Kontinu: Jurnal Penelitian Didaktik Matematika
E-ISSN: 2656-5544
P-ISSN: 2715-7326
Vol. 7, No. 2, November 2023
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Examining the Influence of the WEE (Wondering, Exploring, and Explaining) Learning Model on Students' Mathematical Reflective Thinking Proficiency

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Abstract. The learning process in eighth-grade classes at SMPN 2 Sewon does not adequately support students' development of mathematical reflective thinking abilities. Consequently, students continue to rely heavily on memorization of formulas, leading to persistent challenges in problem-solving. This study aims to investigate the potential impact of the WEE (Wondering, Exploring, and Explaining) learning model on the mathematical reflective thinking abilities of eighth-grade students at SMP N 2 Sewon. This research follows a quantitative approach, employing experimental methods and adopting a posttest-only control design. The study's population consists of eighth-grade students at SMP N 2 Sewon, and a sample of 32 students from class VIII C and 32 students from class VIII D was selected using a cluster random sampling technique. The findings indicate that students who were exposed to the WEE learning model demonstrated superior mathematical reflective thinking abilities compared to those who did not experience this instructional approach. In conclusion, the WEE learning model significantly influences students' mathematical reflective thinking abilities.

Keywords: WEE (Wondering, Exploring, and Explaining) learning model, thinking ability, mathematical reflective

INTRODUCTION

Mathematics is known as an important science for various sciences in the field of knowledge. Mathematics is also a source of developing human thinking power. Therefore, mathematics is a main subject in elementary school (SD) to high school (SMA) and at similar levels. The aim of teaching mathematics to students has been stipulated in the Regulation of the Minister of National Education of the Republic of Indonesia number 23 of 2006, namely to provide students with the ability to think critically logically, be organized, and collaborate (Syamsuddin et al., 2021). Based on these goals, students should be able to use mathematical concepts to solve problems that exist in everyday life. It is this important aspect that students at school should be able to train their thinking skills in order to achieve mathematics learning goals (Gega et al., 2019).

This thinking ability is the ability to think at a high level. According to Krulik (Armelia & Ismail, 2021), one of the abilities in high-level thinking is the ability to think reflectively. John Dewey defines reflective thinking as a thinking activity that is carried out continuously and persistently in solving a problem with careful consideration in order to find a conclusion (Ramadhani & Aini, 2019). According to Boud, reflection in learning is an intellectual and effective activity that is useful in exploring an experience in order to gain new understanding and knowledge (Saminanto & Romadiastri, 2020).

According to the pragmatic view, this reflective thinking ability can be created by teachers by making students feel the emergence of a problem, thereby fostering a sense of solving the problem, and ultimately, students will cooperate in learning (Masamah, 2017). Thus, later, students will be required to understand existing problems and make plans using their knowledge and processes to solve them. Indirectly, this reflective thinking ability directs students to have the ability to identify problems, apply what knowledge is known, and process the information they have obtained.

However, in reality, the mathematical reflective thinking abilities possessed by students in Indonesia are still worrying. This situation is proven by the results of the PISA (Programme for International Student Assessment) test for the mathematics category, which was participated in by 79 countries. Indonesia was ranked 73rd. This data is data from a survey conducted by the OECD (Organization for Economic Cooperation and Development) in 2018 (Tohir, 2019). The PISA test by the OECD tests several competencies, namely understanding, reasoning, and problem-solving abilities (Gega et al., 2019). Problem-solving abilities here are required by the ability to think mathematically. Therefore, based on the results of the PISA test, it can be interpreted that the quality of Indonesian students' reflective thinking abilities is still relatively low.

One of the reasons why the ability to think reflectively in mathematics is low is because educational staff still uses the lecture learning model a lot. This action

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often causes students to only see and listen to the teacher's material without being directly involved in learning activities. It is reinforced by the results of an interview with one of the class VIII mathematics teachers at SMP N 2 Sewon, namely Mrs. Rona, on August 22, 2022, who said that her teaching and learning activities still implemented a teacher-centered learning model. As a result, interaction between students is still very lacking, which slows down the development of students' thinking abilities.

On the other hand, the mathematics teacher also said that during the learning process, students still prioritize memorizing formulas and calculating. It is what triggers and causes students to feel difficulty when dealing with problems that are not the same as the example questions. Finally, students are unable to understand, relate to, and solve problems, and their thinking abilities do not appear. Therefore, it can be said that the mathematical reflective thinking abilities of class VIII students at SMP N 2 Sewon are still not comprehensive.

In light of the issues mentioned above, a solution is needed to foster mathematical reflective thinking skills in students. This ability can be grown and developed with the right learning model. The model used can provide space for students to discover their knowledge, feel problems, and find solutions to mathematical problems either individually or in groups. One of them is the WEE (Wondering, Exploring, and Explaining) model, which is part of the cooperative learning model. According to Scott, cooperative learning is defined as a learning environment that is held by creating heterogeneous groups or small groups so they can work together (Maryatun, 2022). The WEE learning model has three stages in practice, namely, Wondering, Exploring, and Explaining (Wahyuni et al., 2019). Wondering is the stage of generating curiosity after the reading activity is carried out. Exploring is the stage of searching and finding things you want to know. Explaining is the stage of conveying the results of the search/exploration to other students.

The Wondering, Exploring, and Explaining learning model invites students to be curious about the information they have found, hold discussions, and find solutions to these problems individually and in groups. According to the findings of Iqoh et al. (2021), the WEE activities incorporated into the learning process exhibit a positive influence on students. It is evident in the improvement of student interactions and the fostering of greater engagement in discussions. Furthermore, these outcomes align with the perspective presented by Wahyuni et al. (2019), asserting that the Wondering, Exploring, and Explaining learning model proves to be more effective than contextual learning. Thus, this research aims to determine the effect of the WEE (Wondering, Exploring, and Explaining) learning model on the mathematical reflective thinking abilities of class VIII students at SMP N 2 Sewon.

RESEARCH METHODS

This research was carried out at SMP N 2 Sewon in the even semester of the 2022/2023 academic year. This research uses the WEE (Wondering, Exploring, and Explaining) learning model as the independent variable (X) and mathematical reflective thinking ability as the dependent variable (Y). This type of research is quantitative research with experimental methods. The research design used is a "Post-test Only Control Design." The design of the posttest-only control design model is:

R_1	X	O_1
R_2		O_2

Table 1. Research design

Information:
R_1 = Experimental class taken randomly
R_2 = Control class taken randomly
X = Treatment
O_1 = First Observation
O_2 = Second Observation

The meaning of this design is that the first class will be given treatment, while the second class will not be given treatment. Thus, the experimental class means the group that received the Wondering, Exploring, and Explaining model, and the

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P-ISSN: 2715-7326
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control class means the group that did not receive the Wondering, Exploring, and Explaining model.

The population observed was all classes VIII of SMP N 2 Sewon for the 2022/2023 academic year, including classes VIII A, VIII B, VIII C, VIII D, VIII E, VIII F, VIII G, and VIII H. These classes were used to collect data. , namely data in the form of names, number of students, and mathematics scores in the form of end-of-odd-semester assessments. The values that have been obtained are then managed through normality tests, homogeneity tests, and ANOVA tests. Managing tests on these values is necessary to determine the condition of the initial abilities of all classes. If the test results of the data are normally distributed, homogeneous, and have the same average, then sample selection using the cluster random sampling technique should be continued. The results of the sample selection obtained two random classes, namely class VIII C, which was the experimental class with 32 students, and class VIII D, which was the control class with 32 students.

The data collection technique used is a test instrument. The form test instrument is a final test (post-test) in the form of essay questions totaling eight questions. These questions were created with reference to indicators of mathematical reflective thinking abilities, namely reacting, comparing, and contemplating. The indicators of mathematical reflective thinking ability used (Rosmaya & Noer, 2020) are:

Definition	Indicators
Reacting (reflective thinking to react)	Write information or things about an existing problem.
Comparing (reflective thinking for evaluation)	Sorting and determining the concepts used and preparing problem solutions.
Contemplating (reflective thinking for critical inquiry)	Carrying out examinations and providing explanations for the answers obtained from problems.

Table 2. Indicators of Reflective Thinking Ability

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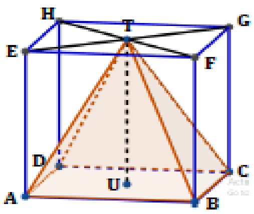
The test instrument that had been prepared was then tested on class IX F, totaling 26 students. Obtaining scores from the trials that have been carried out is followed by feasibility testing through tests of validity, reliability, level of difficulty, and distinguishing power of the questions. It aims to see the feasibility of the instrument questions being prepared. If the results obtained from the test are in accordance with the provisions, then the instrument is suitable for use in research. The next step is to give post-test questions to the two selected samples at the final session of the learning material. The purpose is to get a score on the mathematical reflective thinking abilities of the students being studied. The following are the post-test questions used, namely:

SOAL *POSTTEST* KEMAMPUAN BERPIKIR REFLEKTIF MATEMATIS

1. Layla ingin membuat tiga kotak pernak-pernik berbentuk kubus dari kardus bekas. Apabila kotak pernak-pernik tersebut memiliki panjang rusuk 12 cm, berapakah luas kardus bekas yang dibutuhkan Layla untuk membuat tiga kotak pernak-pernik?
2. Sony sedang mencari kardus bekas berbentuk balok. Ukuran kardus yang dicari yaitu tinggi kardus adalah 12 cm, panjang kardus adalah 13 cm, lebarnya adalah 10 cm. Hitunglah luas permukaan dari kardus bekas yang Sony cari tersebut!
3. Andi baru saja membeli akuarium ikan berbentuk balok. Akuarium tersebut memiliki ukuran panjang sisi 50 cm, lebar 30 cm dan tinggi 40 cm. Apabila Andi mengisi air kedalam akuarium dengan ketinggian 30 cm, hitunglah volume akuarium yang tidak terisi air tersebut!
4. Rini membeli satu produk skincare dengan kemasan berbentuk kubus. Kemasan produk tersebut memiliki luas 294 cm^2. Hitunglah volume dari kemasan skincare milik Rini tersebut!
5. Amati gambar berikut ini!



Diketahui kubus ABCD.EFGH dengan panjang rusuk AB adalah 12 cm. Tentukan volume limas T.ABCD dalam kubus tersebut!

6. Suatu hari Kadita melakukan solo *camping* di salah satu daerah Jawa Timur. Kadita menggunakan tenda *camping* dengan ukuran seperti gambar dibawah ini!

Dari pernyataan tersebut, berapakah volume tenda *camping* yang digunakan Kadita?

7. Sebuah limas dengan alas persegi mempunyai keliling alas 48 cm. Apabila tinggi limas adalah 8 cm, hitunglah luas permukaan limas persegi tersebut!
8. Nana membeli sebuah box sepatu. Box itu berbentuk prisma alas persegi panjang dengan ukuran panjang 31 cm, lebar 19 cm dan tinggi 11 cm. Tentukan luas prisma alas persegi panjang tersebut!

Figure 1. Post-test Questions for Mathematical Reflective Thinking Ability

The post-test scores obtained from the experimental class and control class were then processed using data analysis techniques in the form of prerequisite tests. Prerequisite testing is carried out to ensure that the selected samples have the same conditions or situations. The prerequisite tests used include the normality test and homogeneity test. The hypothesis test used is the independent sample t-test or average difference test with a significance level of 5%. The purpose of testing the independent sample t-test is to find out whether there is a difference in the average mathematical reflective thinking ability of students in the experimental class and the control class.

RESULT AND DISCUSSION

The result of this research is a description of the mathematical reflective thinking ability test data. The experimental class employs the Wondering, Exploring, and Explaining learning model, whereas the control class does not incorporate this particular learning model. The test data was obtained from the results of the post-test scores given to the experimental class and control class. The following is a summary of the results of the mathematical reflective thinking ability test for experimental class and control class students, namely:

Class	N	Number of Values	Average Value
VIII C	30	1651,39	55,046
VIII D	30	1281,94	42,731

Table 3. Post-test Results of Mathematical Reflective Thinking Ability

Based on the results of the post-test, prerequisite tests are then carried out. Prerequisite testing is carried out to ensure that the selected samples have the same conditions or situations. The requirements for this test are the normality test and homogeneity test.

The post-test scores obtained from both the experimental class and the control class were tested for normality. Summary of the results of normality test calculations based on the post-test scores that have been obtained, namely:

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Class	$\chi^2_{calculation}$	χ^2_{table}	Conclusion
VIII C	4,934	11,070	Normal Distribution
VIII D	4,988	11,070	Normal Distribution

Table 4. Post-test Normality Test Results for Mathematical Reflective Thinking Ability

Based on the data presented in Table 4, it is known that through the significance level = 5% and the value dk = k – 1 = 6 - 1 = 5, the value $\chi^2_{table} = 11{,}070$ is obtained. Based on the criteria, then $\chi^2_{calculation} \leq \chi^2_{table}$. Therefore, it can be concluded that the two samples, namely the experimental class (VIII C) and the control class (VIII D), have a normal distribution.

The next test is the F test, which is a homogeneity test. The summary of the F test calculation results based on the post-test scores that have been obtained is:

	Class	
	VIII C	**VIII D**
Varians	447,329	256,317
dk	29	29
$F_{calculation}$	1,745	
F_{table}	1,86	
conclusion	homogeneous	

Table 5. Homogeneity Test Results for Mathematical Reflective Thinking Ability

Based on Table 5. above, it can be seen that from the calculation of the F test, the value of. $F_{calculation} = 1{,}745$ on the other hand, with the value of numerator dk = 29, denominator dk = 29, and a significance level of 5%, the value of $F_{table} = 1{,}86$. Therefore, it is based on decision-making criteria, $F_{calculation} \leq F_{table}$ and it is accepted. The meaning is that two groups of sample data, in which case the experimental class and the control class have the same or homogeneous variance.

The final test in this research is hypothesis testing, which is done in order to obtain answers to the existing problem formulation. The hypothesis test here is the independent sample t-test or average difference test. A summary of the independent sample t-test calculation results obtained is as follows:

Mean Difference Test		
	VIII C	**VIII D**
Means	55,046	42,731
Variant	447,329	256,317
Number of students	30	30
Combined standard deviation	351,823	
dk	58	
$t_{calculation}$	2,543	
t_{table}	1,671	

Table 6. Independent Sample T-Test Results

Based on Table 6 above, the results of the calculation of the average difference test are known. $t_{calculation} = 2{,}543$. In addition, at the level of significance = 5% and the amount and then obtained, so that the value of Assessing the test criteria for the average difference test, it is concluded that $n_1 = 30, n_2 = 30, dk = n_1 + n_2 - 2 = 30 + 30 - 2 = 58, t_{table} = 1{,}671,\ \ t_{calculation} > t_{table}$, then it is rejected. It implies that the mean mathematical reflective thinking ability of the experimental group surpasses that of the control group.

It happens because students in control classes or classes that do not use the Wondering, Exploring, and Explaining learning model are not directly involved in any learning process. Therefore, students tend to feel bored and less active, which results in students not focusing on learning. It also triggers students to be unable to solve problems, so they find it difficult to do the post-test. Different from these classes, students in classes that use the Wondering, Exploring, and Explaining learning model are required to be active and directly involved in every process so that students are better able to solve existing problems.

The Wondering, Exploring, and Explaining learning model makes students experience three stages in the learning process in groups. The first stage is Wondering, which is carried out after the teacher provides an introduction to the material on flat-sided spatial shapes. This activity begins with group division. Here, the class atmosphere is noisy because the students are not used to working together in learning. The next activity is studying and understanding text reading material on LKS (Student Worksheets). This activity encourages students to be curious and seek information based on the problems they encounter.

Therefore, the reaction indicators contained in students' mathematical reflective thinking abilities can be fulfilled. It is because, at this stage, students are trained to be able to find and mention things they know and write questions that are appropriate to the problem on the LKS (Student Worksheet). The situation that occurred was in line with the opinion of Lestiana et al. (2018), who stated that LKS (Student Worksheets) in WEE (Wondering, Exploring, and Explaining) learning activities meant that students were able to add and discover their knowledge.

In the second stage, exploring, students in groups begin to discuss explore, and look for answers from various related sources to solve problems. This activity is the key to achieving comparison indicators on mathematical reflective thinking abilities, where, in working on LKS (Student Worksheets), students will be faced with the process of searching for appropriate concepts. Apart from that, in this process, students will communicate opinions with each other to connect their old knowledge with the problems they encounter so that they get the right answer. For students who find it difficult, the teacher will assist in the form of guidance. This condition is in line with two learning theories, namely cognitivism theory and constructivism theory. Cognitivism theory explains meaningful learning, which means students learn to construct the information studied with relevant concepts (Nurlina et al., 2021). Constructivism theory regarding scaffolding, where learning activities include regular assistance to students so they are able to solve problems (Arsyad, 2021).

The third stage is explaining, which encourages students to be active in explaining the results of the discussion they have obtained to other students. This process trains students to double-check their LKS (Student Worksheet) answers in order to detect the truth. Another thing is that students are trained to be able to make appropriate conclusions based on the information and answers obtained and to be able to evaluate errors. If students can understand this stage, then it can be ensured that the contemplating indicators on students' mathematical reflective thinking abilities can be mastered.

When students have finished making a presentation, the next activity is taking a written test. This written test consists of mathematics questions that are based on indicators of the material studied. This written test also makes students practice their mathematical reflective thinking skills. Such occurrences stem from the fact that written examinations afford students the chance to delve into and address problems that deviate from the provided examples. This situation is in line with the opinion of (2020), who states that giving students varied questions is an important action or aspect in developing mathematical reflective abilities.

Thus, it can be said that the Wondering, Exploring, and Explaining series of models are able to direct students to a problem so that they are encouraged to discuss and solve it in stages. This condition is in line with the pragmatic view in Masamah (2017), where the need for reflective thinking skills can be met through teachers by making students feel that there is a problem. This feeling encourages students' curiosity, so they will carry out searches to solve the problems they encounter.

On the other hand, the implementation of the Wondering, Exploring, and Explaining learning model also makes students active so that students' mathematical reflective thinking abilities are maximized. This assertion is substantiated by findings from the study conducted by Iqoh et al. (2021), which asserts that activities involving Wondering, Exploring, and Explaining (WEE) within the educational context exhibit a propensity to exert a positive impact on students. The research posits that such engagement fosters heightened student communication, manifesting as more robust and active participation in discussions. Apart from that, this situation is also in accordance with research by Wahyuni et al. (2019), which states that the WEE (Wondering, Exploring, and Explaining) learning model is more effective than contextual learning. Based on the explanation above, it can be concluded that the use of the WEE (Wondering, Exploring, and Explaining) learning model influences students' mathematical reflective thinking abilities.

CONCLUSION

The conclusion from the research that has been carried out is that the WEE (Wondering, Exploring, and Explaining) learning model can influence the mathematical reflective thinking abilities of class VIII students at SMP N 2 Sewon. The effect here is shown by the mathematical reflective thinking ability of students in classes that received treatment being better than the mathematical reflective thinking ability of students in classes that did not receive treatment.

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