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THE EFFECT OF TEAMS GAMES TOURNAMENT (TGT) MODIFIED SCHEMA BASED INSTRUCTION (SBI) ON MATHEMATICS PROBLEM SOLVING ABILITY OF GRADE V STUDENTS

PENGARUH *TEAMS GAMES TOURNAMENT* (TGT) MODIFIKASI *SCHEMA BASED INSTRUCTION* (SBI) TERHADAP KEMAMPUAN PEMECAHAN MASALAH MATEMATIKA SISWA KELAS V

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Abstract

Mathematical problem-solving skills are important to develop in learning mathematics in elementary schools. However, the fact that occurs is that students' ability in this competency is still lacking. This study aims to determine whether there is a difference in the mathematical problem-solving ability of students who learn using the Teams Games Tournament method modified by Schema-Based Instruction with students who learn using the expository method. This study used experimental research methods on fifth grade students of SDN Beumopu and was conducted from January to June 2025. The sampling technique used was cluster random sampling. The samples in the experimental class and

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control class amounted to 32 students each. Data collection utilized mathematical problem-solving ability test instruments in the form of essay questions. Indicators of mathematical problem-solving ability include understanding the problem, planning problem-solving strategies, and implementing problem-solving plans. The results showed that the problem-solving ability of fifth-grade students who learned with the SBI modified TGT method was higher than that of students who learned with the expository method.

Keywords: Schema-Based Instruction; Teams Games Tournament; Mathematics Problem-Solving Ability

Abstrak

Kemampuan pemecahan masalah matematika penting untuk dikembangkan pada pembelajaran matematika di sekolah dasar. Namun, fakta yang terjadi adalah kemampuan siswa pada kemampuan pemecahan masalah siswa masih kurang. Penelitian ini bertujuan untuk mengetahui adakah perbedaan kemampuan pemecahan masalah matematika siswa yang belajar menggunakan metode Teams Games Tournament modifikasi Schema Based Instruction dengan siswa yang belajar menggunakan metode ekspositori. Penelitian ini menggunakan metode penelitian eksperimen pada siswa kelas V SDN Beumopu dan dilaksanakan dari bulan Januari sampai bulan Juni 2025. Teknik pengambilan sampel menggunakan cluster random sampling. Sampel pada kelas eksperimen dan kelas kontrol masing-masing berjumlah 32 siswa. Pengumpulan data menggunakan instrumen tes kemampuan pemecahan masalah matematika berupa soal esai. Indikator kemampuan pemecahan masalah matematika adalah memahami masalah, merencanakan strategi penyelesaian masalah dan melaksanakan rencana penyelesaian masalah. Hasil penelitian menunjukkan

bahwa kemampuan pemecahan masalah siswa kelas V yang belajar dengan metode TGT modifikasi SBI lebih tinggi dibandingkan dengan siswa yang belajar dengan metode ekspositori.

Kata Kunci: Schema Based Instruction; Teams Games Tournament; Kemampuan Pemecahan Masalah Matematika

Introduction

There are five skills that students must possess in mathematics learning, namely mathematical problem-solving, mathematical reasoning, mathematical communication, mathematical connections, and mathematical representation (NCTM, 2000). Among the five basic skills above, problem-solving skills are always relevant to current educational and industrial needs (Pebrianti et al., 2022). Mathematical problem-solving has long been regarded as an important aspect of mathematics, mathematics teaching, and mathematics learning (Liljedahl et al., 2016). It has been incorporated into mathematics curricula worldwide to teach problem-solving and mathematics teaching through problem-solving (Voica et al., 2020).

Mathematical problem-solving is a process where someone is faced with mathematical concepts, skills, and processes to solve a problem (Kopparla et al., 2019). This ability is related to students' need to solve problems they face in daily life and to develop themselves (Septian et al., 2022). Without problem-solving skills, students only learn how to calculate, rather than learning why and when to use mathematical skills (Browder et al., 2018). One strategy in solving problems faced by students can be influenced by mathematical ability, so differences in mathematical ability can also influence students' cognitive processes (Pratama et al., 2022). Mathematical problem-solving can be accomplished by students if they have understood the problem given, are able to create a problem-solving plan, implement the problem-solving plan, and perform a review (Polya, 1973).

Problem-solving ability can be seen from students' ability to solve word problems (Root et al., 2017). Word problems are one of the most

difficult types of problems faced by mathematics learners (Verschaffel et al., 2020). Solving mathematical problems in the form of word problems is difficult for students because these problems require not only calculations but also linguistic understanding (Fuchs et al., 2008). This implies that students need to understand the use of words and sentences in problem-solving word problems. Problem-solving requires the process of understanding text and applying mathematical knowledge and operations (Öztürk et al., 2020).

Mathematics teaching methods in elementary schools remain traditional, focusing on the provision of information and direct instruction by teachers (Noviyana et al., 2025). This model tends to limit students' active interaction with the learning material. Information is usually presented in a fixed sequence without adapting to students' curiosity or responses in the moment. However, to develop problem-solving skills, students need to be actively involved in the learning process. This approach can limit students' creativity in finding solutions and dampen their interest in mathematics (Santagata et al., 2018).

Based on facts found in the field, there are still many fifth-grade elementary school students in Kelapa Lima District, Kupang City, who have difficulty understanding problems when solving story problems. This can be seen from the results of students' work when solving problems. Students do not fully understand the wording of the word problem, making them unable to identify the information they already know and determine what is being asked. Fifth-grade students do not fully understand the problems in the questions, so they make mistakes in planning how to solve them. This is evident from the results of the students' work. Incorrect plans for solving problems are evident from the incorrect use of mathematical symbols, resulting in incorrect mathematical equations. Inadequate problem-solving plans lead to errors in the problem-solving process. The problem-solving process is related to students' ability to perform arithmetic operations. Some fifth-grade elementary school students make mistakes in the planning process, which affects the results of problem-solving.

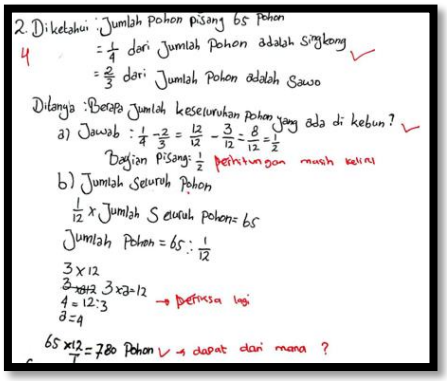

Figure 1. The results of the students' work.

In the classroom learning process, problem-solving questions are given towards the end of the learning topic. This results in students having a poor understanding of the integration of the mathematical concepts they have learned into their daily life. Learning is focused on students' ability to perform calculations, so students have a poor understanding of the problem-solving questions given in text form.

Previous studies have been conducted to determine the learning methods that influence elementary school students' mathematical problem-solving abilities. The study conducted by Gyanthi et al. (2023) applied the Logan Avenue Problem Solving (LAPS)-Heuristic method to fifth-grade elementary school students. The findings of this study indicate that the LAPS-Heuristic method can assist students in learning mathematics, thereby enhancing their problem-solving abilities. This study implies that the implementation of the LAPS-Heuristic learning model has a positive impact on students' learning conditions because students can learn collaboratively. However, this study did not apply the Schema-Based Instruction (SBI) method to improve students' problem-solving abilities.

Previous research was conducted by Skinner and Cuevas (2023), who applied SBI to the mathematics learning of third-grade elementary school students. The findings of this study indicate that the SBI method can help third-grade elementary school students develop problem-solving skills. This study did not combine the SBI method with other learning methods that could improve students' problem-solving skills.

Unlike previous studies, this study develops mathematical problem-solving skills using the Teams Games Tournament (TGT) method, which is a modification of the Schema Based Instruction (SBI) method. This study aims to determine whether there is a difference in the mathematical problem-solving skills of students who learn using the Teams Games Tournament (TGT) method, which is a modification of the Schema Based Instruction (SBI) method, compared to students who use the expository method.

The Teams Games Tournament (TGT) method is a cooperative learning model. (2016) suggests two reasons why cooperative models are good for learning. The first reason is that cooperative learning can improve students' learning achievement, enhance social relationships, foster attitudes of humility towards oneself and others, and increase self-esteem. Second, cooperative learning can fulfill students' needs in learning to think, solve problems, and integrate knowledge with skills. The TGT method is often implemented in mathematics, Indonesian language, and natural science subjects, which can be used from second grade elementary school to university level (Priansa, 2017).

Solving mathematical problems requires the ability to apply various strategies and different solution models (Kaitera & Harmoinen, 2022). Appropriate teaching methods are needed to help students develop different solution models for each problem-solving question. The Schema Based Instruction (SBI) method is a schematic diagram teaching model for encoding information in problems that helps solve problem-solving questions (Desmarais et al., 2019). The SBI method helps students create cognitive structures from the information obtained in mathematical problem-solving questions (Jung et al., 2022). In SBI, students identify and complete schematic diagrams, identify solution plans, implement plans, and check their accuracy (Peltier & Vannest, 2017).

In the classroom learning process, the TGT method can be combined with other learning methods to achieve the expected learning objectives (Slavin, 2016). In this study, the researcher modified the TGT method with the Schema-Based Instruction (SBI) method. One implication of the TGT method, which is a cooperative method, is that students in a group can help other students solve problems and perform the correct calculation procedures in the context of a game (Davidson,

1991). This indicates that in the application of the TGT method, students play an active role in learning and collaborating in groups. The problem-solving process can be completed by students using problem-solving schemes, so the researcher applied the SBI method in the initial stage.

Mathematical problem solving requires the ability to apply various strategies and different solution models (Kaitera & Harmoinen, 2022). Appropriate learning methods are needed to help students develop different solution models for each problem-solving question. Modifications to the TGT and SBI learning methods aim to help students solve mathematical problem-solving questions. The SBI method helps students create cognitive structures from the information obtained in mathematical problem-solving questions (Jung et al., 2022). In SBI, students identify and complete schematic diagrams, identify solution plans, implement plans, and check their accuracy (Peltier & Vannest, 2017). In the TGT method, students are allowed to learn in groups and play, making learning more enjoyable for elementary school students. Learning in groups facilitates students to support and help each other, ensuring that every group member learns so they can achieve the best score for their team during the play phase (Slavin, 2016). This play phase trains students to compete positively and test their abilities against the concepts they have learned.

Mathematical Problem-Solving Skills

Problem-solving skills are one of the competencies required in the learning process. Since Polya pioneered problem-solving strategies, the development of problem-solving skills has been a focus at all levels of education to this day (Suntari et al., 2023). According to Polya (1973), problem-solving is the process of finding a way out of difficulty to achieve a goal. Problem-solving is a process that prioritizes strategic steps taken to solve a problem and ultimately find an answer to that problem (Kopparla et al., 2019). According to Pramuditya et al. (2022), problem-solving ability can be defined as the ability to solve problems through appropriate steps and strategies to obtain solutions. Problem-solving ability is an effort or process of thinking to solve problems with appropriate strategies to find solutions and achieve goals.

Kilpatrick et al. (2001) define mathematical problem-solving ability as the ability to use mathematical knowledge in understanding,

formulating, solving, and communicating problems in everyday contexts. Kilpatrick et al.'s opinion is supported by Ling and Mahmud (2023), who explain that mathematical problem-solving ability is the ability to deal with various mathematical problems in everyday life based on each individual's understanding and creativity. Problems in everyday life can be expressed using mathematical notation, text, or images (Kaskens et al., 2020). Mathematical problem-solving ability is the ability of students to solve problems that occur in the context of everyday life. Mathematics learning should be contextualized within students' everyday experiences to facilitate the construction of relevant knowledge and foster the development of effective problem-solving skills.

Mathematics can actually be taught through problem-solving, enabling students to engage in meaningful problem-solving tasks to develop conceptual understanding (Kaitera & Harmoinen, 2022). Furthermore, Voica et al (2020) state that problem-solving skills help students develop new knowledge, solve problems that arise, apply and use various strategies, and reflect on and monitor the problem-solving process. The problems that students need to solve should challenge them cognitively so that they are faced with productive struggles in mathematical problem solving (J. W. Son & Lee, 2021). Thus, mathematical problem solving is both a competency in itself and a means of expanding mathematical knowledge (Son & Lee, 2021).

According to Mayasari et al. (2021), problem-solving skills need to be taught in classroom learning because they help students develop thinking skills, choose problem-solving strategies, have confidence when solving problems, improve their ability to connect several mathematical concepts, improve their ability to evaluate solutions to problems, and enhance cooperative attitudes in learning. Additionally, Fitriani et al. (2023) suggest that mathematical problem-solving skills can help students learn concepts in other subjects (Fitriani et al., 2023). Based on the opinions of the experts above, it can be concluded that the purpose of mathematical problem-solving is to develop conceptual understanding, solve problems, apply knowledge to real-life contexts, learn collaboratively, and expand mathematical knowledge.

According to the National Council of Teachers of Mathematics (2000), the standards for problem-solving skills for students from kindergarten to grade 12 are: (1) students can build new mathematical knowledge through problem-solving; (2) students can solve problems in

mathematical and other contexts; (3) students can apply and adapt various strategies to solve problems; and (4) students can monitor and reflect on the process of solving mathematical problems. Teachers play an important role in learning to support and facilitate students in achieving the expected standards. Teachers can help students by providing meaningful problems that are appropriate for the students' level of understanding, assessing students' understanding and use of strategies, and valuing every idea presented by students (NCTM, 2000). Students can develop mathematical problem-solving skills through the learning process in the classroom. Therefore, teachers need to provide a comfortable learning environment and give students the opportunity to solve problem-solving questions.

Teams Games Tournament (TGT) Method

The Teams Games Tournament (TGT) method is one of the cooperative learning methods. According to Johnson and Johnson (1999), the TGT method is one of the methods in the cooperative learning approach that uses group games and tournaments as tools to increase student engagement and learning achievement. This view is supported by Woolfolk (2014), who defines the TGT method as a group learning method that involves competition and tournaments in games to help students learn in a fun and motivating way. The TGT method is a group learning method that uses group discussions, games, and tournaments to make learning more enjoyable and motivating for students.

According to Johnson and Johnson (1999), the purpose of the TGT method is to increase student involvement in the learning process because they are involved in group discussion and game activities. Group learning can improve students' social skills to work together, communicate, and collaborate with team members. In the TGT method, students are given the opportunity to play, thereby increasing their motivation to learn and actively participate in learning activities.

The other purpose of the TGT method is to improve cooperation among students in solving problems and provide opportunities to express opinions and ideas (Priansa, 2017). Learning using the TGT method can help students develop a positive attitude toward mathematics learning.

Group discussions help reduce feelings of inferiority in students with lower abilities and help them achieve better academic performance.

According to Slavin (2005), the syntax or stages of learning the TGT method are as follows:

1. Class presentation. At this stage, the teacher explains the material that students will learn in the lesson. At this stage, the teacher can explain using various learning methods and media that support students in understanding the material to be studied.
2. Teams. Students are divided into groups of four to five people. The division of group members represents diversity in the class, such as academic ability, gender, race, and ethnicity. After the teacher explains the material, a discussion sheet or other activities are given to be done together in groups. Each member ensures that they perform their tasks well and help other group members.
3. Games. Games consist of questions with content relevant to testing the knowledge students have acquired during the class presentation and group discussion stages. Games can take the form of questions written on numbered cards. Each group member takes turns picking up a card and answering the question written on it.
4. Tournament. A tournament is a structure in which the game takes place. The points that students have earned in the game stage are accumulated in this stage. The tournament is held at tournament tables that have been prepared. Students sit at the tournament tables according to the division announced by the teacher.
5. Team recognition. After the tournament is over, immediately calculate the total points earned by each group. From the calculation of points, data will be obtained for the groups that earned the highest points to the lowest points. Each group receives an award from the teacher according to the class agreement that has been determined.

Schema-Based Instruction (SBI)

The Schema-Based Instruction (SBI) method evolved from the ideas of Marshall (1995), who applied schema theory to solve mathematical word problems (Peltier et al., 2020). According to Kintsch (1998), the SBI

method is a method that involves the use of cognitive schemas to help students construct meaning and understand texts. The SBI method is a method that uses schemas to help students solve problem-solving questions, especially story problems.

Schemas are defined as mental representations that enable students to solve a problem (Mayer & Hegarty, 2012). According to Kirschner and Hendrick (2020), over the past few decades, this concept has taken on a central role in formal teaching and learning. Schemas are mental frameworks or models of problems that need to be solved. Students use schemas to organize and solve story problems (Powell, 2011). The broader the schema, the more likely students are to recognize the connection between strategies that have been taught and problems that have not been taught but use the same strategies (Fuchs, et al., 2006). This is known as "transfer" and is considered one of the most important goals of teaching (Soderstrom & Bjork, 2015). Students who are successful in problem-solving create a complete mental representation of the problem schema, which in turn enables them to recall the information needed to solve the problem.

According to Diezmann and English (2001), drawing diagrams provides a clearer picture when solving problems, thereby providing a basis for solving problems correctly. This is also supported by the opinion of Fede et al. (2013) that students who are able to draw diagrams accurately almost always choose the correct problem-solving strategy. Furthermore, he explains that identifying the type of diagram appropriate to the problem helps students in solving the problem.

The SBI method teaches students to identify the underlying structure of word problems, select and complete the related schematic diagrams, write numerical sentences that facilitate solutions, perform calculations, and review the solutions that have been worked out (Peltier et al., 2020). This is also supported by Hughes & Cuevas (2020), who state that in SBI, students learn to categorize problem-solving story problems based on problem structure. The SBI method can be used as a method to help students solve mathematical problems in story problems by completing schematic diagrams appropriate to the type of problem they wish to solve.

According to Hord and Xin (2013), the SBI method emphasizes the semantic analysis of word problems and mapping problems into schematic diagrams specific to various types of problems (e.g., changing,

grouping, and comparing). This view is complemented by Xin (2019), who states that in SBI, students need to identify the type of problem (e.g., changing, combining or grouping, comparing or differing), then represent the problem in an appropriate schematic diagram, and finally make a decision about the choice of operations for the solution.

Expository Method

According to Womack (1989), the expository method is a learning method in which the teacher plays a role in delivering learning material and instructions to be carried out by students. According to Sumantri (2016), the expository method is a learning method that provides opportunities for teachers to convey facts, principles, and important information to students. According to Sanjaya (2018), the expository method is a teaching method emphasizes the process of storytelling delivered by the teacher and listened to by students to master the learning material presented by the teacher. The expository method emphasizes the role of the teacher in conveying information to students in the learning process.

According to Hidayati et al. (2019), the expository method is a more practical teaching method, where the lesson material is presented in a neat, systematic, and complete form prepared by the teacher, allowing students to listen and absorb it in an orderly and structured manner. This method has the advantage of enabling teachers to control the class more easily and organize the class more simply. However, according to Hidayati et al. (2019), this method does not encourage students to be actively involved in the process of discovering mathematical concepts; students tend to accept what has been prepared by the teacher. This is also supported by the opinion of Egbo (2014) that the expository method creates space for intellectual passivity and promotes rote learning among students. This can result in low academic achievement among students.
The expository method is a teaching method where information is conveyed verbally by the teacher with the aim of explaining, elaborating, or revealing a topic or concept in detail. Students are expected to pay attention to the teacher's explanations and follow the instructions given. Learning is focused on the teacher's delivery of information, so students are less actively involved in the learning process.

According to Womack (1989), the expository method can be effectively implemented in learning if the teacher prepares a lesson plan that aligns with students' needs. The expository method emphasizes the teacher's role as the primary source of information, making it crucial for teachers to thoroughly prepare the instructional materials they will teach. Furthermore, Womack (1989) explains that teachers should anticipate which parts of the lesson require repetition to ensure students understand the material being presented. Teachers must also prepare formative and summative assessments that are systematically planned so that students' understanding of the learning material can be measured and evaluated on a regular basis.

According to Sanjaya (2018), there are four principles in the expository method. The first principle is goal-oriented. The expository method can help students achieve learning objectives. The explanations provided by teachers are important things that students need to achieve learning objectives. Teachers using the expository method need to clearly determine learning objectives before starting teaching. These objectives must be specific, measurable, achievable, relevant, and time-bound. This helps students focus on important information and guides the teaching process.

The second principle is communication. It is necessary to convey information clearly and effectively to students so that they can understand the information presented by the teacher. Teachers play a role in conveying important information, so it is necessary to use interesting ways of conveying information so that students can pay attention to the teacher's explanations. Intonation and clarity are needed when teachers deliver material. Adjusting communication style, teaching tempo, and the level of complexity of the material can increase the effectiveness of communication.

The third principle is readiness. The principle of readiness in the expository method highlights the importance of ensuring that students have the intellectual readiness and mental preparation to receive and understand the material being taught. Students must listen to the explanations given by the teacher, so it is very important to prepare students before the teacher begins explaining the material. The fourth principle is continuity. Learning using the expository method encourages students to seek and discover new insights through the process of independent learning.

Sanjaya (2018) mentions several characteristics of the expository method, namely:

1. The delivery of learning material is done verbally by the teacher. Good communication skills are required when the teacher delivers the lesson.
2. Usually, the learning material delivered consists of data, facts, and certain concepts that are memorized, so it does not require students to think critically.
3. The learning objective is mastery of the material so that after the learning process ends, students can correctly understand and restate the material that has been explained.

According to Lumbantoruan (2022), the expository learning method emphasizes the verbal delivery of material from an educator to learners. He further explains that the expository learning strategy is not appropriate for mathematics learning. This is because mathematics material requires conceptual knowledge transfer, formula proof, explaining how to solve problems, and understanding one material in relation to another. The concepts of mathematics material. According to Lumbantoruan (2022), the teacher's purpose in using expository strategies is for students to understand the basic concepts of a newly learned material and master the lesson material in a structured and comprehensive manner.

According to (Roemintoyo et al., 2022), the expository method is often used in learning because it allows teachers to control student order during the learning process and can be used to explain learning material with a broad scope. He also explains that this method can be used in classes with a large number of students. The focus of this method is student academic achievement. This also needs to be supported by the teacher's skills in delivering learning material.

Research Method

This study was conducted on fifth-grade students at a public school in Kupang City, East Nusa Tenggara. The research was conducted from February to June 2025. There were four study groups in the fifth grade, namely classes VA, VB, VC, and VD, with a total of 108 students. Fifth grade students have the same average mathematics ability as seen from

the average student report on card scores. This study used an experimental research method. Experimental research explains whether an intervention affects the results for one group compared to another group (Cresswell, 2012). The experimental group and control group in the experimental method are related to efforts to measure the effects of a treatment or manipulation of independent variables on dependent variables in a reliable manner. In this research design, there are control and experimental groups. The experimental class received treatment in the form of the application of the Teams Games Tournament (TGT) method modified by Schema-Based Instruction (SBI). Meanwhile, the control class did not receive treatment, where the teacher taught using the usual learning method, namely the expository method.

This study uses an experimental research method with a posttest-only control group design. According to Campbell and Stanley (1963), a posttest-only control group design is an experimental design in which the control group and treatment group are measured after the treatment is administered. In this design, the researcher collected data after the treatment was given to the treatment group and the control group to determine whether there were differences between the two groups (Fraenkel and Wallen, 2006). The research design can be presented in the following table:

Table 1. Experimental Design Post-test Only Control Group Design

Group	Treatment	*Post-test*
R	X	O_1
R	-	O_2

Research variables are attributes, characteristics, or values of individuals, objects, or activities that have certain variations selected by researchers to be studied, and then conclusions are drawn (Sugiyono, 2013). The variables in this study are:

1. The dependent variable is mathematical problem-solving ability.
2. The independent variable is the modified SBI TGT learning method.

Data Collection Techniques

The instrument for testing mathematical problem-solving ability consists of essay questions with rubric-based measurement criteria. This test is conducted to measure students' mathematical problem-solving ability before and after treatment. The number of essay questions completed by students is 6. Students' mathematical problem-solving ability can be calculated from the scores or grades obtained by students on indicators such as the ability to solve problems in a mathematical context, solve mathematical problems related to everyday life contexts, and apply appropriate strategies to solve mathematical problems. Scores were obtained from the evaluation results using essay assessment techniques from the mathematical problem-solving ability variable. The test was administered to students at the end of the learning process related to fractions. The questions used were valid and reliable.

Table 2. Rubric for assessing students' mathematical problem-solving abilities in grade 5

Indicators	Criteria	Score
understanding the problem	no answer	0
	write down some of the information correctly	1
	write down all the information correctly	2
	write down the information asked correctly	1
planning a strategy to solve the problem	no answer	
	Write down the strategy used	1
	Write down a mathematical model to solve the problem correctly.	2
implementing the plan to solve the problem	no answer	0
	Perform calculations correctly according to the concept	1
	Write down the problem-solving process correctly	1
	Write down the final answer correctly.	1
	Write down the conclusion of the problem that has been solved.	1
Total Score		10

Table 3. Question for assessing students' mathematical problem-solving abilities in grade 5

1. Mr. Amos has a garden planted with cassava, sapodilla, and banana trees. One-quarter of the trees are cassava, two-thirds are sapodilla, and the rest are banana trees. If there are 65 banana trees in the garden, how many trees are there in total?
2. The Mince family harvested 12 1/2 kg of peanuts to sell at the market. The peanuts will be packed in plastic bags with a capacity of 2 5/10 kg. The selling price per bag is Rp. 45,000. How many bags are needed to store the peanuts? How much income will the Mince family earn from selling peanuts?
3. Mrs. Yanti has 420 mangoes from her harvest in the garden. She gives 1/3 of the harvest to Mrs. Vera and 2/7 of the harvest to Mrs. Susan to sell. How many mangoes are left?

In this study, the researcher acted as a teacher who taught the experimental class and the control class. To ensure that the treatment given by applying the modified SBI TGT method and the expository method was carried out in accordance with the learning stages, the researcher used a learning method implementation observation sheet. This observation sheet was filled out by the classroom teacher while the researcher was teaching. This supports the fact that the learning process in the experimental class and control class was in accordance with the appropriate learning stages.

Research Results

The research results present a description of the problem-solving abilities of students who learned using the Teams Games Tournament (TGT) method modified by Schema-Based Instruction (SBI) and students who learned using the expository method. Then, the prerequisite test and research hypothesis test will be presented. The learning outcomes measured are the mathematical problem-solving abilities of students

who learn using the TGT method modified by SBI and students who learn using the expository method.

Table 4. Mean Score of Mathematical Problem-Solving Ability

Learning Method	Max Test Score	Min Test Score	Average	
			Problem-Solving Ability Score	Deviation standard
SBI modified TGT	92	40	83.50	11.294
Expository	85	40	57.00	11.827
SBI modified TGT	85	40	60.00	13.733
Expository	88	55	72.39	10.336
SBI modified TGT	92	40	71.75	17.192
Expository	88	55	64.69	13.444

The table above shows that the average mathematical problem-solving ability in the experimental group was higher than that in the control group by a margin of 7.06. A prerequisite test was conducted before performing inferential analysis. The normality of the overall data was tested using Kolmogorov-Smirnov.

Table 5. Test of Normality of The Mean Score of Problem-Solving Ability

Group	Statistic	Df	Score Sig.	H_0
SBI modified TGT	0.962	18	0.635	Accept
Expository	0.936	18	0.251	
SBI modified TGT	0.923	18	0.144	
Expository	0.934	18	0.225	
Learning Method	0.083	72	0.200	Accept

Next, a homogeneity test was conducted. The results of the homogeneity test are presented in the table below.

Table 6. Homogeneity test of problem-solving ability scores

Levene Statistic	df1	df2	Skor Sig.	H_0
1.751	3	68	0.165	Accept

Based on the table above, it can be seen that the significance value is above 0.05 in both the group and overall normality tests, so it can be concluded that the data is normally distributed. The table shows that the research data have homogeneous variance. Thus, the data meet the prerequisite test and can proceed to the parametric test. A two-way ANOVA test was conducted to determine the difference in mathematical problem-solving ability between students who learned using the modified SBI TGT method and those who learned using the expository method. The results of the two-way ANOVA test are presented in the following table:

Table 7. Two-way ANOVA calculation results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4389.389[a]	3	1463.130	11.615	0.000
Intercept	363804.500	1	363804.500	2887.974	0.000
A	1250.000	1	1250.000	9.923	0.002
A * B	2738.000	1	2738.000	21.735	0.000

The table shows that the learning method factor has a significance value of < 0.05, namely 0.002, so H0 is rejected. This indicates that the mathematical problem-solving abilities of students who learn using the modified SBI TGT method are significantly better than those of students who learn using the expository method.

Discussion of Research Results

The results of the analysis in this study indicate that there is a significant difference in problem-solving ability between students who learn using the Teams Games Tournament (TGT) method modified from the Schema Based Instruction (SBI) method and students who learn using the expository method. This conclusion was obtained from the significance value of the learning method factor in the calculation results using SPSS of 0.002 (see Table 4). The difference in problem-solving abilities was due to the fact that learning with the modified SBI TGT method was carried out in groups, and each group had varying levels of ability so that they could discuss and help each other. Students who are already skilled in problem-solving (experts) explain the steps to solve problems to students who are not yet skilled (novices). The explanations provided by peers use everyday language that is easy to understand, so that the students being helped can understand the explanations given. The discussion process aims to enable all group members to solve mathematical problems. The results of this study are in line with the research conducted by Priansa (2017) that learning and discussion in groups provide opportunities for students to help each other in solving problems.

The results of the study indicate that learning that implements the modified SBI TGT method helps students understand the information in the questions and gives meaning to that information. The information that has been understood is entered into a scheme that helps them understand the relationship between the known information and the problem that needs to be solved (Powell, 2011). At the beginning of the learning process, students listened to the teacher's explanation of the types of problem-solving schemes. After students became familiar with the types of schemes, they learned to enter the known and asked for information according to the schemes that had been taught. This process facilitates students' ability to carefully select important information that fits the problem-solving scheme. Then, students can understand the continuity between the known information and the problem that needs to be solved through the scheme that has been created. This is in line with research conducted by Xin (2019) that students need to understand the types of problem-solving schemes and then represent the problem in the appropriate scheme.

The application of the modified SBI TGT method in learning facilitates students' ability to plan problem-solving strategies. This occurs because the scheme created is a visualization of important information and questions, so that students' ability to plan strategies is evident through their ability to create appropriate solution schemes. Schemas provide a structure that organizes information into well-defined categories (Jitendra et al., 2011). The strategy of creating schemas or diagrams allows students to illustrate the relationships between different parts based on the information in a problem, thereby gaining a clearer understanding (Reys et al., 2009). Information already entered into the schema allows students to quickly access relevant knowledge from previous experiences or learning. Schemas are organized based on familiar concepts or situations, enabling students to recall and apply previously learned solutions to new problems with similar structures. Research conducted by Hughes and Cuevas (2020) also states that the SBI method helps students learn to categorize problem-solving questions based on the structure of the problem so that they can plan the right solution.

Learning in the control class applied an expository method that did not facilitate students' ability to analyze problems and find solutions. Students mostly listened to the information presented by the teacher, so their role became passive. The teacher's explanations contained concepts and procedures, but solving problems requires experience and pattern recognition to help students solve problems. When students do not participate actively, their opportunities to practice these skills are reduced. This is in line with the results of research by Hidayati et al. (2019) that the expository method does not make students very involved in the process of discovering mathematical concepts because students tend to accept what has been conveyed by the teacher.

Students who are less able to solve problems find it even more difficult when learning using the expository method. They are given fewer opportunities to discuss with peers who are more proficient because they rely solely on the information explained by the teacher. Meanwhile, problem-solving is often more effective through discussion and collaboration, where students can exchange ideas and strategies. Learning with the expository method emphasizes the individual role of students in understanding the information conveyed by the teacher. This is ineffective because each class has students with different problem-

solving abilities. The expository method is not appropriate for mathematics lessons because it does not provide sufficient space for interaction between students (Lumbantoruan, 2022).

Based on the above explanation, it can be concluded that students who learn in experimental classes that apply the modified SBI TGT method have higher problem-solving abilities than students who learn in control classes that apply the expository method.

Implications

The application of the modified Teams Games Tournament (TGT) method with the Schema-Based Instruction (SBI) method has a significant positive impact on students' mathematical problem-solving abilities. Through teamwork, students can share knowledge and problem-solving strategies that can improve their deep understanding of mathematical concepts. Teachers need to convey the rules before students discuss them in groups so that discussion time can help students help each other solve problems. These rules can be conveyed before each discussion. Teachers convey the rules verbally and in writing, displayed via a projector.

Teachers need to manage time effectively during group discussions so that the focus is on the objectives and tasks to be completed, and irrelevant topics are avoided. Managing time during discussions also helps students learn to manage their own time better. This is a useful skill in everyday life.

The use of schemas to solve mathematical problems helps students organize mathematical information and concepts into structured schemas, making it easier for them to understand and remember the material. Teachers need to repeatedly explain the types of problem-solving schemes that students can use. Explanations about the types of schemes need to be done gradually so that students do not find it difficult to remember all the types of schemes. Teachers can start with schemes that students encounter more often in their daily lives.

The tournament and game stages create a fun and challenging learning environment that can increase students' motivation to learn and participate actively. Teachers need to convey the rules of the game and ensure that students understand the rules given. During the game, teachers can use an online timer displayed via a projector so that

students can see the time elapsing and focus on completing the questions within the given time. This also helps teachers avoid subjectively granting additional time to certain students. Students can use specific identification markers displaying their names and group names when playing at the tournament table. These markers can be name cards or hats worn by students on their heads.

Conclusion

The problem-solving abilities of students who learn in classes that implement the Teams Games Tournament (TGT) method modified by Schema-Based Instruction (SBI) are higher than those of students who learn in classes that implement the expository method. Learning that applies to the TGT method modified by SBI provides opportunities for students to discuss and help each other in groups. The use of schemas helps students understand information and gives meaning to that information. The schemes created also help students plan solutions to problems. Learning in classrooms that apply the expository method does not facilitate students in solving problems because the information source is conveyed by the teacher, thus providing less space for students to interact with each other.

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