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The Effect of the PBL Model with the TTW Strategy in Terms of Problem-Solving Skills and Learning Motivation of Junior High School Students

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Abstract

This research aimed to: (1) Describe the effectiveness of the PBL learning model with the TTW strategy in mathematics learning for eighth-grade junior high school students on statistics material, viewed from students' problem-solving abilities and learning motivation; (2) describe the effectiveness of the PBL learning model in mathematics learning for eighth-grade junior high school students on statistics material, viewed from students' problem-solving abilities and learning motivation; (3) if both are effective, describe which learning model is more effective between the PBL with TTW strategy model and the PBL model, viewed from students' problem-solving abilities and learning motivation on statistics material. This research is a quasi-experimental study using a pretest-posttest nonequivalent control group design. The population of this study was all students of class VIII of SMPN 2 Mlati, consisting of four classes. The sample of this study was selected by purposive sampling and class VIIIA was selected as the control class using the PBL model and class VIIIB as the experimental class using the PBL model with the TTW strategy. Data collection in this study used questionnaires and tests. The questionnaire was used to measure students' learning motivation and the test was used to measure students' problem-solving abilities. The criteria for the effectiveness of this study were based on: the average posttest problem-solving ability score is at least 75, the average posttest learning motivation score is at least 72, and the average posttest ability is greater than the pretest. The results of the study at the significance level showed that: (1) the PBL model with the TTW strategy was effective in terms of students' problem-solving abilities and learning motivation; (2) the PBL model was effective in terms of students' problem-solving abilities and learning motivation; (3) the PBL model with the TTW strategy was more effective compared to the PBL model in terms of students' learning motivation, but the PBL model with the TTW strategy was not more effective compared to the PBL model in terms of problem-solving abilities.

Keywords: *PBL; TTW; Problem-Solving Abilit; Learning Motivation; JHS Statistics*

Introduction

Education is a planned effort to assist or guide adults in developing the physical and spiritual potential of students in achieving maturity so that they are able to carry out their duties independently (Hidayat & Abdillah, n.d., p.24). Education is also a learning process for students to understand and improve their critical thinking skills. However, in reality, the quality of education today is still low.

Regarding the quality of education in Indonesia, the results of the international study Program for International Student Assessment (PISA), under the auspices of the Organization for Economic Co-operation and Development (OECD) in 2022 related to testing education programs around the world, Indonesia only had an average score of 366, which is still far from Singapore's highest score of 575, when viewed from their mathematical abilities. This shows that the implementation of the mathematics learning process is still not optimal, while the questions used in PISA are related to problem-solving skills (Romadhoni & Setyaningsih, 2022).

The current situation shows that many Indonesian students still struggle with situations that require problem-solving skills using mathematics, or in other words, the problem-solving skills of students in Indonesia are still relatively low (Rambe et al., 2024). The cause of this is still one of the reasons for students' low problem-solving skills is that they are only accustomed to solving routine problems (Hendriko et al., 2024). As a result, when given more complex problems, they find it difficult to answer them. Teachers also have not oriented students to everyday problems that are relevant to their lives, thereby neglecting their problem-solving abilities. Students only understand the material when it is explained by the teacher and do not explore their own abilities further because mathematics learning is generally teacher-centered (Hendriko et al., 2024).

If the learning model applied is not in line with the learning objectives, it will affect students' problem-solving abilities, making learning less effective (Muhaimin & MZ, 2020). This is because learning is teacher-centered and students are only passive listeners, and there is no group discussion, so students' creativity in solving mathematical problems does not increase.

Problem-solving skills are important for students to have (Amalia & Hadi, 2021). Problem-solving skills make it easier for students to identifying problems, designing solutions, solving problems, and analyzing the answers obtained. Students are also assisted in answering mathematical questions in the form of story problems or everyday life problems if they have problem-solving skills (Pramita & Wiranda, 2023). This is because problem-solving is an integral part of everyday life (Albab et al., 2021). Problem-solving skills are also one of the five mathematical competency standards that students must possess (Loviasari & Mampouw, 2022). Therefore, students are required to improve their problem-solving skills in order to develop their critical thinking skills (Pramita & Wiranda, 2023).

In addition to problem-solving skills developed as a cognitive aspect, students also need to develop affective aspects, such as learning motivation. This is because learning motivation is a determinant of success in learning (Nurlita et al., 2023). Learning motivation encourages a person to engage in learning activities to achieve their desired goals. Motivation also determines how much students will learn, how many activities they will participate in, and how quickly they will achieve their goals or how much information students can obtain in achieving their goals (Susanti, 2020).

Students who are motivated to learn will use their abilities to learn continuously and when faced with challenges will persevere, even striving to solve problems. Teachers also play a major role in training students' problem-solving skills and motivation to learn, which requires adequate teaching strategies, especially in mathematics. Innovative and creative learning is needed to encourage students to be more active and creative in solving problems in the future. In addition, although problem solving is a taught skill, it also requires conducive and optimal learning activities.

One way to improve the quality of education is to innovate learning using a problem-solving model, namely Problem-Based Learning (PBL) (Susbiyanto et al., 2019). The PBL model emerged as a response to the shortcomings of conventional learning models, which are carried out in large classes using lecture methods that have failed to prepare students for solving real-world problems (Ates & Aktamis, 2024).

The use of the PBL model is also recommended for school improvement (Seng Tan, 2003). Through the problem-solving model in mathematics learning, students are trained to use problem-solving skills in every phase of problem solving, starting from understanding the problem, making a plan to solve it, implementing the plan, and then reevaluating the plan that has been carried out. Therefore, PBL can improve problem-solving skills (Durasa et al., 2024).

In addition, the PBL model can also develop students' critical thinking skills in solving problems given by teachers and foster student motivation in learning (Setiawan et al., 2023). PBL emphasizes student-centered learning, authentic problem solving, and teacher facilitation to better equip educators in preparing students for the dynamic demands of the 21st century (Ates & Aktamis, 2024). PBL learning can also increase student motivation because students are involved in meaningful and relevant learning (Warsini, 2024, p.29).

Better learning outcomes also require learning strategies, one of which is Think Talk Write (TTW) (Hanifah & Nuraeni, 2020). TTW is a strategy that can help students think correctly, reflect, organize, and test their ideas before being asked to write. Therefore, the TTW strategy can foster students' thinking skills (Hapsan, 2021, p.7).

TTW can also improve students' problem-solving skills because there are steps in the procedure, teachers and students collaborate in solving problems to improve performance and enhance critical thinking (Hardiyanto & Santoso, 2018). Research conducted by Hanifah and Nuraeni (2020) also states that TTW can facilitate the improvement of problem-solving skills. The learning atmosphere also becomes more enjoyable, which can stimulate students' interest and understanding of the material being studied (Purwita et al., 2020).

One of the subjects at the junior high school level that is quite difficult for students is statistics (Asmar et al., 2024). Statistics is a subject that studies Data collection, data processing, data interpretation, and drawing conclusions based on the results of data analysis presented in graphs, tables, diagrams, circles, or frequencies (Maryati, 2021). This material is very important for students to master because statistics is a subject that is studied from elementary school to college, making it the basis and prerequisite for mastering statistics at advanced education levels (Maryati, 2021).

Method

This study is a quasi-experimental study using the Quasi-Experimental Design method, which involves giving two different treatments to two classes. The first class, or control class, was given the Problem-Based Learning model, while the second class, or experimental class, was given the Problem-Based Learning model with the Think Talk Write strategy. The population in this study was eighth-grade students at SMPN 2 Mlati. Sampling was determined using purposive sampling. Through this technique, class VIIIA was selected as the control class and class VIIIB as the experimental class. Each class consisted of 28 students. The techniques used in this study were tests and questionnaires. The tests and questionnaires were conducted after the treatments were given to both class so that the problem-solving abilities and learning motivation of students using the PBL model and the PBL model with the TTW strategy can be determined. The instrument was developed based on statistics material and student learning motivation.

The researchers chose statistics material because it is one of the subjects at the junior high school level that is quite difficult for students (Asmar et al., 2024). Statistics is a subject that studies data centralization, data processing, data interpretation, and drawing conclusions based on the results of data analysis presented in graphs, tables, diagrams, circles, or frequencies (Maryati, 2021). This subject is very important for students to master because statistics is a subject that is studied from elementary school to

college, making it the basis and prerequisite for mastering statistics at advanced education levels (Maryati, 2021).

The instruments used are expected to be able to measure students' problem-solving abilities and learning motivation well. The researchers also conducted content validity tests on these instruments. Content validity was obtained from the results of expert judgment. Data analysis was performed using normality tests, homogeneity tests, and hypothesis tests. Normality tests used the Henze Zirkler and Shapiro Wilk tests with the help of the R Program. Homogeneity tests were performed to determine whether the data variance was homogeneous or not. Meanwhile, hypothesis tests were performed to determine whether the PBL model with the TTW strategy had an effect on students' problem-solving abilities and learning motivation.

Results and Discussion

The research results were obtained from the posttest scores of students' problem-solving abilities and learning motivation. The posttest was conducted after the students received the learning model treatment. The following are the posttest results from the control class and the experimental class.

Table 1. Posttest Results on Problem-Solving Skills

Calculation	**PBLTTW**	**PBL**
	Posttest	***Posttest***
Average	79,00	78,93
Variance	149,02	138,32
Standard deviation	11,76	12,21
High score	100	100
Lowest score	47	53

Table 2. Posttest Results on Learning Motivation

Calculation	**PBLTTW**	**PBL**
	Posttest	***Posttest***
Average	88,10	83,87
Variance	46,24	43,32
Standard deviation	6,80	6,58
High score	99	97
Lowest score	73	73

The results of the normality test of the posttest scores in the experimental class and control class are presented in the following table.

Table 3. Multivariate Normality Test

Variable	**Model**	***Henze-Zirkler***
Posttest problem-solving ability and learning motivation	PBL with TTW strategy	*HZ* = 0,490 *p-value* = 0,338
	PBL	*HZ* = 0,439 *p-value* = 0,445

Table 4. Univariate Normality Test

Keterangan	**Model**	**Variable**	***Shapiro Wilk***
Posttest	PBL with TTW strategy	Problem-solving ability	*Shapiro-Wilk* = 0,934 *p-value* = 0,102
		Learning motivation	*Shapiro-Wilk* = 0,976 *p-value* = 0,786
	PBL	Problem-solving ability	*Shapiro-Wilk* = 0,972 *p-value* = 0,638
		Learning motivation	*Shapiro-Wilk* = 0,957 *p-value* = 0,297

Based on Table 6, it shows that the p-value of the experimental class is 0.102>0.05 for problem-solving skills and 0.786>0.05 for learning motivation. Meanwhile, the p-value of the control class is 0.638>0.05 for problem-solving skills and 0.297>0.05 for learning motivation. From the data of both classes, H0 is accepted.

Because the data in this study is normally distributed, the next step is to perform a homogeneity test using the R Program. The table below shows the results of the homogeneity test.

Table 5. Homogeneity Test

Keterangan	**Variable**	***F Test***
Posttest	Problem-solving ability	*F* = 1,061 and *p-value* = 0,879
	Learning motivation	*F* = 1,072 *and p-value* = 0,858

Based on Table 7, the p-value obtained was 0.879>0.05 for problem-solving ability and 0.858>0.05 for learning motivation. Thus, it can be concluded that the posttest data in both classes had the same variance (homogeneous).

The final step in this study was hypothesis testing. H0 was accepted if tcount<ttable with a significance level of 0.05. Based on calculations using the independent sample test, it was found that the problem-solving ability value was 0.033<2.005, so it can be concluded that the PBL model with the TTW strategy is not more effective than the PBL model in terms of problem-solving ability. Meanwhile, the learning motivation score is 2.402>2.005. Therefore, it can be concluded that the PBL model with the TTW strategy is more effective than the PBL model in terms of learning motivation.

Based on the observer's observations, the learning implementation score for the experimental class is 95.23%, while that for the control class is 94.87%. This shows that there was an increase in student learning activities using the PBLTTW model. The PBLTTW model was implemented well during the research period. This model also brought about changes in the learning process. Students who were initially passive and dependent on the teacher's explanations are now encouraged to actively discuss with their group mates. The LKPD used also helped students in discussing with their groups.

Susanto (2018) revealed that TTW learning effectively improves students' problem-solving skills, as seen from the increase in activity and ability in solving problem-solving questions. The existence of TTW makes students think more deeply, discuss with friends so that students will be more active, and from the results of these discussions, they are then written down so that students are trained to process information gradually.

The increase in learning motivation shows a positive impact on students' mathematics learning after the implementation of the PBL model with the TTW strategy. Artati, I (2018) said that TTW can significantly increase learning motivation. TTW provides space for students to think independently, discuss, and write, making them more active. These activities help students develop self-confidence and feel involved in the learning process. Interaction between groups also develops students' talents for expressing opinions, cooperation, and strengthens thei enthusiasm for learning.

Conclusion

Based on the discussion of this study, it can be concluded that the PBL model with the TTW strategy is not more effective than the PBL model in terms of problem-solving skills, and the PBL model with the TTW strategy is more effective than the PBL model in terms of learning motivation. The PBL model with the TTW strategy can make students more effective in developing communication skills, critical thinking, and in-depth conceptual understanding. Students are also trained to understand the problems given, discuss with friends, and process their thoughts in writing.

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