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Learning model experimentation Think Talk Write with project learning against mathematics learning outcomes

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Abstract: This research was conducted with the aim of seeing which model is better between the TTW learning model and Project learning, TTW, and direct learning of students' mathematics learning outcomes in the matter of comparison of values and comparisons of turning values in class VII SMPN 2 Jogorogo. With a total of 68 students for the experimental group and 34 for the control group. Quasi Experimental Design is the type of research used in this study with the sampling technique that is Cluster Random Sampling. In this study, the sample consisted of three groups with normal and homogeneous distribution. Experimental group I (VII A) was given the TTW learning model with Project learning, Experimental group II (VII B) was given the TTW learning model, while the control group (VII C) was given a direct learning model. Hypothesis testing was carried out by a one way anova test and post-anova follow-up test. The conclusions that can be drawn from this study are (1) Obtained differences in TTW mathematics learning outcomes with Project learning get an average of 78.24, TTW got an average of 71.03, and direct learning get an average of 63.24 with the conclusion F_{obs} (13,13) > F_{table} (3.09). (2) The TTW learning model with Project learning gives results that are as good as the TTW, seen from F_{obs} (6,06) < F_{table} (6,18). (3) The TTW learning model with Project learning gives better results than direct learning, seen from F_{obs} (26,25) > F_{table} (6,18). (4) The TTW learning model gives better results than direct learning, seen from F_{obs} (7,08) > F_{table} (6,18).

Keywords: Learning outcomes; Project Learning; Think Talk Write

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INTRODUCTION

Learning is an education, expertise, knowledge and knowledge, as well as the formation of attitudes and beliefs of a student obtained from a teacher and other learning resources in a learning environment (Harahap, 2022). A lesson every year should always develop following the changing era. Such developments are always carried out to achieve a learning goal, one of which is to improve learning outcomes. According to Suardi (2018) learning outcomes are student learning achievements in totality which are indicators of initial competence and the degree of transformation of the behavior concerned. There are many problems that affect learning outcomes, both problems caused by students, the atmosphere of education and even teachers or educators cannot be separated from deficiencies which are the source of the problem of lack of achievement in learning outcomes.

A learning is said to be successful if students have learning outcomes above the KKM (Minimum Completeness Criteria) and do not experience problems in their work (Harefa, 2020). Effective learning activities will result in maximum learning outcomes, especially in learning mathematics. Learning mathematics tends to be a scary thing for students because

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they think mathematics is difficult. This can be seen when the teacher gives practice questions with a high level of difficulty, only some students are able to do it correctly, some other students only work on questions they find easy and don't work on questions they find difficult, and some students don't even do the same. very. Therefore, the role of a teacher should guide and guide students to learn according to their capacity. The teacher must also know the range of teaching materials provided so that the teaching materials provided are well conveyed and easily accepted by students.

The researcher conducted an interview with one of the class VII mathematics teachers at SMP Negeri 2 Jogorogo and obtained information that the learning model used so far was a direct learning model. Only teachers are active in learning. While students only passively become loyal listeners. That way, the learning process only applies in one direction. The teacher only explains and provides information about the concept of the material being studied. While students only listen and do the questions given by the teacher. This agrees with Dewi et al. (2019) which explains that the main activity carried out by a teacher in using the direct learning model is to provide material, while students only listen and record what is given by the teacher. Besides that, according to Daen et al. (2020)s in direct learning, students are less involved in the learning process so they are less active and cannot develop the knowledge they have. As a result, student learning outcomes tend to be low. It is proven that students' learning outcomes in mathematics are still low due to the odd semester final assessment results in 2022/2023. There are still many students who have not reached the minimum completeness standard (KKM) set by the school. Of all class VII students of SMP Negeri 2 Jogorogo, there were 90 out of 102 students who had scores below the KKM, with an average of 56. This score was still less than the specified KKM score of 75.

The value of student mathematics learning outcomes is still very low. This is caused by students who have difficulty understanding and mastering material comparisons of value and value turning. After further observation with the mathematics teacher in class VII SMP Negeri 2 Jogorogo, he revealed that the material that was difficult for students to accept was comparative material. The observation was also continued with several students who said that the material for comparison of values and value comparisons was difficult material and delivered in a monotonous way of learning so that many students were sleepy and did not pay attention to learning. Students' difficulties in understanding a learning material are caused by learning that is still teacher-centered and the selection of learning models that are felt to be inappropriate. The lecture method and the assignment method are learning methods that are usually used by teachers. Thus, students become less interested and unable to be creative in giving answers or giving opinions. Students are still confused in understanding mathematical concepts and the weakness in students' mathematical abilities that affect their learning outcomes.

One solution to overcome this problem is to apply a more effective learning model (Isrok'atun & Amelia R., 2018). The learning model used is the learning model Think Talk Write with Project learning. Use of learning models Think Talk Write With project learning it is expected to be able to add value to students' mathematics learning outcomes. This is because the TTW learning model encourages students to think about finding solutions to the problems they face with their own ideas, then talk about these ideas in a discussion, so they can bring up new ideas to solve a problem (Naniastuti et al., 2019). In this learning model, before forming groups of students, they are given worksheets to work on. Students work on questions on the LKS and record which parts they do not understand. In groups they discuss things that are not understood and explain to each other what they know and record explanations from their group mates. Group representatives came forward to present the results of their discussions to other groups (Pratiwi, 2022).

The TTW learning model is a learning that requires students to think, speak, and then write down a certain topic (Rohmah & Maulana, 2020). This model helps students collect and develop ideas through structured conversations. The characteristics of the TTW model

according to (Ramadhani, 2021) are starting with thinking through the reading material or problems presented, then the results of the reading or problems presented are communicated by discussion and making a presentation report. In accordance with research from Sinaga (2019), with the results of the research showing that there is an effect of using the TTW learning model on mathematics learning outcomes. Subsequent research from Ibrahim et al. (2017), the results showed that the average participation questionnaire scores and mathematics learning outcomes of experimental class students by providing TTW learning were 35.05 and 83.50 compared to the average participation scores and students' mathematics learning outcomes control class with the provision of direct learning, namely 27.80 and 72.50. So the conclusion obtained is that there is an influence of the TTW learning model on student participation and learning outcomes in learning mathematics (Ibrahim et al., 2017).

The advantages of this learning model are developing meaningful solutions in order to understand teaching material, developing students' critical and creative thinking skills, interacting and discussing in groups will involve students actively in the learning process, and familiarize students with thinking and communicating with friends, teachers, and others. even himself. Meanwhile, the weakness of the Think Talk Write (TTW) cooperative learning model is that when students work in groups it can eliminate students' self-confidence because they join with other friends who have different abilities, the teacher must really prepare carefully so that in implementing the learning model Think Talk Write (TTW) does not experience difficulties, and requires a lot of time to implement this learning model (Setiyaningrum & Istiqomah, 2015) Not only thorough preparation but also it is necessary to have a learning project so that all students can hone each other's abilities and work together with one another. According to Mayuni et al. (2019) having a project as a learning approach will certainly help students hone and grow their abilities. Not only that, students will be required to be able to work together in a group so that problems can be resolved. In addition to collaboration, students are also required to communicate with each other either in their own study groups or with other groups when communicating their findings in the form of presentations.

Student-centered learning with the aim that students can master a material concept by exploring in depth about a problem and looking for relevant solutions and implementing them in a project is the notion of project-based learning (Gunantara, 2014). The main perceived benefit from project learning is the meaningful learning experience that occurs in connection with their own project. This contribution is reflected in: respecting others, productive group learning, explaining each other's views, supporting each other, and strengthening the social values of fellow peers (Azizah, 2022). According to previous research conducted by Nurul Utami, the results showed that the average learning outcomes of the experimental group with the application of the learning model project based learning of 80.68 and the average control group learning outcomes with the application of direct learning models of 75.39. Then the conclusion that can be drawn is the learning model project based learning gives higher student learning outcomes than the direct learning model (Utami, 2018).

Unlike the class that applies the direct learning model, the teacher conveys the material by demonstrating the material being discussed and giving space to ask questions if something is not understood. But after being given the opportunity, not many students asked. Not even responding to questions given by the teacher. In this model, it can be seen that the teacher dominates so that students only act as recipients of material, playing with their friends when asked questions and students are less enthusiastic about learning (Mahadi et al., 2023). To overcome the above problems, it is necessary to have a new learning model, namely the learning model Think Talk Write with project learning. This learning model will provide a new learning atmosphere because students are required to play an active role in the learning process. From a given problem, students are required to solve the problem individually by making small notes. After that the notes were communicated again and developed with

friends from one group so as to get a complex solution from various points of view. Not only that, but students are also required to retell or present the results of their discussions in front of the class. Students can interact with each other, train to communicate with each other and work well together, respect others and have the courage to express their opinions. If students can focus and enjoy the learning process, students will understand the material they are studying. So that the learning model Think Talk Write with project learning can improve mathematics learning outcomes.

This is reinforced by the results of Fauziati's (2019) research, namely that there is an increase in the ability to produce opinion/editorial texts in the TTW learning model with Project-Based learning better than conventional models. This research was conducted on students of SMA Negeri 1 Paguyangan class XI MIPA 3 Semester 2 of the 2016/2017 academic year, the research time lasted 3 months with 2 cycles. Each cycle is carried out by planning, implementing, acting, observing and reflecting. There is an increase in the ability to compose opinion/editorial texts using the TTW learning model with Project-Based learning, namely in the first cycle around 70.57% and in the second cycle it reaches 92.59% (Fauziati, 2019). Based on the description above, the purpose of this study was to determine the effect of the Think Talk Write learning model (TTW) with project learning on the results of learning mathematics for class VII students of SMP Negeri 2 Jogorogo and learning material about comparisons of value and return value.

METHOD

Quasi Experimental Design is the type of research used in this study. This is because it is not possible for researchers to control all relevant variables. As stated by Budiyono (2016), the purpose of quasi-experimentation is to obtain information which is an estimate of the information that can be obtained with actual experiments in circumstances where it is impossible to control all relevant variables. The population taken for this research was class VII students of SMP Negeri 2 Jogorogo in the 2022/2023 academic year, which consisted of 102 students.

Cluster Random Sampling is a sampling technique used in this study because the object to be studied or the source of data is very broad, making it easier for researchers to determine the sample to be studied. This sampling was carried out by writing all VII graders on paper and then drawing lots to determine which class would be used as the experimental group and the control group. Due to obtaining random samples in the form of small groups, not all samples could be identified. This study used 2 research groups, namely the control group with 68 students and the experimental group with 34 students. The control group is the group that is given a direct learning model, namely teaching and learning activities that still use the lecture method and the experimental group is the group that is given a treatment. Experimental group 1, namely teaching and learning activities that use learning models TTW, and Experimental Group 2 namely teaching and learning activities that use learning model TTW with project learning.

This study used data from the end of the odd semester grade VII SMPN 2 Jogorogo as data on students' initial abilities obtained from the mathematics teacher for class VII and the final data (posttest) obtained from the results of the learning tests at the time of the study. The posttest questions were obtained from the results of the instrument trial. The instrument in this study was self-made by the researcher in the form of multiple choice questions with 4 possible answers so that it needs to be validated by a validator and tested first to determine the level of reliability, level of difficulty and distinguishing power. The test questions for the instrument made by the researcher were 35 questions.

Content validation was carried out using a Likert scale with 5 scores. Testing the validity of the test instruments in this study were 3 experts who were considered capable in their fields. After that the questions were tried out in other schools with 30 students as respondents. Reliability test is used to determine whether the items are reliable or not in data collection.

The instrument is said to be reliable if the reliability index is more than 0.70 (r_{11} = 0.70). The reliability test obtained by using the Kuder Richardson formula or KR 20 is r_{11}=0.895. This shows that the instrument is reliable and can be used. The next test is the level of difficulty test. an item is said to be good if the item is not too easy and not too difficult, in other words, the type of item used is an item with a moderate difficulty level with a difficulty index of 0.25 ≤ P ≤ 0.75. The final instrument test is the power of difference test which is used to determine whether or not an item is capable of differentiating between participants who have high abilities and participants who have low abilities. In this study the items used were items that had a value of D > 0.40 and D ≤ 0.40, so the items were not used.

based on the four test instruments obtained 20 questions that can be used as a posttest. The Posttest method used is in the form of an objective test in the form of multiple choices with 4 answer choices and 60 minutes of processing time are provided. The final score is calculated from the number of items answered correctly multiplied by 5. So the minimum score is 0 and the maximum score is 100. Before the posttest is given to students, each group gets the learning model treatment for 3 meetings. At the fourth meeting, each group was given a posttest.

The implementation procedure in this study can be described as follows: (1) Preparation of research proposals and instruments, (2) Conducting research instrument testing including; validity test, difficulty level test, discriminating power test, and reliability test, (3) Experimentation of learning models in each class, (4) Provision of posttest in the form of multiple choices in each class, (5) Processing data obtained from research, (6) carry out prerequisite test procedures, (7) analyze data on student learning test results using the Analysis of Variance test One cell line is the same, and post-anova follow-up test, namely the Scheffe method.

RESULTS AND DISCUSSION

RESULTS

The purpose of this research is to see which model is better between the TTW learning model and Project learning, TTW, and direct learning of students' mathematics learning outcomes in the matter of comparison of values and comparison of value returns in class VII SMPN 2 Jogorogo. Based on the sampling technique, three groups were obtained for this study. The three groups are experimental group I (VII A) given the TTW learning model with project learning, experimental group II (VII B) given the TTW learning model, and the control group (VII C) given the direct learning model. Before being given a learning model, the three groups must have the same or balanced initial abilities. Table 1 presents initial ability data obtained from math scores at the end of the semester assessment for class VII SMP Negeri 2 Jogorogo in 2022/2023. To see if the initial abilities of students from the three groups are balanced or not, this can be done by using a balance test. The requirement to carry out a balance test is that the data must come from a homogeneous and normally distributed variance.

Table 1. Student Initial Ability Data

Class	N	X	Me	Mo	X_{min}	X_{max}	S^2
TTW with project learning	34	57,50	56,5	48	40	80	9,03
TTW	34	57,15	56,5	55	55	78	10,13
Direct	34	56,26	55	55	55	85	12,54

Normality testing is needed to see whether the data on the initial abilities of the three classes are normally distributed. Because the initial ability data is single data or not in the frequency distribution of grouped data, the normality test uses the Liliefors test at a significant level of 5%. The results of the Normality Test are presented in Table 2.

Table 2. Initial Ability Normality Test

Class	N	L_{obs}	L_{table}	Decision	Conclusion
TTW with project learning	34	0,1090	0,1519	H_O accepted	Normal
TTW	34	0,1107	0,1519	H_O accepted	Normal
Direct	34	0,0989	0,1519	H_O accepted	Normal

The next test is the student's initial ability homogeneity test, which is a test conducted to see whether the variances of the population are the same or not (Budiyono, 2016). Table 3 presents the homogeneity test (bartlet test) with a significant level of 5%.

Table 3. Initial Ability Homogeneity Test

Class	K	X^2_{obs}	X^2_{table}	Decision	Conclusion
TTW with project, TTW, and Direct learning	3	3,732	5,991	H_O accepted	Homogeneous

After the normality test and homogeneity test was carried out, the initial ability data was followed by a balance test using the same one cell line ANOVA test because there were more than 2 groups and each group had the same number of samples (Wicaksono, 2021).The calculation results are in Table 4.

Table 4. One Way Anava Test of Initial Ability Data

Source Variance	JK	DK	RK	F_{obs}	F_{table}
Class (A)	27,53	2	13,76	0,12	3,09
Error (G)	11609,38	99	117,27	-	-
Total (T)	11636,91	-	-	-	-

From the Table 4, it is known that F_{obs} = 0,12 < F_{table} = 3,09, eye H_0 accepted, which means that the data on the initial abilities of students from the three groups are stated to be the same or balanced. So that the three classes can be treated with a learning model for 4 meetings.

Based on the research results obtained from the three groups after being given the treatment of the learning model, the results of students' mathematics learning tests or grades were obtained Posttest which are presented in Table 5. The data obtained from the three classes were then tested on the research prerequisites. There are two types of prerequisite tests in this study, namely the homogeneity test (Bartllet test) presented in Table 6 and the normality test (Liliesfors test) presented in Table 7.

Table 5. Data on Student Mathematics Learning Test Results

Class	N	X	Me	Mo	X_{min}	X_{max}	S^2
TTW with project learning	34	78,24	80	80	55	100	9,84
TTW	34	71,03	72,5	80	40	90	12,17
Direct	34	63,24	65	65	40	90	13,39

Table 6. Test for Normality of Student Learning Outcomes

Class	N	L_{obs}	L_{table}	Decision	Conclusion
TTW with project learning	34	0,1053	0,1519	H_O accepted	Normal
TTW	34	0,1015	0,1519	H_O accepted	Normal
Direct	34	0,1032	0,1519	H_O accepted	Normal

Table 7. Homogeneity Test of Student Learning Outcomes

Class	K	X^2_{obs}	X^2_{table}	Decision	Conclusion
TTW with project, TTW, and Direct learning	3	3,126	5,991	H_O accepted	Homogeneous

After the result data posttest it is proven that students' mathematics come from a population that is homogeneous and normally distributed, then the next step is testing the hypothesis through the ANOVA test of one cell line. The purpose of using this test is to find out the differences of several learning models on student mathematics learning outcomes by comparing the averages of several populations (Sugiyono, 2016). The calculation results are in Table 8.

Table 8. One Line Anava Test Data Posttest

Source Variance	JK	DK	RK	F_{obs}	F_{table}
Class (A)	3826,96	2	1913,48	13,13	3,09
Error (G)	14427,21	99	145,73	-	-
Total (T)	18254,17	-	-	-	-

From the Table 8, it is known that F_{obs} = 13,13 > F_{table} = 3,09, eye H_0 rejected, which means that the results of students' mathematics learning between the TTW learning model and project learning, TTW, and direct learning have differences. The calculation of the anava test above obtained H_0 If it is rejected, then it must be continued with post-anava follow-up tests. The post-ANOVA follow-up test is a follow-up to the analysis of variance because the analysis of variance can only determine if the null hypothesis is accepted or rejected. This means that if the hypothesis is rejected, it cannot be known which means are different. To overcome the null hypothesis that was rejected, the researcher used one of the methods from the post-anava follow-up test, namely the method Scheffe. Method Scheffe was chosen because this method is conservative and flexible in its decisions so it is suitable for post-anava follow-up tests. The calculation results are in Table 9.

Table 9. Summary of Post Anava Follow-up Test Results

H_0	F_{obs}	$(k-1)F_{table}$	Test Decision
$\mu_1 = \mu_2$	6,06	6,18	H_0 accepted
$\mu_1 = \mu_3$	26,25	6,18	H_0 rejected
$\mu_2 = \mu_3$	7,08	6,18	H_0 rejected

Based on the Table 9, it is obtained that F_{1-2} = 6,06; F_{1-3} = 26.25; and F_{2-3} = 7.08; with DK = {F|F > (2)(3.09)} = {F|F > 6.18} then by comparing F_{obs} and F_{table} it can be seen that there is a difference and it can be concluded that: in the first hypothesis, namely comparing the TTW learning model with project learning and the TTW learning model gives a decision that the null hypothesis is accepted. This means that the TTW learning model with project learning provides learning outcomes that are as good as TTW learning at a significant level of 5% because F_{obs} (6,06) < F_{table}(6,18).

In the second hypothesis, which is comparing the TTW learning model with project learning and the direct learning model, it is decided that the null hypothesis is rejected. This means that the TTW learning model with project learning provides learning outcomes that are not the same quality as direct learning at a significant level of 5% because F_{obs} (26,25) > F_{table}(6,18). The mean value of the TTW learning model with project learning (78.24) is higher than the average value of the direct learning model (63.24), so it can be concluded that the TTW learning model with project learning provides better learning outcomes than the direct learning model.

In the third hypothesis, which is comparing the TTW learning model and the direct learning model, it gives a decision that the null hypothesis is rejected. This means that the

TTW learning model provides learning outcomes that are not the same quality as direct learning at a significant level of 5% because F_{obs} (7,08) > F_{table}(6,18). The mean value of the TTW learning model (71.03) is higher than the average value of the direct learning model (63.24), so it can be concluded that the TTW learning model provides better learning outcomes than the direct learning model.

DISCUSSION

The conclusion obtained based on hypothesis testing is $F_{obs} > F_{table}$ with F $grade_{obs}$ = 13,13 and F_{table}= 3.09 so that from the test it can be seen that between TTW learning and project learning, TTW learning, and direct learning have differences in learning outcomes. This is in accordance with previous research conducted by Rakhman and Rokmanah (2023). The results of his research showed that the improvement of high school students' communication skills in learning mathematics in linear programming material in the experimental class using the project-based TTW learning model was better than the control class using direct learning. The quality of improving mathematical communication skills from the experimental class was 0.42 in the medium category and the control class was 0.27 in the low category (Rakhman & Rokmanah, 2023). From this research there is an increase in students' communication skills which will have an impact on improving learning outcomes. Then the conclusion obtained is that the TTW learning model with project learning can also affect student learning outcomes.

Based on the post-anava follow-up test, it was shown that TTW learning with project learning obtained an average value of 78.24, TTW learning obtained an average value of 71.03, and direct learning obtained an average value of 63.24. Based on this description, it shows that TTW with project learning has a higher average value than the group that was given TTW learning and direct learning. This can be seen during the implementation of the research, where the class given the TTW learning model with project learning is better and it can be seen from the students who are given the opportunity to think individually and in groups and with project learning, they are more active and enthusiastic in solving a problem. They also communicate with each other both in their own study groups and other groups when communicating their findings in the form of presentations. In this case learning projects are able to attract students' attention, make the learning atmosphere more enjoyable, increase student learning interest and students' views are more focused on learning material. In contrast to direct learning, in the learning process students tend to appear not to take the teacher's presentation seriously. They are only busy taking notes, following the teacher's explanation, receiving, storing in memory and carrying out activities according to what they see, so that their mathematics learning outcomes are not good. In this model the teacher is very dominant, and students are passive, playing with their friends when asked questions, lacking enthusiasm in learning (Muis & Priawasana, 2022). As a result, students do not master and understand the material presented. Based on this research, using the TTW model with project learning contributes to students' mathematics learning outcomes. Through this model students are very enthusiastic in developing their own capacity and knowledge to understand a learning material.

CONCLUSION

The results of this study illustrate that there is an influence of the TTW learning model with project learning on student mathematics learning outcomes when compared to direct learning. This can be seen from the acquisition of the mean value of the mathematics learning outcomes of students who are given the treatment of the TTW learning model with project learning which is higher (78.24) compared to the mean value of the TTW learning model (71.03) and the direct learning model (63.24). Similarly, in testing the first hypothesis with the same cell line anova test, it was found that F_{obs} (13,13) > F_{table} (3.09) a conclusion is obtained that is between the TTW learning model and project learning, the TTW learning model, and the direct learning model have differences in learning outcomes. This difference can also be

seen from the way students respond to learning when given the TTW learning model with project learning, students are very happy and actively discuss working on a group project. The results of the second hypothesis using the post-anava follow-up test concluded that F_{obs} (6,06) < F_{table} (6.18), so that the TTW learning model with project learning gives results that are as good as the TTW learning model. The results of the third hypothesis using the post-anava follow-up test concluded that F_{obs} (26,25) > F_{table} (6.18), so TTW learning with project learning gives better results than direct learning. The results of the fourth hypothesis using the post-anava follow-up test concluded that F_{obs} (7,08) > F_{table} (6,18), so that TTW learning gives better results than direct learning.

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