork and problem-solving abilities through literature review and empirical analysis. Research indicates that IBL effectively stimulates students' critical thinking and autonomous learning abilities, while CL enhances teamwork and communication, improving students' collaborative efficiency in complex tasks. Combining these two teaching methods creates a complementary effect, enhancing students' knowledge construction while improving their ability to

innovatively solve problems in team settings.

Furthermore, the implementation of the combined model not only offers new perspectives for educational theory but also provides valuable references for exploring more efficient hybrid learning models in teaching practice. Although the sample size and scope of the literature review in this study are limited, future research could expand the sample size to further verify the model's applicability across different educational stages and disciplines. Additionally, further exploration of combining this model with other teaching methods such as Project-Based Learning (PBL) could provide more innovative opportunities for educational practice.

In summary, the integration of IBL and CL not only fosters students' growth in academic domains but also provides critical support for the development of their social skills, teamwork capabilities, and innovative thinking. Future teaching designs should increasingly consider the application of this model to help students achieve better outcomes in complex social and professional environments.

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