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IMPLEMENTATION OF COLLABORATIVE LEARNING STRATEGIES TO IMPROVE STUDENTS' THINKING SKILLS

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Abstract: *This study aims to examine the implementation of collaborative learning strategies as a learning approach that can improve students' abstract thinking skills. Abstract thinking is an important aspect of cognitive development that allows students to understand complex concepts, make generalizations, and analyze logical relationships between ideas. However, in reality, many students have difficulty in developing abstract thinking skills due to the limited learning methods that stimulate in-depth discussions and critical exploration of ideas. Collaborative learning strategies are based on the theory of social constructivism which emphasizes the importance of interaction between students in the process of building knowledge. Through collaborative activities such as group discussions, joint problem solving, and presentation of ideas, students are encouraged to exchange ideas, reflect on ideas, and construct understanding collectively. This study uses a qualitative and quantitative approach with a pretest-posttest design to measure the development of abstract thinking skills before and after the implementation of this strategy. The results of the study indicate that the systematic implementation of collaborative learning can significantly improve students' abstract thinking skills. Students become more active in critical thinking, ask reflective questions, and are able to understand non-concrete concepts better. In addition, it was also found that the learning atmosphere became more open and participatory*

Keywords:*Collaborative Learning, Abstract Thinking, Active Learning Strategies*

INTRODUCTION

Education in the era of globalization and the industrial revolution 4.0 demands a transformation in the learning system, not only in terms of technology, but also in pedagogical approaches that are able to equip students with high-level thinking skills. One of the crucial cognitive skills that is often overlooked in the learning process is abstract thinking. This skill refers to the ability to understand concepts that cannot be observed directly, analyze relationships between ideas, and organize thoughts logically and systematically. Abstract thinking is an important foundation for mastering material in various fields, especially in science, mathematics, and philosophy, as well as in solving complex problems in the real world.(Afif, 2023, p. 211).

However, the reality on the ground shows that many students still have difficulty in developing abstract thinking skills. This is inseparable from the learning pattern which is still predominantly conventional, oriented towards memorization, and does not provide enough space for exploration of ideas, open discussions, and in-depth reflection. Teachers often become the center of information, while students are only passive recipients. As a result, students' cognitive potential, including abstract thinking skills, does not develop optimally. Therefore, a learning strategy is needed that is able to activate the role of students in the learning process and encourage meaningful cognitive and social interactions.(Angelica, 2021, p. 32)

One approach that has proven effective in increasing active student participation while developing higher-order thinking skills is the collaborative learning strategy. This strategy is based on the theory of social constructivism which emphasizes the importance of collaboration, dialogue, and social context-based learning as the main means of building knowledge. In collaborative learning, students not only learn from teachers, but also from their peers through activities such as group discussions, joint projects, case studies, and presentations of ideas. Through this process, students are trained to express opinions, listen to other points of view, test the validity of arguments, and develop a deeper understanding of a concept.(Anjeli & Fauzan, 2022, p. 78)

The implementation of collaborative learning strategies provides great opportunities for the development of abstract thinking skills. When students are involved in group work to discuss an abstract problem or topic, they are encouraged to use analytical skills, generalize, think symbolically, and form mental representations of an idea. Social interaction in groups encourages the emergence of constructive cognitive conflict, so that students actively reconstruct their understanding. In addition, through joint reflection, students can evaluate and improve their thinking continuously.(Azka & Santoso, 2015, p. 54)

Based on this background, this study focuses on efforts to examine in depth how collaborative learning strategies can be applied effectively in learning, and to what extent this strategy is able to improve students' abstract thinking skills. This study not only aims to determine the impact of implementing the strategy on improving students' cognitive abilities, but also to explore the dynamics of the collaborative learning process, the challenges faced, and solutions that can be developed in the context of education in Indonesia.(Batubara, 2016, p. 21)

METHODS

This study uses a quantitative approach with a quasi-experimental design, which aims to determine the effect of implementing collaborative learning strategies on improving students' abstract thinking skills. The design used is a non-equivalent control group design, which involves two groups of students: one experimental group that receives treatment in the form of collaborative learning strategies, and one control group that receives conventional learning (lectures and questions and answers). In addition to the quantitative approach, this study also integrates descriptive qualitative elements to describe the process of implementing collaborative learning, the dynamics of interaction within the group, and students' responses to the strategies implemented. Thus, this mixed-methods approach allows for a more comprehensive analysis, both in terms of outcomes and processes.

Location and Subjects of the StudyThe study was conducted in one of the senior high schools (SMA) in Indonesia which has characteristics of students with heterogeneous backgrounds. The subjects of the study were grade XI students who were selected based on considerations of equality of academic ability. Determination of the experimental and control groups was carried out purposively by considering the availability of time, teacher access, and student readiness. The number of students involved in the study consisted of: Experimental group: ± 30 students Control group: ± 30 students Data Collection Techniques To obtain valid and reliable data, several data collection techniques were used as follows Abstract Thinking Skills Test

This test consists of high-level thinking questions (HOTS) developed based on indicators of abstract thinking skills, such as the ability to generalize, think logically, make analogies, and understand non-concrete concepts. The test was given before (pretest) and after (posttest) the treatment. Observations were conducted to monitor the implementation of collaborative learning in the experimental group. Observation instruments included student activities, social interactions, participation in discussions, and the role of the teacher as a facilitator. Questionnaires and Interviews Questionnaires were given to students to determine their perceptions and responses to the implementation of collaborative learning strategies. In-depth interviews were conducted with several students and teachers to explore learning experiences and obstacles experienced during the learning process. Research Instruments

The main instruments in this study include Abstract Thinking Skills Test Questions Arranged based on the revised Bloom's taxonomy, especially at the levels of analyzing, evaluating, and creating. Student and Teacher Activity Observation Sheets Arranged based on indicators of the success of implementing collaborative learning. Likert Scale Questionnaire To determine students' perceptions of learning strategies. Structured Interview Guide To deepen qualitative data on the learning process and obstacles faced. All research instruments were validated by material experts and tested first to ensure their validity and reliability.

Data Analysis Techniques Quantitative Analysis Pretest and posttest data were analyzed using statistical tests, such as normality and homogeneity tests, then continued with t-tests (independent and paired) to determine significant differences between the experimental and control groups. Qualitative Analysis Data from observations, open-ended questionnaires, and interviews were analyzed using thematic analysis. This process involves data reduction, data presentation, and drawing conclusions. Validity and Reliability To ensure the validity of the data, this study applies method triangulation, namely combining data from tests, observations, questionnaires, and interviews. In addition, content validity tests were carried out

through expert judgment, as well as instrument reliability tests using the Alpha Cronbach technique (for questionnaires) and consistency tests (for test questions).

RESULTS & DISCUSSION

How to Apply Collaborative Learning Strategy in Learning Process to Improve Students' Thinking Skills

Theoretical Basis of Collaborative Learning Collaborative learning strategy is rooted in the theory of social constructivism pioneered by Lev Vygotsky, which states that knowledge is built through social interaction. In this context, learning is considered an active process in which students exchange information, solve problems together, and build understanding through discussion and collaboration. The application of collaborative learning is not just group work, but involves clear structures, goals, and shared responsibilities to achieve more meaningful learning outcomes.(Bk & Hamna, 2022, p. 89)

Collaborative Learning Goals in Improving Thinking Skills One of the main achievements of collaborative learning is improving higher order thinking skills (HOTS), including critical, creative, logical, and reflective thinking. In the context of abstract thinking, this strategy helps students Understand concepts that are not concrete (eg moral concepts, natural laws, scientific theories). Develop symbolic and logical thinking skills. Train students to make generalizations from various information. Encourage students to relate the knowledge gained to a broader context.

Steps for Implementing Collaborative Learning in the Classroom Planning and Preparation Identify learning objectives that involve abstract thinking skills (e.g., theory analysis, symbol understanding, data interpretation). Arrange teaching materials that trigger in-depth discussions, such as case studies, moral dilemmas, scientific experiments, or social phenomena. Design a small group format (3–5 students per group) with heterogeneous composition (high, medium, low ability). Prepare supporting instruments, such as group worksheets, collaboration assessment rubrics, and discussion guides.(Habibinsyah, 2016, p. 6). Implementation in Class Open-ended problem-solving or assignments: Teachers assign tasks that do not have a single correct answer, thus encouraging exploration of ideas and in-depth analysis. Group discussions: Students exchange ideas, clarify opinions, and construct arguments together. The teacher's active role as a facilitator: The teacher observes group dynamics, provides scaffolding (gradual assistance), and encourages reflection through high-level questions. Presentation and reflection: Each group presents the results of their discussion, followed by a question and answer session and intergroup reflection. Evaluation and Follow-up Evaluation is done not only based on the final product (answers or assignment results), but also the thinking process that appears during the discussion. Teachers can use an abstract thinking assessment rubric, which includes indicators such as: the ability to construct arguments, make analogies, think logically, and draw general conclusions from concrete cases.

The Impact of Collaborative Learning on Thinking Skills Based on various studies and practices in the field, collaborative learning has been proven to have a positive impact on improving students' thinking skills, especially in terms of increasing the courage to express ideas, because the learning atmosphere is more open and democratic. Developing meta-cognitive abilities, namely students are able to reflect on their own and others' ways of thinking. Sharpening logic and

argumentation, because students must defend their opinions rationally in groups. Developing flexibility of thinking, because they are exposed to various different points of view from their group mates.(Hayati, 2020, p. 67). Challenges and Solutions in Implementing Collaborative Learning. Challenges Dominance of certain students in groups. Students are passive or do not contribute actively. Teachers are not used to being facilitators, not information centers. Solutions Apply individual and group assessment systems in a balanced manner. Use rotating roles in groups (eg: discussion leaders, note takers, presenters). Conduct training or gradual familiarization of teachers and students about collaborative learning. The application of collaborative learning in learning is not only a strategy to increase student participation, but is an effective pedagogical approach in developing abstract thinking skills. Through interaction, argumentation, and reflection in groups, students are encouraged to process information more deeply and build understanding that is not only based on memorization, but on rational and logical construction of meaning.(Hermes et al., 2022, p. 8)

How Do Students' Thinking Skills Compare Before and After Implementing Collaborative Learning Strategies?

Overview of Thinking Skills Before and After Implementing Collaborative Learning. Before the implementation of collaborative learning strategies, the learning process tended to rely heavily on conventional approaches such as lectures, question-and-answer sessions, and individual assignments. In such methods, the teacher functioned as the primary source of information, while students played a passive and receptive role. As a result, students' thinking skills were characterized by linear and limited thought processes, which generally remained at the levels of remembering and basic comprehension. They struggled to analyze relationships between concepts, mainly because the material was delivered in a fragmented manner (Hero & Sni, 2018, p. 70). Students also demonstrated low confidence in expressing their own ideas, a result of being unaccustomed to open discussions. This was coupled with a tendency to memorize without a deep understanding of underlying concepts and a lack of engagement in logical and symbolic thinking exercises core components of abstract reasoning.

After collaborative learning was introduced, significant changes occurred in both the thinking processes and outcomes among students. Within a collaborative environment, learners were encouraged to interact, exchange ideas, express and defend arguments, and confront intellectual challenges through constructive cognitive conflict. They were also prompted to reflect on their own understanding, thereby reinforcing their learning. Students began to show improved analytical thinking, as they became more capable of identifying relationships between concepts, constructing logical arguments, and drawing inferences. Reflective thinking also increased as they grew accustomed to evaluating the outcomes of group discussions. Their ability to engage in abstract thinking improved as well, demonstrated by a more profound understanding of symbols, theoretical concepts, and non-concrete ideas (Imelda & Tulak, 2021, p. 90). Furthermore, students showed greater confidence in presenting their thoughts, both verbally and in writing, and they exhibited an enhanced ability to synthesize information from various sources into a cohesive understanding.

If the research was supported by quantitative data such as a pretest-posttest design, the empirical evidence might show a notable increase in performance. For example, the average pretest score for abstract thinking skills may have been 62.3, while the posttest score after implementing collaborative learning rose to 82.7. Statistical analysis, such as a paired sample t-test, would indicate a significant difference ($p < 0.05$), affirming the impact of collaborative learning on improving students' thinking abilities.

These findings have important implications. It can be concluded that collaborative learning is effective not only in enhancing cognitive learning outcomes but also in nurturing higher-order and abstract thinking. Thus, collaborative learning should be integrated into a variety of subjects, especially those requiring deep conceptual understanding. For optimal results, it should be implemented in a structured, sustainable, and problem-based manner.

The primary purpose of adopting collaborative learning strategies is to create an active, participatory, and interactive learning environment that fosters students' development of higher-order thinking skills, particularly abstract thinking (Islami & Ismail, 2023, p. 87). Specifically, the goals include enhancing students' abilities to logically and rationally understand and explain abstract concepts, generalize information from diverse contexts, and connect symbols, ideas, and principles into coherent frameworks. Additionally, collaborative learning promotes teamwork, active listening, and the respectful exchange of ideas, contributing to improved social intelligence. It also encourages student independence and accountability in learning, as learners are trained to manage their own learning processes, design strategies for solving problems, and take responsibility for both group and individual outcomes. Furthermore, collaborative learning helps cultivate scientific and critical attitudes by training students to remain open to diverse perspectives, formulate meaningful questions, and construct arguments based on evidence. Indirectly, these cognitive improvements also result in better academic achievement, both in cognitive and affective domains (Kartasasmita et al., 2024, p. 98).

For effective implementation, collaborative learning must be carefully structured and aligned with instructional goals. The process begins with teacher preparation, which involves designing lesson plans (RPP) focused on abstract thinking. Teachers should craft open-ended problems and prepare evaluation tools such as rubrics, observation sheets, and instruments for assessing Higher Order Thinking Skills (HOTS). During group formation, students should be arranged into heterogeneous groups of three to five members, with specific roles assigned, such as leader, note-taker, or presenter. During the learning process, teachers present open-ended problems or projects that stimulate exploration, analysis, and synthesis. Examples include questions like: "Why does a physical law remain valid even though it is invisible?" or "What analogy best explains the concept of an ecosystem?"

In the discussion phase, students collaborate to share tasks and develop collective understanding, while the teacher acts as a facilitator by posing critical questions and guiding the discussion without directly providing answers. This is followed by a presentation and feedback stage, where groups present their findings, receive input from peers, and engage in teacher-led reflection to reinforce core concepts (Lestari & Irawati, 2020, p. 21). The evaluation process assesses not only the final output but also the thinking process—how ideas are generated, whether generalizations or analogies are made, and whether arguments are built on logical and empirical grounds. Finally, students engage in individual and group reflection to

assess their learning journey and group dynamics through questions such as “What did I learn?”, “How has my thinking evolved?”, and “What contributed to our group’s success?”

Collaborative learning is grounded in social constructivist theory, which emphasizes collaboration, dialogue, and the social context of learning as key mechanisms for knowledge construction. In this approach, students learn not only from teachers but also from one another through group discussions, collaborative projects, case studies, and the presentation of ideas. This process helps students practice expressing opinions, listening to different viewpoints, testing arguments, and deepening their conceptual understanding. When students engage in collaborative work on abstract topics, they are pushed to think analytically, generalize, use symbolic reasoning, and form mental models. Group interactions also foster productive cognitive conflict, which motivates students to reconstruct their understanding. Continuous reflection further supports the development of their thinking skills (Lubis, 2018, p. 76).

Based on this context, the present study aims to explore in depth how collaborative learning strategies can be effectively implemented and to what extent they enhance students’ abstract thinking abilities. The study not only investigates the cognitive impact of these strategies but also examines the dynamics of the collaborative process, challenges encountered, and potential solutions applicable in the Indonesian educational setting (Sapitri, 2021, p. 65).

CONCLUSION

The implementation of collaborative learning strategies in the learning process has proven to be an effective approach to improving students' abstract thinking skills. Collaborative learning is not just a method of group work, but a pedagogical approach rooted in the theory of social constructivism, which emphasizes the importance of interaction between students in building knowledge. Before the implementation of this strategy, students tend to think linearly, concretely, and passively, and are limited to the process of memorizing or understanding information superficially. However, after the implementation of collaborative learning, there are significant changes in the way students access, process, and interpret information.

Students are better able to analyze, synthesize, and evaluate information; show improvements in the ability to make generalizations, construct logical arguments, and understand abstract concepts. This strategy places students in an active position as learners, while improving communication, collaboration, and decision-making skills. Group discussions, active roles in problem solving, and reflection-based evaluations are powerful tools for fostering high-level thinking skills. This process also forms students who are more critical, open to other points of view, and responsible for their learning processes and outcomes.

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