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The Effect of STAD Model on Students' Critical Thinking in Grade XI Economics at SMA Negeri 1 Cibingbin

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ABSTRACT

This study was conducted due to the low critical thinking skills of Grade XI Economics students at SMA Negeri 1 Cibingbin, as identified from the results of a preliminary test. The purpose of this research was to determine the effect of applying the cooperative learning model using the Student Teams Achievement Division (STAD) technique on students' critical thinking skills in economics, specifically on the topics of the Theory of Demand and Supply of Money, Price Index, and Inflation. The research used a quasi-experimental method with a nonequivalent control group design. The instrument used was an essay test, and hypothesis testing was conducted using parametric statistical tests: paired sample test and independent sample test with SPSS 26. The results showed a significant difference in the critical thinking skills of students in the experimental class before and after the implementation of the STAD model. In addition, a significant difference was also found between the experimental class and the control class that used a varied lecture method, with the experimental class achieving higher critical thinking scores. These findings prove that the implementation of the STAD cooperative learning model has a positive influence on students' critical thinking skills, supporting the use of student-centered and collaborative learning approaches in improving the quality of economic education.

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INTRODUCTION

Critical thinking, as a component of higher-order thinking skills, is recognized as a crucial key for students to actively contribute to the development of 21st-century competencies, namely the 4Cs: Communication, Collaboration, Critical Thinking, and Creativity. These competencies are essential to be integrated into the learning process across all subject areas in schools (Kotzebue et al., 2021). Today's learners are no longer expected to passively listen or memorize content; rather, they are encouraged to construct their own knowledge and skills in accordance with their cognitive development stages (Daryanto & Karim, 2017, p. 10).

Critical thinking serves as the foundation for cognitive processes used to comprehend ideas and concepts (Zhang et al., 2023). Through critical thinking, individuals are able to analyze various perspectives, understand diverse meanings and interpretations, and construct coherent and logical reasoning (Dekker, 2020). This ability is indispensable in education, equipping students to critically analyze information, devise creative solutions to problems, and make sound decisions in a variety of contexts (Ramírez-Montoya et al., 2022).

The ability to think critically fosters active student engagement in the learning process. It enables learners to synthesize information from multiple sources, identify assumptions, and understand concepts more profoundly, ultimately enhancing mastery of the material, developing effective learning skills, and improving academic performance (Wolgemuth et al., 2017). Moreover, critical thinking helps students overcome learning difficulties and make informed decisions when facing challenges in everyday life (Kusuma et al., 2024).

The effectiveness of developing critical thinking skills in the learning process can be measured by how well students comprehend the intent and purpose of questions posed by their teachers (Tarchi & Mason, 2020). In practice, however, teachers still face challenges in implementing learning strategies that foster critical thinking. As a result, not all students develop adequate critical thinking abilities, as evidenced in the case of SMA Negeri 1 Cibingbin.

Table 1. *Critical Thinking Ability Test Results of Grade XI Economics Students at SMA Negeri 1 Cibingbin*

No	Score Range	Grade	Category	Frequency (Students)	Percentage (%)
1	90–100	A	Very High	0	0.00
2	80–89	B	High	0	0.00
3	65–79	C	Moderate	2	0.93
4	55–64	D	Low	13	6.05
5	<54	E	Very Low	200	93.02
Total				**215**	**100**
Maximum				**65**	
Minimum				**5**	
Average				**35,33**	

Source: Pre-research data from SMA Negeri 1 Cibingbin (2024)

Based on Table 1, it is evident that the critical thinking skills of Grade XI Economics students at SMA Negeri 1 Cibingbin are significantly low. The highest level achieved falls within the "moderate" category by only 2 students, accounting for 0.93%. Meanwhile, 13 students (6.05%) were in the "low" category, and the majority, 200 students (93.02%), were in the "very low" category.

These findings are further supported by data on the percentages of critical thinking indicators. Table 2 presents a summary of the critical thinking indicators assessed in the pre-research:

Table 2. *Summary of Critical Thinking Indicators – Grade XI Economics Students, SMA Negeri 1 Cibingbin*

Critical Thinking Indicators	Providing Simple Explanation	Building Basic Skills	Making Inferences	Advanced Clarification	Strategies and Tactics
Percentage (%)	29.5%	25.5%	23.5%	14.5%	11.5%
Skill Category	Less Critical	Less Critical	Less Critical	Less Critical	Less Critical
Average Score:	**20.9% (Less Critical)**				

Source: Pre-research data from SMA Negeri 1 Cibingbin (2024)

The data from Table 2 indicates that the students' critical thinking skills across all indicators are within the "less critical" category, with an average score of only 20.9%. Among the five indicators, "providing simple explanations" had the highest percentage (29.5%), while "strategies and tactics" had the lowest (11.5%), followed by "advanced clarification" as the second lowest. These results suggest an urgent need to identify and address factors that could improve students' critical thinking skills.

One of the suspected contributing factors is the lack of variety in instructional models, with teachers still relying heavily on conventional lecture-based teaching (Park & Carroll, 2024). Teacher-centered instruction often results in student passivity and disinterest, which hinders the development of critical thinking (Berg & Lepp, 2023. Therefore, a shift towards more active learning models is needed, such as the application of cooperative learning strategies (Bonache et al., 2025).

Cooperative learning is rooted in constructivist theory (Feyzi-Behnagh & Yasrebi, 2020). In constructivism, learning is likened to a gradual construction of knowledge, whereby new information is linked to prior understanding. Learners actively build their own knowledge through real-world experiences and interactions with their environment (O'Connor, 2020). This philosophy aligns with cooperative learning, which emphasizes active student participation in constructing knowledge through group interaction to achieve learning goals (Isohätälä et al., 2020).

Cooperative learning places emphasis on collaboration and social interaction among students during the learning process. In groups, students can share knowledge and help one another (Yang, 2023). The cooperative learning process encourages active engagement through discussions and group interactions, which allow students to exchange opinions and express ideas, activities that significantly support the development of critical thinking. Through this collaborative process, students learn to recognize differing viewpoints, find solutions, and better understand learning concepts, thereby enhancing their critical thinking abilities (Tedla & Chen, 2024).

One well-established cooperative learning technique is the Student Team Achievement Division (STAD). STAD emphasizes student collaboration in achieving shared learning objectives. The teacher begins by presenting the lesson, then forms small, heterogeneous student groups. Each group is assigned tasks or problems to solve collectively. Subsequently, individual quizzes are administered to assess each student's comprehension. These individual scores are then aggregated to form a group score, with top-performing groups receiving recognition or rewards (Ismailoglu, 2021).

The STAD technique fosters a healthy competitive learning environment where students are motivated to collaborate and perform well as a team (Yulianti et al., 2024). The collaborative nature of STAD promotes meaningful interaction, where students assist one another in understanding the material and contribute ideas in group tasks, ultimately enhancing their critical thinking skills. This claim is supported by studies conducted by (Ghufron et al., 2023). all of which found a significant influence of STAD on students' critical thinking abilities. However, Supratman et al. (2021) found no significant difference in critical thinking skills between an experimental class using STAD and a control class employing traditional teaching methods.

Based on the above considerations, this study seeks to examine the effect of applying the STAD cooperative learning model on students' critical thinking abilities in a different research setting and subject group. The urgency of this research lies in the need to improve the quality of learning and foster students' critical thinking abilities, particularly in the context of economics education (Dumitru et al., 2023).

LITERATURE REVIEW

Critical thinking, as a component of higher-order thinking skills (HOTS), is a fundamental ability that every student should possess. It enables learners to engage in thoughtful analysis, problem-solving, and decision-making in both academic and real-life contexts. According to Verma et al., (2022), critical thinking is a reflective and reasonable process focused on deciding what to believe or do. It involves more than merely receiving and memorizing information, it requires the learner to reflect upon, analyze, and evaluate the information in a logical and systematic way. Critical thinking helps students make informed decisions and determine appropriate actions when facing complex problems in their everyday lives.

The development of critical thinking skills in students is closely related to their ability to construct knowledge independently. This notion aligns with the grand theory that underpins this study, constructivism, as developed by Jean Piaget and Lev Vygotsky. Constructivist theory posits that knowledge is not passively absorbed but actively constructed by the learner through meaningful experiences. According to this view, cognitive development occurs as a result of the learner's interaction with their environment, including social and cultural factors. Learning, therefore, is an active, contextualized process of constructing knowledge rather than acquiring it.

The constructivist approach emphasizes that meaningful learning can only occur when students are actively involved in the learning process. It requires teaching methods that engage students cognitively and socially, where they are encouraged to question, explore, and construct understanding through interaction and reflection. This theory implies that effective learning environments should promote student engagement, curiosity, and collaboration. Hence, it demands a shift in classroom instruction from teacher-centered to student-centered learning.

However, creating an active learning environment that fosters student independence and critical thinking is not an easy task. Traditional classroom practices, especially those dominated by teacher-centered methods such as lectures and rote memorization, often result in passive learning and disengagement. Such practices limit opportunities for students to explore, question, and engage in analytical reasoning. Ideally, the learning process should stimulate students' critical faculties by involving them in inquiry-based activities, problem-solving tasks, and reflective discussions.

To address this challenge, educators need to adopt instructional models that not only convey knowledge but also empower students to seek, analyze, and apply information independently. In this regard, cooperative learning has emerged as one of the most effective strategies for enhancing students' critical thinking abilities. As a student-centered approach rooted in constructivist theory, cooperative learning encourages students to actively construct knowledge through social interaction and collaboration. This model acknowledges individual differences among learners and uses those differences as assets for mutual learning.

In cooperative learning settings, students work together in small groups to discuss topics, solve problems, and share ideas. The cooperative process encourages peer-to-peer teaching, in which students learn from one another through structured group activities. During these interactions, they engage in higher-order thinking by evaluating multiple perspectives, synthesizing information, identifying errors, and jointly constructing solutions. As noted by Warsah et al. (2021), this collaborative process facilitates deeper engagement with content and helps foster critical thinking skills in a supportive learning environment.

Cooperative learning is particularly useful in helping students understand complex concepts by encouraging them to discuss and construct knowledge through peer interactions. The exchange of ideas within a group helps students clarify their own understanding and refine their reasoning based on feedback from others. Knoche (2022) emphasized that cooperative learning creates a social learning environment where learning groups function as platforms for sharing, exploring, and challenging each other's knowledge and ideas. Such dynamics support the development of metacognition, reasoning, and evaluative thinking, all of which are key aspects of critical thinking.

Among the various cooperative learning strategies, one widely recognized and empirically supported method is the Student Team Achievement Division (STAD) model, originally developed by Wulandari et al. (2018). STAD is designed to facilitate collaborative learning and equitable participation by forming heterogeneous groups of students who work together to understand academic material and complete learning tasks. Each member of the team is responsible not only for their own learning but also for helping their teammates succeed.

The STAD technique begins with the teacher delivering a lesson, followed by group activities in which students collaborate to master the material. Subsequently, individual quizzes are administered to assess each student's understanding. The individual scores contribute to the team's overall performance, and groups that show improvement or achieve high performance receive recognition or rewards. This structure combines individual accountability with team collaboration, making it a powerful tool for promoting both academic achievement and critical thinking.

Through the STAD model, students are encouraged to articulate their thoughts, defend their reasoning, and evaluate the contributions of their peers, activities that are inherently reflective and analytical. The group-based tasks and discussions compel students to engage critically with the subject matter while also developing social and communication skills. Moreover, the element of team competition and reward fosters motivation and a sense of shared responsibility, which further enhances learning outcomes (Malek et al., 2020).

In conclusion, the integration of cooperative learning strategies, particularly the STAD technique, offers a promising approach to cultivating students' critical thinking skills. This model provides opportunities for active engagement, peer interaction, and reflective analysis, all of which are essential for higher-order cognitive development. As such, it is imperative for educators to explore and implement cooperative learning techniques as part of their instructional repertoire to enhance student thinking and foster a more dynamic, interactive learning environment.

METHODS

The primary focus of this research is to investigate students' critical thinking skills as the dependent variable and the implementation of the cooperative learning model using the Student Team Achievement Division (STAD) technique as the independent variable. The research was conducted at SMA Negeri 1 Cibingbin, specifically targeting students of Class XI majoring in Economics during the academic year 2024/2025. The study sample comprised two intact classes selected through purposive sampling. Class XI-L was assigned as the experimental group and received the STAD treatment, whereas Class XI-J served as the control group and was taught using a varied lecture method. This sampling method was chosen due to institutional constraints that made random assignment impractical, a common limitation in school-based educational research.

The study employed a quasi-experimental research design, specifically the nonequivalent control group design. This design is widely used in educational research to evaluate instructional interventions when true experimental conditions (i.e., random assignment) are not possible. While both groups were similar in terms of academic background and demographic characteristics, their grouping was not randomized, making it crucial to control for potential threats to internal validity. Despite this limitation, the design allows researchers to make inferences about the effects of the intervention by comparing outcomes between the groups before and after the treatment.

To assess students' critical thinking abilities, the study used a constructed-response test in the form of essay questions. This instrument was developed based on indicators of critical thinking skills such as analysis, evaluation, inference, explanation, and self-regulation, following the framework proposed by Cai dan Song (2024). Open-ended questions were chosen to elicit detailed responses that reflect the depth and complexity of students' thought processes, as opposed to closed-format tests that may fail to capture higher-order thinking. Prior to its implementation, the test instrument underwent content validation by subject matter experts to ensure that it accurately measured the intended construct. A pilot test was also conducted to assess the reliability of the instrument using Cronbach's Alpha, ensuring its consistency across administrations.

Data collection was carried out through pretests and posttests administered to both groups. To determine the level of improvement in students' critical thinking, normalized gain scores (N-gain) were calculated, comparing the mean scores before and after the intervention. In addition, the data were subjected to a normality test (using the Shapiro-Wilk test) and a homogeneity of variance test (using Levene's Test) to verify that they met the assumptions for parametric statistical analysis. These diagnostic tests were essential to ensure the validity of further inferential tests and to reduce the risk of Type I and Type II errors in hypothesis testing.

For hypothesis testing, two main statistical procedures were employed. The paired sample t-test was used to determine whether there were significant improvements within each group by comparing pretest and posttest scores. This analysis helped to identify the effectiveness of the intervention within the experimental group and the natural progression (if any) within the control group. The independent sample t-test was then conducted to compare the posttest scores between the two groups, aiming to assess whether the STAD technique resulted in significantly higher critical thinking skills compared to the varied lecture method. The tests were conducted using SPSS 26 software, with a significance level set at 0.05. A p-value lower than this threshold was interpreted as evidence of a statistically significant difference between the groups.

Overall, the research methodology was carefully designed to evaluate the influence of the STAD cooperative learning model on students' critical thinking development. The use of a rigorous testing protocol, valid and reliable instruments, and appropriate statistical methods provides a strong basis for drawing conclusions about the impact of the intervention. This comprehensive methodological framework also ensures that the findings of the study can contribute meaningfully to the growing body of educational research on student-centered instructional strategies and their role in enhancing higher-order cognitive skills.

RESULT

1. Descriptive Analysis of Critical Thinking Skills

This study was carried out over a series of three structured learning sessions, involving two distinct class groups that received different instructional approaches. The experimental class was exposed to the cooperative learning model through the implementation of the Student Teams Achievement Division (STAD) technique, while the control class engaged with the subject matter via a varied lecture method, which incorporated traditional teacher-centered instruction with minimal student collaboration. The primary objective of this design was to examine and compare the development of students' critical thinking skills under these two contrasting teaching methodologies. To accurately evaluate the progression of students' critical thinking abilities, both classes were administered a pretest before the intervention and a posttest following the completion of the instructional treatment.

In the experimental class, the results showed a substantial and statistically meaningful improvement in students' critical thinking scores after the STAD model was applied. The mean score on the pretest was 20.06, with individual scores ranging from a minimum of 10 to a maximum of 30. The standard deviation of 5.981 indicates a moderate spread of scores, suggesting varied levels of initial critical thinking ability among students prior to the intervention. However, following the implementation of STAD, the posttest scores increased dramatically, with a new mean of 58.28, and a broader range of 36 to 88, reflecting significant learning gains across the class. The posttest's standard deviation of 11.703 further suggests increased variability in student performance, which may be attributed to the differential impact of collaborative learning, where some students advanced more than others depending on their engagement and group dynamics.

These findings are clearly illustrated in Table 3, which presents the descriptive statistics of the experimental group's performance:

Table 3. *Descriptive Statistics of Critical Thinking Skills in the Experimental Class*

Critical Thinking Skills	N	Min	Max	Mean	Std. Deviation
Pretest	36	10	30	20.06	5.981
Posttest	36	36	88	58.28	11.703

The marked improvement in mean scores indicates that the cooperative learning environment facilitated by STAD played a crucial role in enhancing students' abilities to reason, analyze, interpret, and evaluate information critically. The increase of over 38 points from pretest to posttest in mean scores represents not only a statistically significant gain but also a pedagogically meaningful shift in student learning outcomes, especially considering the relatively short time span of the intervention. These results align with the principles of cooperative learning, which emphasize student-centered instruction, peer support, and mutual accountability, key components that contribute to cognitive development (Cavaletto & Miglietta, 2024).

In contrast, the control class, which relied on the varied lecture method, also exhibited some improvement in critical thinking test scores, although the increase was notably smaller. Prior to the intervention, the average pretest score stood at 36.67, with scores ranging from 18 to 50 and a standard deviation of 8.363, indicating a relatively broad spectrum of initial abilities. After the lecture-based instruction, the posttest mean rose modestly to 44.28, with individual scores spanning from 24 to 68. The standard deviation also increased slightly to 9.148, implying minor variation in student progress. These results are summarized in Table 4:

Table 4. *Descriptive Statistics of Critical Thinking Skills in the Control Class*

Critical Thinking Skills	N	Min	Max	Mean	Std. Deviation
Pretest	36	18	50	36.67	8.363
Posttest	36	24	68	44.28	9.148

Although the control group's mean posttest score showed an upward trend, the gain of approximately 7.61 points is significantly lower than the gain recorded in the experimental class. This modest increase could suggest that the varied lecture method provided limited opportunities for students to actively process, apply, and synthesize information, skills that are central to the development of critical thinking. The relatively passive nature of lecture-based learning may have constrained students' cognitive engagement, resulting in only marginal improvements (Tan et al., 2021).

Taken together, the comparative descriptive statistics of both classes demonstrate that students exposed to the STAD model benefited more substantially in terms of critical thinking skill acquisition than those who experienced conventional lecture-based instruction. The large disparity in learning gains between the experimental and control classes serves as a strong indicator of the superior pedagogical value of cooperative learning, particularly in enhancing higher-order thinking abilities within the context of economics education. These preliminary findings will be further supported by inferential statistical tests, including the N-Gain analysis and hypothesis testing, to determine the significance and consistency of the observed improvements across both groups.

2. Mastery of Critical Thinking Indicators

In addition to analyzing students' overall performance based on their pretest and posttest scores, this study also examined the development of specific critical thinking indicators to gain a more nuanced understanding of how each domain of thinking evolved throughout the intervention. Five core indicators were assessed to measure the breadth and depth of students' critical thinking abilities. These included: (1) Providing Simple Explanations, (2) Building Basic Skills, (3) Making Inferences, (4) Giving Further Clarification, and (5) Developing Strategies and Tactics. The goal of this analysis was to determine whether the cooperative learning model using the STAD technique led to balanced cognitive growth across these indicators or whether certain areas remained underdeveloped.

The percentage mastery levels of each indicator were assessed for both the experimental and control groups, at both the pretest and posttest stages. These results are summarized in Table 5:

Table 5. *Percentage Recapitulation of Critical Thinking Indicators*

Indicator	Experimental (Pre)	Experimental (Post)	Control (Pre)	Control (Post)
Providing Simple Explanation	28.6% (Low)	73.3% (High)	57.5% (Moderate)	67.8% (High)
Building Basic Skills	20.8% (Low)	51.4% (Moderate)	34.2% (Low)	40.0% (Low)
Inference	17.8% (Low)	56.7% (Moderate)	37.2% (Low)	43.1% (Low)
Giving Further Clarification	19.4% (Low)	60.8% (Moderate)	32.8% (Low)	40.8% (Low)
Strategy and Tactics	13.6% (Low)	49.2% (Moderate)	21.7% (Low)	29.7% (Low)

The table above clearly demonstrates that all five indicators experienced an improvement in both the experimental and control classes. However, the magnitude of improvement was significantly greater in the experimental group, which received instruction through the STAD model. This suggests that cooperative learning, when structured and implemented effectively, contributes meaningfully to the enhancement of critical thinking across multiple domains.

The "Providing Simple Explanations" indicator showed the highest level of growth, particularly in the experimental class, where it increased from 28.6% (low) to 73.3% (high), moving the students' performance into the "critical" category. This indicates a substantial development in the ability of students to articulate basic concepts, clarify ideas, and explain reasoning in a coherent and logical manner. In contrast, the control class also demonstrated improvement in this indicator, from 57.5% (moderate) to 67.8% (high), but the relative increase was smaller compared to the experimental group. The strong performance in this area may be attributed to the interactive and student-centered nature of the STAD model, which provides students with continuous opportunities to explain their thoughts, justify their positions, and receive feedback during group discussions (Resendes et al., 2015). These experiences help cultivate clarity of expression and strengthen the ability to communicate ideas effectively, both essential components of critical thinking.

Another notable finding is the development observed in the "Giving Further Clarification" and "Making Inferences" indicators. In the experimental group, the percentage of students mastering the "Inference" indicator increased from 17.8% to 56.7%, while the "Giving Further Clarification" indicator improved from 19.4% to 60.8%. These shifts suggest that the STAD technique also supports students in drawing conclusions from given data, identifying implicit meanings, and elaborating on their initial responses with additional evidence or reasoning. In contrast, the gains in the control class for these two indicators were far less substantial. For instance, inference only rose from 37.2% to 43.1%, and clarification from 32.8% to 40.8%, indicating that the lecture-based approach was less successful in fostering deeper analytical thinking and elaboration skills.

However, despite these gains, the "Strategy and Tactics" indicator remained the lowest across both groups. In the experimental class, mastery of this indicator increased from 13.6% to 49.2%, which, while representing notable growth, still falls within the "moderate" category and reveals room for further development. In the control class, the indicator improved from 21.7% to just 29.7%, remaining firmly in the "low" range. This indicator involves students' ability to plan, evaluate alternatives, and make strategic decisions in problem-solving contexts, competencies that demand not only cognitive engagement but also the capacity for metacognitive regulation and long-term reasoning (Elezaj & Kuqi, 2023). The relatively modest gains in this area imply that short-term interventions, even when using a collaborative model like STAD, may not be sufficient to develop the most advanced forms of critical thinking. More sustained practice, scaffolded instruction, and perhaps integration with metacognitive training may be needed to cultivate such complex cognitive behaviors.

The "Building Basic Skills" indicator also reflected moderate gains in the experimental group, increasing from 20.8% to 51.4%, while the control class only improved from 34.2% to 40.0%. Basic skills refer to the students' ability to observe, categorize, compare, and recall information, foundational competencies that support higher-order thinking. The stronger progress made by the experimental group suggests that the STAD model helped reinforce these basic skills by repeatedly engaging students in information processing, clarification tasks, and collaborative analysis.

Taken as a whole, the analysis of critical thinking indicators illustrates the differential impact of the STAD model not only on overall critical thinking scores but also on specific components of critical thinking. The gains across multiple indicators highlight the holistic nature of cooperative learning, which enables students to strengthen various dimensions of thinking in an integrated and participatory learning environment. Nevertheless, the persistence of relatively low scores in indicators related to higher-order reasoning (e.g., strategy and inference) points to the importance of longer-term interventions and more targeted support in order to foster critical thinking skills at the highest levels of Bloom's Taxonomy.

These findings emphasize the multifaceted character of critical thinking and suggest that different instructional approaches yield different patterns of development across indicators. The STAD technique appears particularly effective in promoting communicative clarity, foundational analysis, and explanatory skills. Meanwhile, skills such as planning strategies and applying abstract reasoning may require a more prolonged exposure to reflective thinking practices and integrative problem-solving tasks. Thus, educators are encouraged to combine cooperative learning techniques like STAD with other instructional strategies, such as inquiry-based learning, case-based reasoning, or project-based learning, to ensure balanced development across all dimensions of critical thinking (Ghufron et al., 2023).

3. Normality and Homogeneity Testing

Before proceeding with hypothesis testing to examine the effect of the STAD cooperative learning model on students' critical thinking skills, it is essential to confirm that the data meet the underlying assumptions required for parametric statistical analyses, particularly the *paired sample t-test* and the *independent sample t-test*. Two primary assumptions were tested: (1) whether the data were normally distributed, and (2) whether the variances between groups were homogeneous. Meeting these assumptions ensures the validity and reliability of the statistical procedures used to test the research hypotheses.

To assess normality, the Kolmogorov-Smirnov test was employed. This non-parametric test determines whether the distribution of the sample data significantly deviates from a normal distribution. The test was applied to both the pretest and posttest data of the experimental and control groups. The results of the normality test are summarized in Table 6 below:

Table 6. *Normality Test Results*

Group	Statistic	df	Sig.
Experimental Pre-Test (STAD)	0.100	36	0.200
Experimental Post-Test (STAD)	0.093	36	0.200
Control Pre-Test	0.099	36	0.200
Control Post-Test	0.120	36	0.200

As shown in the table above, all four datasets produced significance values of 0.200, which are greater than the standard alpha level of 0.05. This indicates that none of the datasets deviate significantly from a normal distribution, and thus the assumption of normality is satisfied for both the experimental and control groups, at both the pretest and posttest stages. A normal distribution is particularly important in t-tests, as it ensures that the sampling distribution of the mean approximates a normal curve, allowing for more accurate and meaningful interpretation of the test statistics. The results affirm that the sample data are appropriate for further parametric testing.

Following the test of normality, the assumption of homogeneity of variances was evaluated using Levene's Test (Christine et al., 2024). This test assesses whether the variances of the two independent groups (experimental and control) are equal, a necessary condition for conducting an independent samples t-test. The results are presented in Table 7:

Table 7. *Homogeneity Test Results*

Variable	Levene Statistic	df1	df2	Sig.
Critical Thinking Skills	2.268	1	70	0.137

According to the table, the significance value of 0.137 is also greater than the alpha level of 0.05. This means that the variances of the two groups can be assumed to be equal, and the data fulfill the assumption of homogeneity. Thus, any comparison between the means of the two groups using independent sample t-tests can be considered statistically valid and unbiased.

Collectively, the results of the normality and homogeneity tests confirm that the datasets meet the essential assumptions required for further inferential analysis. These outcomes validate the use of the paired sample t-test to compare the experimental group's performance before and after the implementation of STAD, and the independent sample t-test to compare the effectiveness of STAD and the varied lecture method across groups.

4. Hypothesis Testing Using Paired Sample T-Test

To examine the effectiveness of the STAD cooperative learning model in improving students' critical thinking skills, a paired sample t-test was conducted on the pretest and posttest scores of the experimental group. The test was designed to determine whether the difference between students' critical thinking performance before and after the STAD intervention was statistically significant.

The results of the paired sample t-test are presented in Table 8 below:

Table 8. *Paired Sample T-Test Results (Experimental Class)*

Pair	Mean Difference	Std. Dev.	Std. Error	t	df	Sig. (2-tailed)
Pre-Test & Post-Test STAD	-38.222	11.689	1.948	-19.619	35	0.000

As shown in Table 8, the mean difference between the pretest and posttest scores in the experimental class is -38.222, indicating a considerable increase in students' scores after the implementation of the STAD model. The negative sign in the mean difference simply reflects the direction of the comparison (pretest minus posttest). The t-value of -19.619, with 35 degrees of freedom, and the p-value of 0.000 (Sig. 2-tailed), which is less than 0.05, confirms that this difference is highly significant.

These results provide strong statistical evidence to reject the null hypothesis (which posited no difference in critical thinking performance before and after treatment) and accept the alternative hypothesis, which suggests that the application of the STAD model resulted in a measurable improvement in students' critical thinking abilities. The very large t-value and very small p-value indicate that the observed changes are unlikely to be due to chance, thus confirming the effectiveness of the STAD technique as a pedagogical intervention.

Moreover, the standard deviation of 11.689 and standard error of 1.948 indicate a moderate spread in individual learning gains within the group. While most students improved substantially, some variation in score improvement was observed, which is natural in cooperative learning environments where the degree of individual participation and group dynamics can differ. Nevertheless, the overall result confirms that the STAD model was consistently effective across the majority of the sample.

The paired sample t-test serves as a critical statistical foundation for this study's core conclusion: that cooperative learning through the STAD model contributes significantly to the development of critical thinking skills in senior high school students, especially when applied in the context of economics education. This finding aligns with contemporary educational theories that emphasize active, student-centered learning and supports the broader implementation of STAD in similar classroom environments.

5. N-Gain Analysis

To evaluate the effectiveness of the STAD (Student Teams Achievement Division) cooperative learning model beyond raw score differences, a normalized gain analysis, commonly referred to as N-Gain, was conducted. The N-Gain calculation provides a more refined understanding of learning progress by considering the potential improvement students can achieve relative to their starting point. This method accounts for variations in baseline knowledge and is particularly useful for comparing the degree of instructional impact across different groups or interventions.

The formula for N-Gain is expressed as:

$$N - Gain = \frac{Posttest\ Score\ -\ Pretest\ Score}{Maximum\ Score\ -\ Pretest\ Score}$$

This ratio ranges from 0 to 1 and is categorized into three levels of effectiveness based on Hake's (1998) classification:

1. High if $g > 0.70$
2. Medium if $0.30 \le g \le 0.70$
3. Low if $g < 0.30$

In the context of this study, the N-Gain analysis was applied to the experimental class, which received instruction through the STAD model. The aim was to determine not only whether students improved, but also how much of the possible improvement was realized. The results are presented in Table 9 below.

Table 9. *N-Gain Results (Experimental Class)*

Test	Mean Score	Gain	N-Gain	Index Interpretation
Pretest	20.056	38.222	0.478	Medium
Posttest	58.278			

As shown in the table, the average pretest score of the experimental class was 20.056, while the posttest score rose significantly to 58.278, resulting in a mean gain of 38.222 points. This gain, when normalized through the N-Gain formula, yielded a score of 0.478, which falls within the "medium" effectiveness category.

This classification implies that the STAD model was moderately effective in helping students reach their potential for improvement in critical thinking. It is important to emphasize that a medium-level gain is still considered pedagogically meaningful, particularly within the context of higher-order cognitive skills such as critical thinking, which typically require more time and scaffolding to develop compared to lower-order skills like remembering or understanding (Hakam et al., 2024).

The moderate effectiveness observed may be attributed to several interrelated factors. First, the collaborative structure of STAD, which involves group discussions, peer teaching, and mutual accountability, likely contributed to the development of students' reasoning, questioning, and argumentation skills. These components are essential to critical thinking and are naturally cultivated in cooperative learning environments. Second, the active engagement promoted by STAD shifts students from passive recipients of knowledge to active constructors, encouraging them to interact with content, challenge ideas, and reflect on their understanding, activities that promote cognitive growth.

However, it is also necessary to consider that a medium N-Gain score, while positive, suggests that there is still considerable room for further improvement. Critical thinking is a complex skill that often develops over extended periods, and the relatively short duration of the intervention (only three learning sessions) may have limited the depth of cognitive transformation achievable within the time frame. Additionally, students may have required more time to adapt to the cooperative learning format, especially if they were previously accustomed to lecture-based instruction.

The implications of these results are twofold. On one hand, the N-Gain score of 0.478 clearly supports the conclusion that the STAD model contributed significantly to student learning. On the other hand, it also signals the need for more longitudinal and intensive implementation if the goal is to foster deeper, sustained improvements in critical thinking skills. The effectiveness of STAD could potentially increase to the high category if applied consistently across multiple topics and over a longer academic period, with continual refinement of group composition, instructional scaffolding, and reflective feedback.

In summary, the results of the N-Gain analysis provide compelling evidence that the STAD model has a moderately strong impact on students' critical thinking development. The approach succeeded in moving students meaningfully forward from their initial skill levels, validating its use as an effective instructional strategy in economics education at the senior high school level. These findings also serve as a foundation for further instructional innovation, encouraging educators to combine cooperative learning with complementary pedagogical strategies to maximize cognitive gains and promote comprehensive critical thinking growth.

6. Independent Sample T-Test

To determine whether the observed improvement in critical thinking skills differed significantly between the experimental group (which received the STAD cooperative learning model) and the control group (which received instruction through a varied lecture method), an independent sample t-test was conducted on the posttest scores of both groups. This statistical procedure is designed to test whether the difference in the means of two independent groups is statistically significant, taking into account the variability of scores within each group (Hakam et al., 2024).

Prior to conducting the t-test, the assumption of homogeneity of variances was verified using Levene's Test, as shown in the previous section (Table 9). The Levene's Test result yielded a significance value of 0.137 (greater than 0.05), indicating that the variances between the two groups were not significantly different, and therefore, the assumption of equal variances was met. This allowed for the use of the "equal variances assumed" model in the interpretation of the independent sample t-test results.

The output of the independent sample t-test is presented in Table 10 below.

Table 10. *Independent Sample T-Test Results*

Test	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error	CI Lower	CI Upper
Equal variances assumed	2.268	0.137	5.655	70	0.000	14.000	2.476	9.062	18.938

7. Comparative N-Gain Analysis

To further assess the relative effectiveness of the learning interventions applied in both the experimental and control classes, a comparative N-Gain analysis was conducted. This analysis serves to evaluate not just the raw improvement in students' scores, but the normalized learning gain, which reflects the proportion of actual improvement relative to the maximum possible gain. The use of normalized gain is particularly valuable in educational research, as it controls for variations in baseline scores and allows for a more equitable comparison between groups that may start from different initial levels of understanding (Christman et al., 2024).

The results of the N-Gain comparison between the two groups are displayed in Table 11:

Table 11. *Comparative N-Gain Analysis*

Class	N-Gain	Index Interpretation
Experimental Class	0.478	Medium
Control Class	0.116	Low

As shown in the table, the experimental class achieved an N-Gain score of 0.478, which falls within the "medium" category, according to Hake's (1998) classification. This score indicates that, on average, students in the experimental group achieved approximately 47.8% of the total possible improvement in their critical thinking skills. In contrast, the control class recorded an N-Gain score of just 0.116, which is categorized as "low", suggesting that these students only reached 11.6% of their potential improvement.

The stark difference in normalized gains between the two groups offers strong empirical support for the superior effectiveness of the STAD cooperative learning model over the traditional lecture-based approach in fostering the development of critical thinking. While both groups showed progress from pretest to posttest, the magnitude of improvement was substantially greater among students exposed to cooperative, student-centered learning strategies. The fact that the experimental group's average gain falls near the midpoint of the medium range highlights that STAD was not only statistically effective (as shown in previous t-tests), but also pedagogically impactful in practical terms.

The low N-Gain score of the control group further reinforces the limitations of passive instructional methods. While lectures may deliver content efficiently, they often lack the interactive, reflective, and socially constructed elements that are essential for deeper cognitive engagement (Deslauriers et al., 2019). In this study, students in the control group were likely limited in their opportunities to engage in critical analysis, defend their reasoning, challenge peer perspectives, or collaboratively construct knowledge, all of which are central to the development of critical thinking and are well-supported by cooperative learning models like STAD (Ghufron et al., 2023).

This comparative perspective also provides useful insights for educators and policymakers. The fact that the experimental group consistently outperformed the control group, both in terms of mean posttest scores and normalized gains, suggests that instructional design and methodology have a direct influence on the quality of student learning outcomes (Li et al., 2022). It is not enough to merely expose students to academic content; the way in which that content is delivered, practiced, and internalized plays a pivotal role in determining its cognitive impact.

Furthermore, the results suggest that short-term exposure to the STAD model, even within just three learning sessions, can yield measurable improvements in students' critical thinking skills (Supratman et al., 2021). This indicates that the model is not only effective, but also efficient and implementable in real classroom settings. Nevertheless, given that the N-Gain remains within the medium category, there is also an opportunity for further enhancement. Sustained application of STAD across multiple topics and subjects, coupled with ongoing teacher training and refinement of group dynamics, could potentially increase the normalized gain to the "high" category in future implementations.

In conclusion, the comparative N-Gain analysis clearly illustrates the pedagogical value of cooperative learning, especially in developing complex cognitive skills such as critical thinking. The difference between the two groups is not merely quantitative, but also qualitative, reflecting deeper engagement, richer interaction, and more active learning processes in the experimental class. These findings not only validate the effectiveness of STAD but also provide a compelling argument for its wider adoption in secondary education curricula. The data presented in this section have been outlined objectively and systematically, serving as the factual foundation for further interpretation and synthesis, which will be elaborated in the next chapter, the Discussion

DISCUSSION

The findings of this study reveal that the implementation of the cooperative learning model using the Student Teams Achievement Division (STAD) technique had a significant and measurable impact on improving students' critical thinking skills. This is evidenced by a substantial increase in posttest scores in the experimental class compared to the pretest scores, as well as the statistically significant results of the paired sample t-test ($p < 0.05$). These findings strongly suggest that STAD-based instruction effectively nurtures critical thinking development in a structured and interactive learning environment. Additionally, the normalized gain (N-Gain) score of 0.478, which falls into the medium category, further illustrates the practical effectiveness of this model in enhancing critical thinking. This is especially noteworthy given the complex nature of the material covered, economic topics such as Money Demand and Supply Theory, Price Indices, and Inflation, which typically require higher-order cognitive engagement.

A closer analysis of critical thinking indicators reveals nuanced insights into the dimensions of students' cognitive growth. Among the five key indicators assessed, "Providing Simple Explanation" demonstrated the highest level of improvement, reaching the "critical" category in the experimental class. This suggests that students became more adept at identifying, articulating, and rationalizing fundamental economic concepts, which marks a crucial step in the development of higher-order thinking. The STAD model's emphasis on peer collaboration and dialogue likely contributed to this outcome, as students were given repeated opportunities to verbalize their understanding and receive feedback within a cooperative setting. On the other hand, the "Strategy and Tactics" indicator exhibited the lowest increase, remaining within the "low" category. This indicator, which demands more advanced competencies such as designing solutions and making evaluative decisions, reflects an area that may require more sustained intervention and targeted instructional scaffolding. While foundational thinking skills showed noticeable improvement, this disparity underscores the need for integrating STAD with additional metacognitive strategies to help students progress from comprehension to strategic reasoning and reflective judgment.

The findings from the independent sample t-test lend further credence to the superiority of the STAD technique compared to conventional lecture methods. Students in the control group, who were taught through varied lectures, experienced only marginal gains in their critical thinking skills, as indicated by a low N-Gain score of 0.116. This outcome suggests that passive instructional methods, where students predominantly receive information without active engagement, are less conducive to fostering the kind of analytical, evaluative, and inferential skills that define critical thinking. These results resonate with previous empirical studies (e.g., Ningsih & Wulandari, 2022; Khairunnisa & Riswanto, 2019; Arifin, 2018), all of which have shown that cooperative learning models, especially those grounded in structured group tasks and peer-led interactions, produce better outcomes in terms of student cognitive growth and classroom participation.

The theoretical foundation for the effectiveness of the STAD model lies firmly in the tenets of constructivist learning theory. According to Jean Piaget, learning is not a mere transmission of facts but a constructive process in which individuals actively organize and adapt knowledge based on their experiences. In this context, the STAD technique empowers students to engage with learning materials more meaningfully through group discussion, problem-solving, and shared responsibility. These experiences align well with Piaget's concept of "cognitive conflict," in which students encounter disequilibrium that challenges their prior knowledge, leading to deeper understanding. Complementing Piaget's view, Lev Vygotsky's theory of social constructivism underscores the centrality of social interaction in learning. Vygotsky's concept of the Zone of Proximal Development (ZPD) suggests that students learn best when working with peers or adults who provide the right level of assistance. STAD's structured collaboration within heterogeneous teams directly supports this notion, allowing students to learn from each other through negotiation, questioning, and elaboration, thereby stimulating their critical faculties in authentic learning contexts.

In practical classroom settings, the STAD model elicited positive affective responses from students. Observation notes indicated an increased level of engagement, enthusiasm, and participation during group-based tasks. Students expressed more confidence in presenting ideas, engaged more openly in debates, and appeared more motivated to contribute to shared learning outcomes. However, challenges were also evident. Some students initially struggled with adjusting to the collaborative format, particularly when navigating group dynamics, sharing responsibilities, or managing time effectively. These challenges highlight the importance of strategic teacher facilitation. Effective implementation of STAD necessitates clear role assignments, ongoing formative feedback, scaffolding of collaborative skills, and structured monitoring to ensure equitable participation. Without these supports, there is a risk that group work may become uneven or dominated by a few students, thereby limiting the model's intended cognitive benefits.

In contrast, the traditional lecture approach used in the control class provided minimal opportunities for student interaction. The teacher-centered nature of lectures limited students' ability to question, clarify, or build upon concepts with their peers. This pedagogical limitation is particularly detrimental to the development of critical thinking, which requires students to evaluate multiple perspectives, test arguments, and construct reasoned conclusions. As noted by Sofiani et al. (2023), lecture-based instruction tends to reduce student engagement and autonomy, which are critical elements in the development of critical thinking. Consequently, it is not surprising that the control class showed only marginal improvement, especially in indicators involving inference, clarification, and strategy.

Despite the experimental class achieving better results overall, it is worth noting that the posttest scores remained on the lower end of the "critical" category. This outcome indicates that although STAD significantly improved students' critical thinking skills, the model's full potential was not yet fully realized within the limited time frame of this study. Several possible explanations exist. First, student readiness may have played a role, many students may not have had prior experience with collaborative learning environments and needed time to adjust. Second, the duration of the study (only three sessions) might have been insufficient for more complex indicators like "strategy and tactics" to develop fully. Third, the novelty of the model may have posed initial cognitive and social challenges that impeded optimal learning. These limitations suggest that sustained implementation over a longer period, complemented by integrated critical thinking strategies, is essential to achieve deeper and broader impacts.

In conclusion, this study reinforces the value of the STAD cooperative learning model as an effective pedagogical strategy for improving students' critical thinking skills in economics education. Through structured collaboration, shared accountability, and peer interaction, STAD creates a rich learning environment that supports both cognitive and social development. Although the level of effectiveness observed in this study is categorized as moderate, the potential for long-term improvement is substantial if supported by well-designed instructional practices and continuous teacher involvement. Based on these findings, the STAD model is highly recommended for broader application in senior high school settings, particularly for subjects that demand critical engagement and complex reasoning. Furthermore, future research should consider longitudinal designs, the integration of digital tools, and differentiated instruction to explore how STAD can be optimized across diverse learner profiles and academic disciplines.

CONCLUSION

The results of this study reveal a statistically and educationally significant difference in students' critical thinking skills in the experimental class before and after the application of the cooperative learning model using the Student Teams Achievement Division (STAD) technique. The observed improvement, as indicated by both descriptive and inferential analyses, including a large mean gain, a medium-level N-Gain score, and significant *t*-values, demonstrates that the STAD model is not only effective in increasing students' academic performance but also instrumental in fostering higher-order cognitive abilities. By engaging students in structured team-based activities, promoting peer accountability, and encouraging active participation, the STAD model creates a learning environment that is conducive to critical thinking development, allowing learners to explore, question, reason, and reflect.

Moreover, the comparative analysis between the experimental and control groups reinforces the effectiveness of the STAD approach. The experimental group, which experienced cooperative learning, consistently outperformed the control group, taught through a varied lecture method, on posttest scores, N-Gain values, and all five critical thinking indicators assessed in the study. This discrepancy underscores the pedagogical advantage of student-centered, cooperative instruction over traditional teacher-centered approaches, particularly in the cultivation of analytical, evaluative, and inferential skills. While the lecture method may transmit information efficiently, it does not necessarily foster the deeper cognitive engagement needed for students to internalize, apply, and evaluate concepts meaningfully. In contrast, STAD offers a dynamic, interactive context where learning is co-constructed, misunderstandings are clarified through dialogue, and knowledge is deepened through peer collaboration.

The positive impact of the STAD technique was particularly evident in the context of economics education, specifically in topics such as the Theory of Demand and Supply of Money, the Price Index, and Inflation. These subjects inherently demand abstract thinking, real-world application, and multi-variable analysis, which align well with the core processes involved in critical thinking. The STAD model, by requiring students to solve problems collaboratively, explain economic phenomena to their peers, and arrive at group consensus, helps to concretize abstract economic concepts while encouraging students to think independently and systematically. Students not only demonstrate improved conceptual understanding but also begin to develop the reasoning and justification skills necessary to analyze real economic scenarios.

In light of the comprehensive findings across various stages of analysis, ranging from descriptive statistics and indicator-specific gains to hypothesis testing and effect size measurements, it can be confidently concluded that the implementation of the STAD cooperative learning model significantly enhances students' critical thinking skills. This improvement is not only measurable but also meaningful in terms of its potential to transform classroom dynamics and elevate the quality of student learning outcomes.

Therefore, the STAD technique emerges from this study as a pedagogically sound and empirically validated instructional model. It is particularly well-suited for subjects that require deep understanding, analytical interpretation, and the application of logic and reasoning, such as economics. Furthermore, the success of this model in a relatively short intervention period suggests that even limited exposure to cooperative learning can produce tangible cognitive benefits. However, it is likely that more substantial and sustained implementation, across longer timeframes or integrated across multiple topics, could yield even greater gains, possibly elevating students to higher proficiency levels in critical thinking.

From a broader educational perspective, these findings lend strong support to the growing call for a shift toward more student-centered learning environments, where learners are active agents in constructing their understanding rather than passive recipients of information. The STAD model aligns closely with contemporary educational paradigms that emphasize collaboration, communication, and critical inquiry as key competencies for 21st-century learners. As such, it holds promise not only for economics instruction but also for other disciplines seeking to cultivate thoughtful, reflective, and independent learners.

In conclusion, this study affirms that the cooperative learning model using the STAD technique has a positive and statistically significant influence on the development of students' critical thinking skills, especially within the domain of economics education. Given its effectiveness, accessibility, and compatibility with current educational goals, the STAD model should be considered a highly relevant instructional strategy for educators aiming to promote deep learning and cognitive growth among senior high school students. Its adoption and integration into classroom practice may contribute meaningfully to the advancement of critical thinking competencies, skills that are essential for academic success, informed citizenship, and lifelong learning.

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