International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 20s, 2025
https://theaspd.com/index.php

Learning Innovation Using Technology (Google Maps) In Mathematics Junior High Schools

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Orchid Id number: 0009-0004-1819-7937

Abstract:
This research examines the implementation of the Realistic Mathematics Education (RME) approach combined with the Student Teams Achievement Divisions (STAD) cooperative learning model to enhance problem-solving and critical thinking skills in junior high school mathematics. The research employed a quasi-experimental design with a one-group pretest-posttest method, involving students who learned line and angle concepts using Google Maps as a contextual tool. Results showed significant improvements in students' problem-solving abilities (average pretest: 48.48; posttest: 80.68) and critical thinking skills (average pretest: 35.98; posttest: 73.48), with reduced score variability indicating more consistent performance. Statistical analysis confirmed the effectiveness of integrating RME and STAD in fostering collaborative learning and real-world mathematical application. The findings suggest that this innovative approach not only strengthens conceptual understanding but also equips students with essential skills for academic and everyday problem-solving.
Keywords: *Realistic Mathematics Education (RME), Student Teams Achievement Divisions (STAD), Technology, Google Maps, Pedagogy.*

INTRODUCTION

Mathematics is one of the subjects that plays an important role in the education curriculum in Indonesia [1]. At Junior High School, this subject is one of the main focuses, especially in class VII, where students are introduced to basic geometric concepts such as lines and angles. A deep understanding of this material is very important because it is the foundation for learning more complex geometric concepts at a higher level [1].

However, the mathematics learning process at Junior High School is not free from various challenges. One of the main challenges is limited study time caused by the busy curriculum [2]. A dense curriculum limits the time available for students to study and understand mathematical concepts in depth. This condition means that students often have to deal with new material before they have truly mastered the previous material, which ultimately hinders the development of problem solving skills needed in mathematics. Apart from that, learning methods that tend to be teacher-centred are also a challenge in themselves [3]. Teacher-centered learning models often reduce interaction and collaboration between students. When students are only passive recipients of information, opportunities to discuss, share understanding and learn from each other are very limited. As a result, the development of communication and collaboration skills that are important in cooperative learning is hampered. In fact, these abilities are very important, not only for understanding mathematical concepts, but also for equipping students with the social skills needed in everyday life. In this context, implementing learning methods that are more student-centered and encourage collaboration between students is becoming increasingly important. One approach that can be applied is cooperative learning, where students work in small groups to complete
tasks together. Based on research results, it shows that cooperative learning models such as Student Teams Achievement Divisions (STAD) can increase student involvement and enable them to help each other in understanding learning material [4].

Thus, learning focuses not only on individual achievement, but also on the success of the group as a whole. Through this approach, it is hoped that students will not only improve their understanding of mathematical concepts, but will also develop better collaboration and communication skills. The importance of combining a problem-solving oriented learning approach with cooperative learning is increasingly relevant in facing educational challenges at Junior High School. In this way, students are not only prepared to face exams, but also to apply their mathematical knowledge in real life, and work together effectively with others.

To overcome the challenges faced in mathematics learning at Junior High School, the use of the Realistic Mathematics Education (RME) approach and the Student Teams Achievement Divisions (STAD) type cooperative learning model can be an effective solution. The RME approach emphasizes the importance of relating mathematical concepts to real- world contexts, so that students can more easily understand and apply their knowledge in everyday situations. As expressed by[4]

RME allows students to see the relevance of mathematics in their lives, which in turn increases their motivation and understanding of the material taught. In practice, RME integrates real contexts that are familiar to students into the learning process[5]. For example, in studying the concepts of lines and angles, students can be invited to explore how these concepts are applied in architecture, design, or everyday navigation. In this way, students not only learn in the abstract, but also understand how mathematics plays a role in the world around them. This approach helps reduce the gap between theory and practice, making learning more meaningful and contextual for students [4].

In addition, the STAD type cooperative learning model provides a framework that allows students to work in small, heterogeneous teams [6]. In this team, students with different abilities can share knowledge and support each other in understanding the material [7]. STAD promotes intensive interaction among team members, where each student is responsible not only for their own understanding, but also for the understanding of other team members. Thus, this model not only improves students' understanding of mathematical concepts, but also develops important social and cooperative skills.

Cooperative learning such as STAD has been proven to improve student learning outcomes, especially in subjects such as mathematics[8]. Through working in teams, students learn to discuss difficult concepts, give and receive feedback, and develop problem-solving strategies together[8].

This also helps overcome challenges often faced in teacher-centered learning, where students tend to be passive and less involved in the learning process. The implementation of the RME approach and STAD model at Junior High School is expected to improve the quality of mathematics learning, especially in line and angle material. With RME, students can see the practical relevance of the material studied, while through STAD, they can develop important collaboration and communication skills. The combination of these two approaches provides a more dynamic learning environment, where students focus not only on individual outcomes, but also on collective success. In this way, it is hoped that students can develop a deeper understanding of basic geometric concepts, as well as social skills that are important in their future lives.

1. Realistic Mathematics Education (RME)

Realistic Mathematics Education (RME) is approach in teaching And learning mathematics using Google maps Which emphasized use context and real-world problems to engage students in mathematical experiences meaningful[9]. Theory (RME) plays a dual role in the world of mathematics education. On the one hand, this theory becomes a guide in designing learning and research. On the other hand, developmental research strengthens and refines the theory itself. The main goal of the RME research program is to find how best to present mathematics education to students . In this way, it is hoped that students can rediscover mathematics independently (reinvantion mathematics) [2]. Goal in RME is to help students connect mathematics to real life. He achieved this by introducing the concepts of horizontal and vertical mathematization. Horizontal mathematics helps students see how everyday problems can be solved with mathematics, while vertical mathematics helps students understand mathematical concepts in more depth [10].

2. Problem-Solving

Problem solving ability is one of the important abilities that must be possessed by every individual. Ability This possible somebody For overcome various obstacles and achieve the desired goals. In everyday life, we are faced with with various problems, both small and large. Ability to solve problem in a way effective will help We in undergo life with more Good[11](Polya, 1957). This aspect of problem solving ability refers to metacognitive problem solving skills. The instructional implication of this metacognitive skills approach is that students need to practice solving problems in real contexts, namely through direct experience in realistic problem solving settings

[12]. In Sternberg's triarchic theory of intelligence, problem solving is an integral part of intelligence. This ability involves in-depth analysis of a problem, development of creative ideas to address the problem, and finally, application of the found solution in a real-world context[13].

3. Critical Thinking

Critical thinking does not only focus on memorization, but also the ability to solve problem. Critical thinking involves using logic and reason to analyze arguments in depth, question assumptions, and understand multiple perspectives, with the goal of achieving wise decision making and effective problem solutions[14]. Heard mengkritik pandangan yang menganggap berpikir kritis sebagai pemikiran yang pasif. Menurutnya, berpikir kritis adalah proses yang aktif dan produktif. Selain menganalisis informasi, berpikir kritis juga melibatkan penerapan informasi tersebut untuk mencapai tujuan tertentu[15]. Critical thinking is the process of systematically analyzing information, testing its truth, and making decisions based on objective standards[16]

4. Students Teams Achievements Divisions (STAD)

The STAD (Student Teams-Achievement Divisions) cooperative model is a cooperative learning method developed to improve students' academic achievement and social skills [17]. As for steps implementation model learning Cooperative type STAD:

Step 1 Team Formation : Students are divided into small, heterogeneous groups, with members of varying levels of academic ability, to ensure diversity within each team. Teams work together on learning activities, such as discussions, exercises, or projects, to collectively understand the subject matter.

Step 2 Individual Assessment : After a period of team work, students are tested individually to assess their understanding of the material that has been taught. These assessments are used to measure individual progress.

Step 3 Points and Awards : Based on the results of individual assessments, teams earn points calculated based on members' individual improvements and overall team achievements. These points are used to determine the outstanding teams, who then receive awards.

Step 4 Feedback : Students receive feedback regarding the results of their work both individually and as a team. This feedback helps them to improve and improve their understanding and learning strategies [18].

METHODS

The method used in this research is an experimental method with a pre-experimental design that focuses on one group without a control group as a comparison. The design used is one-group pretest-posttest , where data is collected before and after treatment to measure its impact. The treatment was only carried out in one class, and a comparison of the pretest and posttest results was used to determine the effect of the treatment[19]. On study time This use type study quasi-experimental. quasi- Experimental is a type of research that aims to explore relationships cause and effect between variables . However, No like experiment true, study quasi-experimental No use randomization full in assignment of participants into experimental and control groups [19].

Table 1 : Research Design

Pre-test	Treatment	Post-test
O 1	X	O 2

Description:

O 1 : Pre-treatment initial test (pre-test).

X :Treatment or treatment is given, namely learning the STAD-type cooperative model with RME approach.

O 2 : Final test, after giving treatment (Post-test).

The implementation location was at Junior High School. In class VIII, the material will be adjusted to the semester when research data collection is carried out. The data collection that will be used in this research is in the form of a questionnaire that is used in the form of multiple choices, a Likert scale, or an open essay and a test that uses a series of questions or tasks that are used to measure the respondent's abilities

or knowledge. Tests can be written tests, oral tests, or performance tests. The analysis technique for this innovation practice is to use the T test (or Student's t-test). is a statistical method used to test hypotheses about averages population. Formulas general for a one sample T test is

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Count mark p (p-value) based on distribution t with degrees freedom (df) Which in accordance. p value with a significance level (α) for example 0.05) to determine whether the null hypothesis can be rejected or not. If $\leq \alpha$, hypothesis zero rejected, show There is significant difference. If $p > \alpha$, hypothesis zero No rejected, show No There is difference significant.

RESULTS

1. Problem-Solving Results

Descriptive analysis of class VII students' problem solving was carried out from pretest and posttest data based on indicators of problem solving ability. Table 2 shows an overview of the results of students' problem solving skills.

Table 2. Problem- solving

	Average	Deviation Raw	Score Mak	Score Min
Pre- Test	48.48	13.02	66.66	16.66
Post-Test	80.68	7.44	100	66.66

Based on data on following is description For Pre-Test And Post-Test. Comparison Pre- Test And Post-Test average happen increase average score Which significant from 48.48 on Pre- Test became 80.68 in the Post- Test. This shows an increase in learning positive after intervention. There was a decrease in the standard deviation value from 13.02 in the Pre-Test to 7.44 on the Post-Test. This shows that students' scores become more focused on average after intervention. Score maximum on Post-Test (100) more tall from score maximum on Pre-Test (66,66). Matter This show that test Post-Test Possible more difficult or covers a wider range of material. The minimum score on the Post-Test (66.66) is the same as the score minimum on Pre-Test (66.66). This shows that there are no students who get it score below 66.66 on the Post-Test. Based on the statistical description above, it can be concluded that there was a significant increase in learning after the intervention. This is demonstrated by average increase score and decrease in standard deviation value.

The hypothesis used in the research is:

H0: There is no significant difference between the pretest and posttest of student problem solving. H1: There is a significant difference between the pretest and posttest of student problem solving.

The paired sample t-test results indicate a significant difference between the pre-test and post-test scores, leading to the rejection of the null hypothesis (H0) and acceptance of the alternative hypothesis (H1). This confirms that the intervention had a significant positive impact on the students' problem-solving skills.

Table 3. Critical Thinking

	Average	Deviation Raw	Score Mak	Score Min
Pre- Test	35.98	11.61	58.33	16.66
Post-Test	73.48	6.62	83.33	66.66

Based on the table above, the following is a statistical description of the Pre-Test and Post-Test. Comparison Pre-Test And Post-Test, average happen increase average score Which significant from 35.98 on Pre-Test was

73.48 in Post-Test. This shows an increase in learning who were positive after the intervention. There was a decrease in the standard deviation value from 11.61 in the Pre-Test to 6.62 on the Post-Test. This shows that students' scores become more focused on average after intervention. Score maximum on Post-Test (83.33) more tall from score maximum in the Pre-Test (58.33). This suggests that the Post-Test may be more difficult or cover a wider range of material. The minimum score on the Post-Test (66.66) is the same as the score minimum on Pre-Test (66.66). This shows that there are no students who get it score below 66.66 on the Post-Test. Based on the statistical description above, it can be concluded that there was a significant increase in learning after the intervention. This is demonstrated by average increase scores and impairments standard deviation.
The hypothesis used in the research is:
H0: There is no significant difference between the pretest and posttest of student Critical Thinking. H1: There is a significant difference between the pretest and posttest of student Critical Thinking.

To test these hypotheses, a paired sample t-test was conducted. The results showed a significant difference between the pre-test and post-test scores, leading to the rejection of the null hypothesis (H0)
and acceptance of the alternative hypothesis (H1). This confirms that the intervention had a significant positive impact on the students' critical thinking skills.

CONCLUSION

Based on the results of the research conducted at one of the private junior high schools in Yogyakarta, it can be concluded that the implementation of the Realistic Mathematics Education (RME) approach and the Student Teams Achievement Divisions (STAD) cooperative learning model has shown significant positive impacts on students' problem-solving and critical thinking skills. The average problem-solving score increased significantly from 48.48 in the pretest to 80.68 in the posttest, with a decrease in standard deviation indicating more consistent performance among students. Similarly, the critical thinking scores improved, with the average rising from
35.98 to 73.48 and a decrease in standard deviation reflecting more focused scores. The maximum scores for both problem-solving and critical thinking saw notable increases, and no student scored below the minimum threshold in the posttests. The statistical analysis confirmed that these improvements were significant, demonstrating that the combined RME and STAD approaches effectively enhance students' mathematical understanding, problem-solving abilities, and critical thinking skills. This integrated educational strategy not only prepares students for academic success but also equips them with vital skills for real-life applications and collaborative work.

Acknowledgement

We would like to express our sincere gratitude to LPDP (Lembaga Pengelola Dana Pendidikan) for their generous funding support for 5TH INTERNATIONAL CONFERENCE ON Acacia Hotel Manila Manila, Philippines Engineering, Social Sciences and Humanities (ICESSU). We also extend our heartfelt thanks to all our mentors for their invaluable knowledge and guidance throughout the development of this manuscript.

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