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The Impact of Cooperative Learning and Contextual Teaching on Problem-Solving Skills and Student Responsibility in High School Mathematics

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A B S T R A C T

Education in Indonesia faces significant challenges in aligning with global advancements, particularly in enhancing students' problem-solving skills and fostering a sense of responsibility. This study aims to investigate the impact of Cooperative Learning and Contextual Teaching and Learning (CTL) models on improving these two critical aspects of high school mathematics education. Using a quasi-experimental design, the study involved two classes at SMA Negeri 1 Rantau Utara, Labuhanbatu Regency, Indonesia. Class X-D was assigned as the experimental group, implementing Cooperative Learning, while Class X-E served as the control group, utilizing the CTL model. Data were collected through pre-tests and post-tests to measure problem-solving skills and questionnaires to assess student responsibility. The data were analyzed using ANOVA with SPSS 27 for Windows. The results revealed that both learning models significantly improved students' problem-solving skills and responsibility. However, the Cooperative Learning group demonstrated a higher level of improvement compared to the CTL group, suggesting that collaborative learning enhances mathematical understanding and responsibility more effectively. This study underscores the importance of transitioning from conventional teaching methods to innovative, student-centered approaches. The findings imply that optimizing the application of Cooperative Learning and CTL can significantly contribute to improving the quality of education in Indonesia.

Keywords: *Cooperative Learning, Contextual Teaching and Learning (CTL), Problem-Solving Skills, Student Responsibility, High School Mathematics*

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INTRODUCTION

Education around the world continues to undergo dynamic transformations, and Indonesia as part of the global community also faces similar challenges. Unfortunately, many students in Indonesia have not been able to keep up with the increasingly advanced development of international education. This condition encourages the need for innovation in learning strategies to overcome various problems that hinder the progress of the national education system. One potential solution is the implementation of cooperative learning and contextual teaching and learning (CTL) models. Both approaches are believed to be able to develop student's basic skills and encourage their academic and personal growth. This study aims to analyze the effect of cooperative learning and CTL models on students' problem-solving ability and sense of responsibility, especially in mathematics learning.

Mathematics as a scientific discipline plays a crucial role in training students to develop problem-solving abilities, which are essential skills to face the challenges of real life. According to the Indonesian National Education Standards, one of the main objectives of learning mathematics is to equip students with the ability to solve problems (Siswanto &

Meiliasari, 2024, p. 46). However, the reality in the field shows that many students still experience difficulties in understanding and solving math problems. This low ability can be caused by various factors, both internal and external. Internally, students are often less mentally and academically prepared to receive learning materials. Meanwhile, external factors such as lack of teacher training, limited school facilities, and inadequate learning resources further exacerbate this situation.

The challenges in mathematics education in Indonesia are multifaceted. According to the Program for International Student Assessment (PISA) 2018, Indonesian students ranked 72nd out of 79 countries in mathematics literacy, with an average score of 379, far below the OECD average of 489 (Tehusijarana, 2019). This low performance reflects systemic issues, including inadequate teacher training, limited access to quality learning resources, and a curriculum that often prioritizes rote memorization over critical thinking. Additionally, the disparity in educational quality between urban and rural areas exacerbates the problem. In rural regions, such as Labuhanbatu, students often face a lack of qualified mathematics teachers and insufficient infrastructure, which further hinders their ability to develop problem-solving skills. These challenges highlight the urgent need for innovative teaching strategies that can address these gaps and improve students' mathematical competencies.

Based on researchers' observations in several schools in Labuhanbatu district, North Sumatra province, Indonesia, it shows that students' interest in learning mathematics is still very low. Many students perceive math as a difficult and scary subject. This perception not only affects their learning motivation but also has an impact on suboptimal learning outcomes. In addition, the learning methods used tend to be conventional and monotonous, pay little attention to students' needs, and do not link the material to real-life contexts. As a result, students have difficulty understanding the relevance of mathematics in everyday life, which ultimately hinders the development of their problem-solving skills.

Cooperative learning is an approach that emphasizes the importance of working together in heterogeneous small groups (Hasanah & Himami, 2021). In this model, students are invited to interact, discuss, and work together to complete academic tasks. Through this process, students not only deepen their understanding of the subject matter but also develop social skills such as communication, collaboration, and responsibility. In the context of mathematics learning, cooperative learning can be a solution to improve students' problem-solving ability through an active and collaborative learning process.

On the other hand, contextual learning (CTL) is an approach that connects academic material with real-life contexts. CTL encourages students to engage in meaningful learning activities, such as problem-based projects, where they can make decisions, take responsibility, gather information, and draw conclusions. By linking learning to everyday experiences, students can see the relevance and meaning of what they are learning. This approach not only improves conceptual understanding but also encourages students to think critically and creatively in solving problems (Hasudungan, 2022).

Although the national curriculum emphasizes the importance of problem-solving skills, many teachers still rely on traditional teacher-centered learning methods. These methods tend to prioritize lectures and textbook-based learning, without providing opportunities for students to express opinions or be actively involved in the learning process. As a result, students are less trained to develop problem-solving skills independently. This ability is very important not only for academic success but also for facing challenges in the real world.

Based on the challenges and potential solutions described, this study focused on three main problem formulations. First, this study aims to determine whether there is a significant effect of the application of the cooperative learning model on students' problem-solving ability at SMA Negeri 1 Rantau Utara in Labuhanbatu district, Indonesia. Secondly, this study will also analyze whether the cooperative learning model affects increasing students'

sense of responsibility at the school. Third, this study further examines the effect of the contextual teaching and learning (CTL) learning model on students' problem-solving ability.

This problem formulation emerged as a response to the challenges faced in learning mathematics, especially at SMA N 1 Rantau Utara. As is well known, low problem-solving skills and a lack of student responsibility for learning are problems that are often encountered in the Indonesian educational context. Therefore, this study seeks to explore the potential of two innovative learning models, namely cooperative learning and CTL, in overcoming these problems. By answering this problem formulation, it is expected that a clear picture can be obtained regarding the effectiveness of the two learning models in improving the quality of mathematics learning, especially in the aspects of problem-solving and student responsibility.

This study also aims to provide practical recommendations for educators and education policymakers. If it is proven that cooperative learning and CTL learning models have a positive influence, then these two approaches can be adopted more widely in the national education system. In addition, the findings are expected to be the foundation for the development of more innovative and student-centered learning strategies, to be able to answer the challenges of education in the era of globalization. Thus, this study is not only academically relevant but also has significant practical implications for improving the quality of education in Indonesia.

Overall, the challenges in learning mathematics in Indonesia require a paradigm shift from conventional learning methods to a more innovative and student-centered approach. Cooperative learning and CTL offer promising solutions to improve problem-solving skills and build students' sense of responsibility for their learning process. Through this study, it is hoped that empirical evidence can be obtained regarding the effectiveness of the two learning models so that it can become a foundation for improving the quality of mathematics education in Indonesia.

Literature Review

The Nature of Learning

Learning is a process of changing individual behavior as a result of interaction with the environment. According to Burton in Setiawati (2018), learning is a process of behavior change that occurs due to interactions between individuals and their environment. Gagne and Berliner in Anastasya et al. (2015) added that learning is a change in organism behavior as a result of experience. Howard L. Kingsley in Aslan (2018) also states that learning is the process of changing behavior through practice or training. In general, learning can be concluded as a conscious process that aims to achieve comprehensive changes in behavior, both through individual and group interactions.

Learning Outcomes

Learning outcomes are influenced by internal and external factors. Internal factors include intelligence, motivation, and physical condition, while external factors include family, school, and community environments (2023). Teachers play an important role in influencing student learning outcomes, especially in creating a varied and meaningful learning process (Andini et al., 2024). Changes in student behavior as a result of learning must be comprehensive and permanent, which can be achieved through the right learning approach.

The Nature of Mathematics

Mathematics is the study of patterns, structures, and logical relationships. According to Soedjadi (Andriani, 2015), mathematics has abstract, deductive, and consistent characteristics in its system. Mathematics also acts as the "queen and servant of science" because it can develop independently while supporting other sciences. Learning mathematics requires

students to think logically, critically, and systematically, so an effective learning approach is needed to improve student learning outcomes.

Teams Games Tournament (TGT) Cooperative Learning

Cooperative learning type TGT emphasizes cooperation and healthy competition among students. According to Komalasari (2014), this model involves the activities of all students, including the role of peer tutors, and is effective in improving learning outcomes. Azukario et al. (2019) in his research found that TGT learning increased student learning completeness by 86.67% on arithmetic series and sequence material. However, this model has disadvantages, such as difficulty in grouping students and long discussion time.

Contextual Learning (CTL)

Contextual learning connects academic material with students' real lives. Muslihah & Suryaningrat (2021) found that CTL improved the mathematical problem-solving ability of grade V elementary school students. The average posttest score of the experimental class using CTL increased from 29% to 34%, while the control class decreased from 30% to 28%. CTL emphasizes the principles of constructivism, inquiry, and reflection, thus making learning more meaningful and interesting for students. By reviewing the various definitions and studies above, it can be understood the relationship between the nature of learning, learning processes, and outcomes, is that both TGT and CTL cooperative learning have the potential to improve learning outcomes and students' problem-solving skills, although both have challenges in their implementation.

METHOD

This study employs a quasi-experimental design to investigate the causal relationship between the application of cooperative learning and contextual teaching models on students' problem-solving abilities and responsibility in mathematics. Quasi-experimental research, as defined by Arikunto (2006, 2014), aims to identify cause-and-effect relationships by comparing one or more experimental groups receiving specific treatments with one or more control groups receiving different treatments. To ensure validity, the experimental and control groups are selected through random sampling and are homogeneous in terms of student abilities. Homogeneous classes, consisting of students with equivalent capabilities, facilitate the delivery of material and ensure a fair comparison. Variables are controlled by ensuring both groups receive the same subject matter, are taught by the same teacher, undergo the same duration of instruction, and experience similar environmental conditions. Additionally, both groups are given a pre-test to assess their initial abilities before the experiment begins.

The research was conducted at SMA Negeri 1 Rantau Utara, located in Labuhanbatu Regency, North Rantau District, during the 2023/2024 academic year, from the end of September to December 2023. The assignment of classes to the experimental and control groups was conducted through a random sampling process to ensure fairness and minimize bias. Initially, the two parallel classes (X-D and X-E) were assessed for homogeneity in terms of students' prior academic performance in mathematics, as determined by their mid-term examination scores. This step ensured that both groups had equivalent baseline capabilities before the intervention. Class X-D was randomly selected as the experimental group, where the cooperative learning model was implemented, while Class X-E was assigned as the control group, where the contextual teaching model was applied. The random assignment was verified by comparing the pre-test scores of both groups, which showed no significant difference, confirming that the groups were comparable at the outset of the study. The population consists of 72 tenth-grade students divided into two parallel classes, each containing 36 students. The sample is divided into two groups: Class X-D, the experimental

group, is taught using the cooperative learning model, while Class X-E, the control group, is taught using the contextual teaching model. The independent variables in this study are the cooperative learning and contextual teaching models, while the dependent variables are students' problem-solving abilities and responsibility. Problem-solving ability is measured through students' scores on a final test, while responsibility is assessed using a questionnaire with Likert-scale items.

The research procedure begins with obtaining permission from the school principal and coordinating with the mathematics teacher to identify the material to be taught. A pre-test is administered to both groups to assess initial abilities, followed by the implementation of the respective teaching models. After the treatment period, a post-test is administered to measure the impact of the interventions. The primary instrument for data collection is a written test consisting of 10 essay questions, with each correct answer scoring 10 points and incorrect answers receiving 0 points, resulting in a maximum score of 100. Before use, the test instrument is validated and tested for reliability through a pilot test to assess validity, reliability, and difficulty levels.

Data collection involves administering pre-tests and post-tests individually to all participants, ensuring a conducive testing environment to minimize disruptions. Data analysis begins with calculating the mean scores and standard deviations for both groups using statistical formulas. Homogeneity of variance is tested using the F-test, and hypotheses are tested using Analysis of Variance (ANOVA) to compare the mean scores of the two groups. ANOVA is chosen because it is suitable for comparing more than two sample groups, with all statistical calculations performed using SPSS 27 for Windows. This methodological approach ensures the study provides valid and reliable insights into the effectiveness of cooperative learning and contextual teaching models in enhancing students' problem-solving abilities and responsibility in mathematics education.

FINDINGS AND DISCUSSION

Research Results

This study aims to analyze the effect of Cooperative Learning (TGT) and Contextual Teaching and Learning (CTL) learning models on problem-solving skills and student responsibility at SMA N 1 Rantau Utara. The research sample consisted of two classes, namely class X-D (TGT) and class X-E (CTL), each totaling 33 students. Data were collected through pretest and posttest, as well as a questionnaire to measure student responsibility. The results were analyzed using a normality test, homogeneity test, and hypothesis test.

Pretest and Posttest Results

A pretest was conducted to measure the initial ability of students before treatment. The pretest results showed that both classes had relatively similar initial abilities, with an average score of 37 for the TGT class and 36 for the CTL class. However, after the treatment, the posttest showed significant differences. The TGT class reached an average score of 79, while the CTL class only reached 42. This shows that the cooperative learning model is more effective in improving student learning outcomes.

Table 1. Pretest and Posttest Results

Statistic	TGT Class (Pre)	CTL Class (Pre)	TGT Class (Post)	CTL Class (Post)
Maximum Score	46	57	90	70
Minimum Score	12	20	61	20
Mean	37	36	79	42
Standard Deviation	7.44	11.52	8.08	12.98

Responsibility Test Results

The responsibility test was conducted using a questionnaire. The results showed that the TGT class had an average score of 51, slightly higher than the CTL class which had an average of 50. Although the difference was not significant, the TGT class showed better consistency with a standard deviation of 5.31 compared to the CTL class which had a standard deviation of 2.77.

Table 2. Responsibility Test Results

Statistic	TGT Class	CTL Class
Maximum Score	60	57
Minimum Score	39	45
Mean	51	50
Standard Deviation	5.31	2.77

Normality and Homogeneity Test

The normality test using Shapiro-Wilk showed that the pretest and posttest data of both classes were normally distributed ($p > 0.05$). The homogeneity test using the F test also showed that both groups were homogeneous (F count = 0.3875 < F table = 0.5541), thus fulfilling the requirements for hypothesis testing.

Hypothesis Test

Hypothesis testing using ANOVA showed that the cooperative learning model (TGT) had a significant effect on improving problem-solving skills (t = 17.881) and student responsibility (t = 9.011). The CTL model also had an effect but with lower t values (t = 17.172 for problem-solving and t = 15.088 for responsibility). This shows that the cooperative model is more effective than the CTL model.

Table 3. Hypothesis Test Results

Hypothesis	t Calculated	t Table	Conclusion
The effect of TGT on problem-solving	17.881	2.0422	Significant
The effect of TGT on responsibility	9.011	2.042	Significant
The effect of CTL on problem-solving	17.172	2.0422	Significant
The effect of CTL on responsibility	15.088	2.0422	Significant

Based on the results of the study, it can be concluded that both learning models (TGT and CTL) have a positive effect on students' problem-solving ability and responsibility. However, the cooperative learning model (TGT) showed higher effectiveness than the CTL model. These findings provide recommendations for educators to consider using cooperative learning models to improve the quality of mathematics learning.

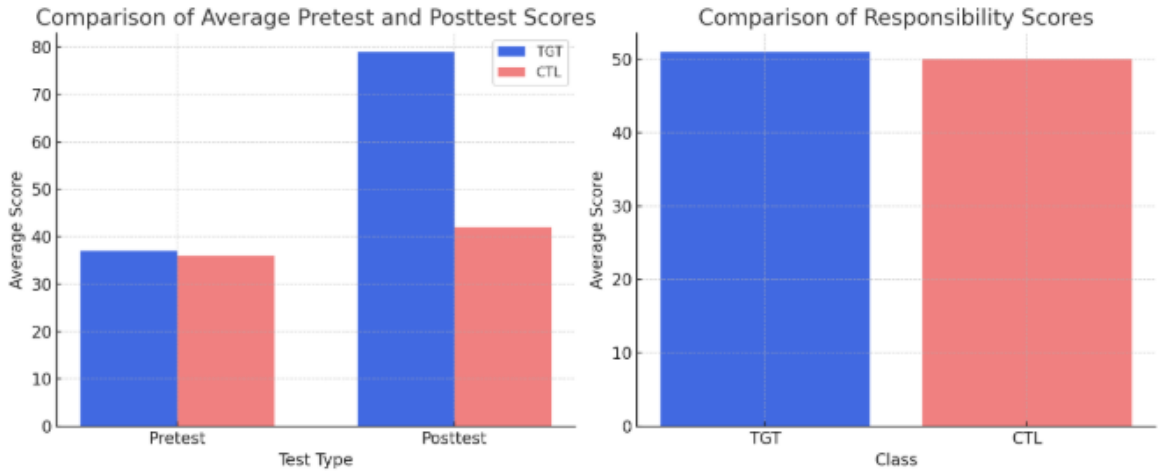

Figure 1. Comparison of Average Pretest and Posttest Scores and Comparison of Responsibility Scores

Notes: The graph compares responsibility scores between TGT and CTL classes.

Discussion

The results of this study indicate that the Cooperative Learning (TGT) and Contextual Teaching and Learning (CTL) learning models affect problem-solving skills and student responsibility at SMA N 1 Rantau Utara. Based on data analysis, classes using the TGT model showed a more significant increase than CTL classes. The average posttest score of the TGT class reached 80, while the CTL class only reached 42. This indicates that game-based learning in the TGT model is more effective in improving student learning outcomes than the lecture and discussion methods used in the CTL model.

These findings align with previous research that highlights the effectiveness of cooperative learning models in enhancing problem-solving skills and student responsibility. For instance, Azukario (2019) found that the Teams Games Tournament (TGT) model significantly improved students' mathematics learning outcomes, with 86.67% of students achieving the minimum mastery criteria. Similarly, Muslihah et al. (2021) demonstrated that the Contextual Teaching and Learning (CTL) model positively influenced students' problem-solving abilities, though the improvement was less pronounced compared to cooperative learning approaches. The current study builds on these findings by directly comparing the TGT and CTL models, revealing that TGT not only enhances academic performance but also fosters a stronger sense of responsibility among students. This adds to the growing body of evidence supporting the use of student-centered learning models in mathematics education, particularly in contexts where traditional methods have proven ineffective.

Spontaneous interviews with students revealed that they felt more motivated and active in learning mathematics after using the TGT and CTL models. Students stated that learning became more interesting because they could relate the material to their daily lives and use various learning resources other than textbooks. The TGT model, in particular, encouraged students to be more courageous in asking questions and actively participating in the learning process, which ultimately improved their understanding and responsibility.

The application of TGT and CTL models requires systematic steps, such as providing contextual questions, formulating learning objectives, and facilitating students to gather information from various sources. This process not only involves cognitive activities but also encourages students to think critically and creatively. However, this model requires quite a long time, about 2-4 hours per session, so it needs careful planning to maintain the effectiveness of learning.

This study was conducted in a classroom with limited learning resources and without grouping students by ability. Nevertheless, the results showed that the TGT model was able to create a more interactive and fun learning environment so that students who were previously less motivated became more responsible for their learning process. This can be seen from the results of the responsibility test, where the TGT class has an average score of 51, slightly higher than the CTL class which has an average of 50.

Based on hypothesis testing, it can be concluded that the TGT model has a more significant effect on students' problem-solving skills and responsibility than the CTL model. The t-count value for the TGT class (17.881) is much greater than the t-table (2.0422), indicating that the difference in learning outcomes between the two learning models is statistically significant. Thus, the cooperative learning model can be used as an effective alternative to improve the quality of mathematics learning, especially in developing students' problem-solving ability and responsibility.

CONCLUSIONS

This study demonstrates that both Cooperative Learning and Contextual Teaching and Learning (CTL) models positively influence students' problem-solving skills and sense of responsibility in mathematics. However, Cooperative Learning, particularly the Teams Games Tournament (TGT) approach, proves more effective in enhancing these outcomes due to its emphasis on collaboration and active participation. CTL, while beneficial for connecting mathematical concepts to real-life contexts, shows a comparatively lesser impact. These findings underscore the importance of adopting student-centered learning models, especially in fostering critical skills like problem-solving and responsibility. For optimal results, educators should integrate Cooperative Learning for collaborative tasks and CTL for contextual understanding, supported by adequate teacher training and school resources. Future research should explore the long-term effects and applicability of these models across diverse subjects and educational settings.

REFERENCES

Anastasya, D., Dewi, S. R., & Murnaka, N. P. (2015). Pengaruh Games Memorize Card Terhadap Hasil Belajar Siswa pada Operasi Hitung Bilangan. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *6*(2), 164. https://doi.org/10.15294/kreano.v6i2.5010

Andini, M., Ramdhani, S., Suriansyah, A., & Cinantya, C. (2024). Peran Guru dalam Menciptakan Proses Belajar yang Menyenangkan. *Maras: Jurnal Penelitian Multidisiplin*, *2*(4), 2298–2305. https://doi.org/10.60126/maras.v2i4.637

Andriani, P. (2015). Penalaran Aljabar dalam Pembelajaran Matematika. *Beta: Jurnal Tadris Matematika*, *8*(1). https://jurnalbeta.ac.id/index.php/betaJTM/article/view/20

Arikunto, S. (2006). *Manajemen Penelitian*. Rhineka Cipta.

Arikunto, S. (2014). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.

Aslan, A. (2018). Makna kurikulum terhadap teori tentang belajar pada perubahan perilaku anak didik. *Cross-Border*, *1*(2). https://journal.iaisambas.ac.id/index.php/Cross-Border/article/view/569

Azukario, A., Hamdani, H., & Yani, A. (2019). Penggunaan model kooperatif tipe teams games tournament materi barisan dan deret kelas XI SMK. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK)*, *8*(3). https://jurnal.untan.ac.id/index.php/jpdpb/article/view/32415

Hasanah, Z., & Himami, A. S. (2021). Model pembelajaran kooperatif dalam menumbuhkan keaktifan belajar siswa. *Irsyaduna: Jurnal Studi Kemahasiswaaan*, *1*(1), 1–13. https://doi.org/10.54437/irsyaduna.v1i1.236

Hasudungan, A. N. (2022). Pembelajaran Contextual Teaching Learning (CTL) Pada Masa Pandemi COVID-19: Sebuah Tinjauan. *Jurnal DinamikA*, *3*(2), 112–126.

https://doi.org/10.18326/dinamika.v3i2.112-126

Komalasari, K. (2014). *Pembelajaran Kontekstual : Konsep dan Aplikasi*. PT Refika Aditama.

Meliana, M., Dedy, A., & Budilaksana, R. (2023). Analisis Faktor-Faktor yang Menyebabkan Rendahnya Hasil Belajar Siswa di SD Negeri Karang Ringin 1. *Journal on Education*, *5*(3), 9356–9363. https://doi.org/10.31004/joe.v5i3.1742

Muslihah, N. N., & Suryaningrat, E. F. (2021). Model Pembelajaran Contextual Teaching and Learning terhadap Kemampuan Pemecahan Masalah Matematis. *Plusminus: Jurnal Pendidikan Matematika*, *1*(3), 553–564. https://doi.org/10.31980/plusminus.v1i3.963

Setiawati, S. M. (2018). Telaah teoritis: Apa itu belajar ? *HELPER : Jurnal Bimbingan Dan Konseling*, *35*(1), 31–46. https://doi.org/10.36456/helper.vol35.no1.a1458

Siswanto, E., & Meiliasari, M. (2024). Kemampuan Pemecahan Masalah pada Pembelajaran Matematika: Systematic Literature Review. *Jurnal Riset Pembelajaran Matematika Sekolah*, *8*(1), 45–59. https://doi.org/10.21009/jrpms.081.06

Tehusijarana, K. M. (2019). *Not even mediocre? Indonesian students score low in math, reading, science: PISA report*. The Jakarta Post. https://www.thejakartapost.com/news/2019/12/04/not-even-mediocre-indonesian-students-score-low-in-math-reading-science-pisa-report.html#:~:text=Both scores were also significantly,and 71st in science.