



Comparative Analysis of Learning With Jigsaw and Think Pair Share (TPS) on Mathematical Problem Solving Abilities on The Properties of Exponents in Grade X

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Abstract

This study aims to analyze the comparison of cooperative learning models, Jigsaw and Think Pair Share (TPS), on students' mathematical problem-solving abilities in the topic of exponent properties among tenth-grade students at SMK Free Methodist Medan in the 2025/2026 academic year. The research method employed was a quasi-experimental design with a pretest-posttest group design. The population consisted of all tenth-grade students at SMK Free Methodist Medan, while the sample included two classes: class X RPL taught using the Jigsaw model and class X TKJ taught using the TPS model. The research instrument was an essay test developed based on mathematical problem-solving indicators, and the data were analyzed using an independent samples t-test. The results of the study indicate that: (1) there is a significant difference in mathematical problem-solving abilities between students taught with the Jigsaw and TPS models ($\text{sig. } 0.023 < 0.05$), and (2) the Jigsaw learning model is more effective than the TPS model in improving students' mathematical problem-solving abilities ($\text{sig. } 0.011 < 0.05$). Therefore, the Jigsaw learning model is recommended as a superior alternative cooperative learning strategy to enhance students' mathematical problem-solving skills in the topic of exponents at the vocational high school level

Keywords: cooperative Learning, Jigsaw, Think Pair Share, Mathematical Problem Solving, Exponents

INTRODUCTION

Mathematics is a branch of science that makes a significant contribution to various areas of human life. According to Rohmah (Amaliyah, Fatimah, & Abustang, 2019), "Mathematics is a field of science that is strongly connected to everyday life and has been used from the past, present, and future." As stated by Suherman (Schjøler, 2019), Mathematics taught in schools serves as an important foundation in developing students' abilities. Through mathematics learning, students are trained to develop their reasoning skills, make decisions, and solve problems abstractly and applicatively (Tambunan, 2024:10). According to Fardiansyah, Purwadi, & Mudzanatun, 2019, the main objective of mathematics learning is not solely focused on understanding concepts, but also aims to train thinking and reasoning skills in drawing conclusions, developing creativity, and solving and communicating solutions to problems.

However, mathematics education in Indonesia remains low compared to other countries. This is evident from the Programme for International Student Assessment (PISA) survey, which found that Indonesia still ranks 68th out of 79 countries, with a mathematics score of 379 points (Nuryasana, 2019). This figure clearly reflects the urgent need to find innovative approaches in mathematics learning to improve the quality of education and student competitiveness at the national and global levels. This problem is influenced by various factors, including inappropriate learning models used by teachers, low interest, and lack of student motivation in learning mathematics (Rahmawati & Hanipah, 2018). Furthermore, many students view mathematics as the most difficult subject to understand (Nuryasana, 2019). This condition, if not immediately addressed, has the potential to hinder the achievement of national education goals and the readiness of the younger generation to face increasingly complex future challenges based on analytical skills.

Based on the Independent Curriculum implemented in Indonesia since 2022, exponents are taught in grade 10 of vocational high schools (SMK), particularly in the first semester, as part of the algebra topic. Learning the concept of exponents has two main objectives: encouraging creative mathematical thinking and improving students' problem-solving abilities (Rachmawati & Erwin, 2022). Exponents serve as an important foundation for understanding advanced materials such as logarithms and exponential equations, which are relevant to vocational fields such as engineering, accounting, and informatics. However, vocational high school students often experience difficulties in understanding and applying exponents, which results in low learning outcomes (Kamil, Arief, Miaz, & Rifma, 2021). Research by Pulungan and Fadli (HR Kurniawan, Elmunsyah, & Muladi, 2018) concluded that "many vocational high school students have difficulty in understanding the basic concepts of exponents and their application in problem solving, resulting in their low ability to solve mathematical problems that are applicable." Based on information obtained from teachers at the Free Methodist Medan Vocational High School, many 10th grade students still have difficulty applying the properties of exponents in an applicable context, which hinders students' mathematical problem-solving abilities. This low understanding of fundamental material can be a serious obstacle for students in pursuing more complex mathematical material and in applications in their vocational fields, thus requiring learning interventions that are able to show better results.

Exponentials are a fundamental concept in mathematics that not only possess theoretical depth but also practical relevance in everyday life. This material is commonly used in real-world contexts such as calculating compound interest in banking systems, population growth, asset depreciation, and data processing in computer science and information technology (Satria, 2021). For example, in finance, the application of exponential formulas is used to project the final value of an investment by considering the periodic accumulation of interest, which requires a deep understanding of the properties of exponentials and logical mathematical interpretation. Similarly, in biology or epidemiology, exponential growth models are used to describe the spread of organisms or diseases, illustrating the importance of this concept in data-driven decision-making. This encourages the need for integration between mathematical concepts and problem-solving based on everyday contexts so that students not only understand the formulas but also can interpret

them applicably. Without these skills, students tend to struggle with applicative problems, negatively impacting their learning outcomes (L. Lestari, Erwandi, & Gusti Satria, 2020) . Problem-solving ability in mathematics is an essential competency that reflects students' level of critical and analytical thinking. According to Polya, problem-solving involves four essential stages: understanding the problem, developing a solution strategy, implementing the strategy, and evaluating the results. However, recent studies have revealed that many students in Indonesia still face challenges in systematically completing these stages. A study by Nanda and Usman (Heliza, 2023) This indicates that students' problem-solving abilities are still relatively low, particularly at the planning and solution evaluation stages. A similar finding was found by Firda et al. (Fitri & Budiman, 2017). which concluded that most students were able to understand the problem, but had difficulty in constructing mathematical models and implementing appropriate solutions (I. Lestari & Luritawaty, 2021) . One factor causing low problem-solving skills is the application of conventional teacher-centered learning methods, which results in a lack of student involvement in exploring alternative problem-solving strategies. Alternative approaches that can be used are cooperative learning, namely the Jigsaw and Think Pair Share (TPS) learning models. The selection of the Think Pair Share (TPS) and Jigsaw learning models in this study was based on the consideration that both models are included in the cooperative learning approach that has been proven effective in encouraging active student participation, improving conceptual understanding, and developing critical thinking skills and problem-solving skills (Handayani & Yanti, 2017).

In Hanifah's research (2019) concluded that, "the Jigsaw model can increase student activity and learning outcomes". The Jigsaw type cooperative learning model has been proven to significantly improve students' problem-solving abilities (Ulm, 2020:21). Students learning with the Think Pair Share (TPS) Model showed a high increase in Mathematical problem-solving abilities (Editia, 2020a) . The Think Pair Share (TPS) model can have a better influence on mathematics learning outcomes (Sari, 2023:12). Based on research (Rati & Murda, 2017) that, "The Jigsaw type cooperative model obtained higher learning outcomes than the Think Pair Share (TPS) type cooperative model on improving students' mathematical abilities". The gap in these findings creates an urgency to conduct a specific comparative analysis on the material of exponential properties in the context of SMK Free Methodist Medan, to find out the differences and which model is better, in order to provide more concrete and relevant recommendations for learning practices in the school in addressing the problem of students' mathematical problem-solving abilities (Zulfah, 2017).

The implementation of the Jigsaw and Think Pair Share (TPS) learning model is expected to optimize the improvement of problem-solving abilities and student learning outcomes. Based on the background that has been stated, the researcher will conduct a study entitled Comparative Analysis of Learning with Jigsaw and Think Pair Share (TPS) on Mathematical Problem Solving on the Material of Exponential Properties in Class X of SMK Free Methodist Medan in the 2025/2026 Academic Year.

METHOD

The research location was conducted at SMK Free Methodist Medan, Jl.Sekolah No.33, Cinta Damai, Medan Helvetia District, Medan City, North Sumatra Province. The selection of the research location at SMK Free Methodist Medan was based on initial information obtained from SMK Free Methodist Medan teachers, there are still many grade X students who have difficulty applying the properties of exponents in an applicative context, which hinders students' mathematical problem-solving abilities. This is in line with the background of the research problem which identifies the low mathematical problem-solving abilities of students on exponent material at the SMK level. (Sulianto, Purnamasari, & Febriarianto, 2019) .

The research was conducted in the odd semester of the 2025/2026 academic year. Population is a generalization area consisting of objects and subjects that have certain quantities and characteristics determined by researchers to be studied and then drawn conclusions (D. Kurniawan, Wahyuningsih, & Normala Sari, 2020) . The population in this study was all class X students of SMK Free Methodist Medan which consisted of 3 classes with a total of 95 students.

A sample is a portion of the number and characteristics possessed by a population (Reinita & Andriska, 2017) . The sample in this study consisted of two classes, and the sample selection method used cluster random sampling, meaning each class had an equal chance of being selected as a sample.

The type of research used was quantitative research with a quasi-experimental approach. According to Sugiyono (MARSELLA, Puspita, & Yosef, 2020), Quasi-experimental research is a method for finding a causal relationship between two or more variables that are intentionally created. This research involved two classes that were given different treatments before being given a post-test. Before being given the treatment, a pre-test was given to see the initial abilities of the experimental class. The sample of this research was divided into two groups, namely experimental class I which was taught using the Jigsaw cooperative model and experimental class II which was taught using the Think Pair Share cooperative model. (Editia, 2020b).

The variables compared in this study are the Jigsaw and Think Pair Share (TPS) cooperative models. The variables measured in this study are mathematical problem-solving abilities. The main instrument in this study is the descriptive questions of problem-solving abilities given before and after treatment in the experimental class. Observation sheets are used to monitor the implementation of the learning model in the experimental class. This instrument is filled out by the mathematics teacher as an observer to ensure objectivity, as well as being authentic evidence that the treatment is actually implemented.

RESULTS AND DISCUSSION

This research was conducted at SMK Free Methodist Medan using a quasi-experimental approach with the aim of comparing the Jigsaw and *Think Pair Share* (TPS) learning models. on problem-solving abilities in class X of SMK Free Methodist Medan. The study was conducted from July 30, 2025 to August 6, 2025, with two experimental classes. The two experimental classes each consisted of 30 students of class X RPL and TKJ. Class X RPL was given a learning treatment using the Jigsaw model and class X TKJ was given a learning treatment using the *think pair share model*. (TPS) (NURHAIDAH, 2021) .

The material taught by the researcher is exponent material with sub-material on the properties of exponents to determine students' problem-solving abilities. The research instrument used by the researcher to determine students' problem-solving abilities is a descriptive test consisting of 4 questions according to the indicators of problem-solving abilities. (Fransiska et al., 2023) . Before using essay -based test questions on the research sample, they were first tested to determine their validity, reliability, difficulty level, and discriminatory power. This was to determine the appropriateness of the questions to be used in accordance with the indicators and learning objectives to be achieved. (Wicaksono, Susilo, & Sueb, 2019).

The validity test of the problem-solving ability test questions was carried out using *the product moment correlation formula*, in managing the data the researcher used *SPSS 25.0 for Windows* with the provision that if $r_{hitung} > r_{tabel}$ the question items are valid at the level $\alpha = 5\%$.

Hypothesis Testing

Initial Ability Equivalency Test

The initial ability equivalence test was used to determine whether the two groups had comparable initial abilities so that the research results could be more valid. To determine the initial equivalence of the experimental class, a t-test was used, the t-test calculation was carried out using *SPSS 25.0 for Windows* . Based on the data in (appendix 12 p.89) the calculation is obtained in the following table 4.9.

Table 1. Results of the t-test of the pre-test data

Independent Samples Test										
		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post-Pretest	Equal variances assumed	.007	.931	-.917	58	.417	-2.667	3.294	-8.200	2.866

Based on the table of t-test significance values on pre-test data based on the homogeneous variance value of 0.417. Thus, $0.417 > 0.05$ means that there is no significant difference in the initial abilities of the two experimental classes.

First hypothesis test

The first hypothesis test of the research was used to determine that learning with the Jigsaw type model and *Think Pair Share* (TPS) has a difference in problem-solving ability in class X students of SMK Free Methodist Medan. To find out the difference in problem-solving ability in the two classes, a two-tailed t-test was conducted, the t-test calculation was carried out using *SPSS 25.0 for windows* . Based on the data in (appendix 12 p.89) the calculation is obtained in the following table 4.10

Table 2. Results of the Post-test Data t-test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	.992	.323	2.334	58	.023	5.733	2.385	.703	8.967

Based on the table of significance values of the t-test on the post-test based on the homogeneous variance value of 0.023. So that $0.023 < 0.05$ is obtained, meaning that the Jigsaw type learning model and *Think Pair Share* (TPS) there are differences in problem solving abilities in class X students of SMK Free Methodist Medan.

Second hypothesis test

The second hypothesis test of the study was used to determine that learning with the Jigsaw type model was better than the *Think Pair Share type model*. (TPS) on problem-solving ability in class X students of SMK Free Methodist Medan. To answer the second hypothesis, a calculation was carried out using the right-tailed t-test with the value formula $sig. = \frac{sig(two\ tailed)}{2}$. Based on table 4.10, sig. (two-tailed) is 0.023, so the sig. value (one-tailed) is 0.011. The sig. value of $0.011 < 0.05$ means that the Jigsaw type learning model is better than the *Think Pair Share type learning model*. (TPS) on problem solving abilities in class X students of SMK Free Methodist Medan.

Research Discussion

Learning with the Jigsaw and *Think Pair Share type models* (TPS) there are differences in students' problem-solving abilities. This is in accordance with the results of research by Utomo et al., (2020) which found significant differences between the two learning models, Jigsaw and *Think Pair Share*. (TPS) . There are differences in learning outcomes between the Jigsaw and TPS learning models (Ardiyani, Gunarhadi, & Riyadi, 2019) . Jigsaw and TPS cooperative learning models *Think Pair Share* (TPS) has different effectiveness in geometry learning (Apriyanti & Ayu, 2020) .

Learning with the Jigsaw type model is better than learning with the same type. *Think Pair Share* (TPS) on students' problem-solving abilities. This is in accordance with the research results of Ritonga & Rakhmawati (Sari & Mayona Chantika, 2019). Learning with the Jigsaw model can improve problem-solving skills and student learning outcomes. The Jigsaw cooperative learning model is more effective for mathematics learning outcomes (Ni'mah, 2020). Student learning outcomes using Jigsaw are higher than those using *Think Pair Share*. (TPS)

CONCLUSION

From the results of research data conducted in class X of SMK Free Methodist Medan on the material on the properties of exponents for the 2025/2026 academic year and hypothesis testing, the following conclusions can be drawn:

1. There are differences between the Jigsaw and *Think Pair Share* (TPS) learning models in relation to students' problem-solving abilities.
2. The Jigsaw type learning model is better than the *Think Pair Share* (TPS) learning model for students' problem-solving abilities.

Suggestion

Based on the conclusions obtained from this research, the researcher puts forward several suggestions as follows:

1. Teachers are advised to choose the appropriate learning model according to learning needs, because each model has its own advantages in developing students' abilities.

2. Teachers are advised to prioritize the use of the Jigsaw model in learning that focuses on improving students' problem-solving abilities.
3. For schools, it would be better to encourage teachers to develop a variety of learning models, including Jigsaw and Think Pair Share (TPS) learning models in teaching and learning activities.
4. This research is still limited to the material on the properties of exponents and the scope of one school. Therefore, future researchers are advised to conduct similar research on different materials or educational levels.

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