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Effectiveness of RME Model on the Ability to Understand Mathematical Concepts Based on Keirsey's Personality Type

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ABSTRAK

Tujuan dari penelitian ini yaitu mengidentifikasi (1) keefektifan model pembelajaran RME dan pembelajaran langsung terhadap kemampuan pemahaman konsep matematis, (2) pengaruh perbedaan tipe kepribadian terhadap kemampuan pemahaman konsep matematis (3) interaksi antara model pembelajaran dan tipe kepribadian berkenaan dengan kemampuan pemahamn konsep matematis. Desain penelitian ini menggunakan *quasi experimen* yaitu *the nonequivalent posttest only control group.* Populasi penelitian yaitu seluruh peserta didik kelas VII SMPN 1 Magelang dengan jumlah 250 peserta didik. Pengambilan sampel dalam penelitian menggunakan teknik *Cluster Random Sampling.* Pengambilan data menggunakan instrumen angket dan soal *post-test.* Teknik analisis data dalam penelitian ini menggunakan analisis variansi dua jalan dengan sel tak sama, dengan prasyarat analisis yaitu normalitas dengan uji Liliefors dan homogenitas dengan uji Barlett. Berdasarkan pengujian hipotesis diperoleh hasil bahwa (1) model pembelajaran RME lebih efektif dibandingkan model pembelajaran langsung terhadap kemampuan pemahaman konsep matematis, (2) tidak terdapat pengaruh perbedaan tipe kepribadian terhadap kemampuan pemahaman konsep matematis, (3) terdapat interaksi antara model pembelajaran dan tipe kepribadian terhadap kemampuan pemahaman konsep matematis.
Kata Kunci: kemampuan pemahaman konsep matematis; RME; tipe kepribadian Keirsey.

ABSTRACT

The purpose of this study is to identify (1) effectiveness between the RME learning model and the direct learning on the ability to understand mathematical concepts, (2) the effect of different personality types on the ability to understand mathematical concepts (3) the interaction between learning models and personality types. to the ability to understand mathematical concepts. The design of this study used a quasi-experimental, namely the nonequivalent posttest-only control group. The population in study were all students of class VII SMP N 1 Magelang totaling 250 students. Sampling in study used the Cluster Random Sampling technique. Collecting data using a questionnaire and post-test. The data analysis technique in this study used a two-way analysis of variance with unequal cells, with the prerequisites of the analysis that normality was by the Liliefors test and homogeneity was by the Barlett test. Based on hypothesis testing, the results obtained are that (1) RME learning model is more efective than direct learning in the ability to understand mathematical concepts, (2) there is no effect of different personality types on the ability to understand mathematical concepts, (3) there is an interaction between the learning model and personality type. on the ability to understand mathematical concepts.
***Keywords**: ability to understand mathematical concepts; RME; Keirsey's personality type*

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INTRODUCTION

Understanding the concept is a very important aspect that students need to master to achieve learning objectives (Kristanti et al., 2019). By the learning objectives stated in Permendiknas Number 22 of 2006 one of them is to understand mathematical concepts, explain the relationship between concepts, and apply concepts or algorithms, flexibly, accurately, efficiently, and solve problems appropriately (Republik Indonesia, 2006). Concepts in mathematics are interconnected. In other words, to be able to master good mathematical concepts, students must understand the concepts that are prerequisites for the concepts being studied (Asfar et al., 2019).

The ability to understand mathematics is the ability of students to remember a concept, explain the concept in their language, and be able to apply the concept to solve problems, then be able to relate the concepts to one another (Rahayu, Roehati, & Yuliani, 2018). While he ability to understand mathematical concepts is the ability possessed by a student in understanding ideas or ideas in a lesson mathematics and use procedures efficiently and precisely (Tona et al., 2019). Mathematics learning is important for teachers to pay attention to how students can understand the concepts being taught properly (Sudarwanti & Harini, 2018). Learning mathematics is not just memorizing concepts, but students must understand concepts well (Gazali, 2016).

One of the problems in learning mathematics at schools is the low ability of students to solve math problems which emphasizes understanding and mastery of concepts (Augustine, Hartono & Indraryanti, 2020). But, based on research conducted by Hutagalung (2017) when given a concept understanding ability test, the majority of students were less able to complete it. Based on interview observations with mathematics teachers at SMP Negeri 1 Magelang, it was found that the learning carried out by the teacher is currently more educator-centered. The learning model applied is the direct learning model. So the teacher gives an explanation and students receive information. In addition, students are also still passive in responding to teacher questions. So we need a learning model that can increase student activity so that it will be able to optimize student learning outcomes, as well as the ability to understand the concept. Based on the results of the pre-research test conducted at SMP Negeri 1 Magelang using 6 essay questions, it shows that students' conceptual understanding skills are still low with an average of 48.5 and below the Minimum Completeness Criteria (KKM).

Several factors causing the low of students to understand concepts can come from internal factors and external factors (Amintoko, 2017). External factors that affect, can be

strategies, models, methods, or learning approaches used by teachers. In line with Suarsana et al. (2018) where students' understanding of concepts can be improve by optimizing lesson plans, learning media, and teaching materials. In this plan, there is a learning model that will be applied. Therefore, we need a learning model that can optimize understanding of concepts or help students understand the concepts being taught. The learning model that is expected to optimized understanding of concepts is Realistic Mathematics Education (RME).

Realistic Mathematics Education (RME) is the use of reality and the environment that students understand to facilitate the mathematics learning process, to achieve the goals of better mathematics education in school learning (Nuraina, Fauzi, & Simbolon, 2021). Learning based on the environment of students will be easily accepted, because learning is based on their knowledge, looks real, and is easily imagined by students. That way the learning of mathematics received by students will be more meaningful. In addition, according to Afriansyah (2016), RME is learning that emphasizes conceptual understanding and encourage students to be active. Through the RME (Realistic Mathematics Education) learning model, it is expected to be able to improve the ability to understanding of mathematical concepts.

This is following previous research conducted by Ridha et al. (2021) with the subject of VII students of SMPN 3 Sungguminasa, the results showed are that there are differences in students' understanding of mathematical concepts with RME and direct learning. So RME is more effective to improving students' conceptual of understanding abilities.

Possible internal factors can affect students' understanding of concept abilities is personality type. This is because each student has a different character. This character is known as personality. According to Suherlan and Budhiono (2013), personality is something that describes a person's uniqueness, which distinguishes that person from others. In line with what Nadya (2020) stated, personality is a difference in behavior or actions of each individual based on the individual's mind and soul. the. The personality of students also varies. In this study, David Keirsey's personality type is classified into four types, namely Guardian, Artisan, Rational, and Idealist (Keirsey, 1998).

Based on this description, researchers are interested in conducting experimental research on the RME learning model on the ability to understand mathematical concepts of class VII students. Therefore, the purpose of this study is to identify (1) whether the RME learning model is more effective than the direct learning model in the ability to understand mathematical concepts of students, (2) whether there is an effect of different personality

types on the ability to understand mathematical concepts, (3) whether there is an interaction between the learning model and personality type on the ability to understand mathematical concepts.

RESEARCH METHODS

This study is a quasi-experiment study with a nonequivalent post-test only control group design. This quasi-experimental design has a control group, but it does not function to control all external variables that affect the implementation of the experiment (Lestari & Yudhanegara, 2017). Design of the nonequivalent post-test only control group, there are two groups, the first group was treated with RME and the other group was treated with direct learning, then both groups were given post-test (Lestari & Yudhanegara, 2017). The design of this study is presented in Table 1.

Table 1. Research Design

Personality Type (B_j) / Learning Model (A_i)	*Idealist* (B_1)	*Artisan* (B_2)	*Rational* (B_3)	*Guardian* (B_4)
Realistic Mathematics Education (RME) (A_1)	A_1B_1	A_1B_2	A_1B_3	A_1B_4
Direct Learning (A_2)	A_2B_1	A_2B_2	A_2B_3	A_2B_4

The population used is class VII SMPN 1 Magelang totaling 250 students. Sampling in this study used the Cluster Random Sampling technique. Sugiyono (2017), Cluster Random Sampling is used if the population consists of group of individuals or clusters. Of the eight classes, namely VII-A, VII-B, VII-C, VII-D, VII-E, VII-F, VII-G, and VII-H, random sampling was carried out to be used as a sample and obtained class VII-F as the experimental class and VII-D as the control class.

Collecting data using a questionnaire instrument Keirsey personality type (Keirsey, 1997) and post-test. The questionnaire consists of 16 items. Students fill in the answers with numbers 1 to 4 from the available choices. From the results of the answers, students will be classified into 4 personality types idealist, artisan, rational, and guardian. The test questions for the ability to understand mathematical concepts consist of 7 description questions.

The data analysis technique used is two-way analysis of variance with unequal cells, with the prerequisites of the analysis that normality Liliefors and homogeneity Barlett. After the two-way analysis of variance has been tested, if the results of the H_0 test are rejected, then further tests will be carried out after ANOVA using the Scheffe method.

RESULT AND DISCUSSION

The study used two classes. One class is experimental treated with the RME learning model, while another class is a control class treated with a direct learning. Concept understanding test instrument before being used in the research was validated and tested. The trial was carried out in class VII-E of SMPN 1 Magelang. Based on the research that has been done and the post-test in the experiment class and the control class, the results are obtained as given in the Table 2.

Table 2. Average Data of Post-Test Results

Personality Type / Learning Model	*Idealist*	*Artisan*	*Rational*	*Guardian*	
Realistic Mathematics Education (RME)	n = 16 $\bar{X}$ = 59,06	n = 5 $\bar{X}$ = 61,4	n = 8 $\bar{X}$ = 75,13	n = 3 $\bar{X}$ = 41,67	$\bar{X}$ = 61,81
Direct Learning	n = 12 $\bar{X}$ = 44,08	n = 5 $\bar{X}$ = 34,4	n = 12 $\bar{X}$ = 48,5	n = 3 $\bar{X}$ = 77,33	$\bar{X}$ = 47,34
$\bar{X}$	48,09	42,86	54,46	52,98	

In Table 2. the average of the experimental class is 61.81 while the control class is 47.34. From these differences, earned on average ability to understand mathematical concepts for the experimental class is better than the average for the control class. While the post-test results of students' mathematical concept understanding ability based on personality type, the experimental class average of idealist personality type are 59.06, artisan personality type is 61.4, rational personality type is 75.13, guardian personality type is 41.67. While in the control class, the average the idealist personality type was 44.08, the artisan personality type was 34.4, the rational personality type was 48.5, and the guardian personality type was 77.33.

After the data is obtained next conducted data analysis. First conducted test normality. In this study, normality testing was carried out with the Liliefors test with a significant level of 5%. The results of the calculation of the normality test for the two classes presented in the Table 3.

Table 3. Results of Normality Calculation of Post-Test Result

Class	N	L_{count}	L_{table}	Decision
Experiment	32	0,100	0,157	H_0 accepted
Control	32	0,150	0,157	H_0 accepted
Idealist Personality Type	28	0,110	0,167	H_0 accepted
Artisan Personality Type	10	0,119	0,258	H_0 accepted
Rational Personality Type	20	0,097	0,190	H_0 accepted
Guardian Personality Type	6	0,246	0,319	H_0 accepted

H_0: Data is normally distributed

H_1: No data normal distribution

Conclusion: if $L_{count} \leq L_{table}$ then H_0 is accepted

On the Table 3, from all sources tasted for normality including the experimental class, the control class, idealist personality type, artisan personality type, rational personality type, and guardian personality type, the result is that $L_{count} \leq L_{table}$ is H_0 accepted. This means that the sample is normally distributed.

Second conducted data analysis with test homogeneity. The homogeneity test was carried out using the Barlett test. Homogeneity calculation resault presented in the Table 4.

Table 4. Results of Homogeneity Calculation of Post-Test Data

Source	dk	$\chi^2 count$	$\chi^2 table$	Decision
Learning Model	1	0,323	3,841	H_0 diterima
Personality Type	3	2,518	7,815	H_0 diterima

H_0: ${\sigma_1}^2 = {\sigma_2}^2 = {\sigma_3}^2 = \cdots = {\sigma_n}^2$ (both variances are homogeneous)

H_1: most a little wrong one sign no same (second variance no homogeneous)

Conclusion: if $\chi^2 count < \chi^2 table$, then H_0 accepted

Based on the Table 4, concluded the homogeneity test between rows (in terms of the learning model) and the homogeneity test between columns (in terms of personality type), the value obtained is $\chi^2 count < \chi^2 table$, then H0accepted. This means that the population is said to be homogeneous.

Next, after the data is declared normal and homogeneus , done test hypothesis with the use of analysis variance two Street cells not same. The results of the two-way ANOVA presented in Table 5.

Table 5. Data Summary of Variance Analysis of Two Dissimilar

Source	JK	dk	RK	F_{obs}	F_{table}	Decision
Model(A)	763,48353	1	763,48353	4,108	4,01	H_0 rejected
Tipe(B)	1448,721	3	482,90701	2,598	2,77	H_0 accepted
Model*tipe	7496,7882	3	2498,9294	13,446	2,77	H_0 rejected
Error	10407,463	56	185,84754			
Total	21204,75	63				

The criteria for testing with ANOVA are two different cell paths, namely if $F_{count} \leq F_{table}$, then it is H_0 accepted, while if $F_{count} > F_{table}$, then it is H_0 rejected. Based on the Table 5, obtained $F_{A\,count} = 4.108 > F_{A\,table} = 4.01$, so that based on the two-way ANOVA test criteria it was concluded that it was H_{0A} rejected. That is, there is a difference

in the effectiveness of the learning model to ability understand the draft mathematically. While the calculation result obtained $F_{B\ count} = 2.598 \leq F_{B\ table} = 2.77$, so that based on the two-way ANOVA test criteria it was concluded that it was H_{0B} accepted. This means that there is no effect of differences in the personality types of students on the ability to understand mathematical concepts. On F_{AB} calculation obtained $F_{AB\ count} = 13.446 > F_{AB\ table} = 2.77$, so that based on the two-way ANOVA test criteria it was concluded that it was H_{0AB} rejected. This means that there is an interaction between the learning model and personality type in the ability to understand mathematical concepts.

Based on the results of the two-way ANOVA test, it was obtained that the same H_{0A} and H_{0AB} rejected. Then, a further post-ANOVA test was carried out using the Scheffe method for hypotheses one and three.

a. Interline Mean Comparison Test

Based on the ANOVA test, the two unequal cell paths in the first hypothesis are H_{0A} rejected, then there is a difference in the effectiveness of the learning model to ability understand the draft mathematically. Because there are only two learning models used, to find out which learning model is more effective, it is not necessary to do a double comparison test between rows. However, it is enough to look at the marginal mean between the rows of the two learning models used. The summary of the marginal mean is presented in the Table 6.

Table 6. Marginal Mean Data

Learning Model	Personality Type				Marginal Mean
	Idealist	*Artisan*	*Rational*	*Guardian*	
RME	59.0625	61.4	75.125	41.67	59.31
Direct	44.0833	34.4	48.5	77.33	51.08
Marginal Mean	49.57	47,9	61.81	59.5	

On Table 6 the marginal mean for RME learning model is 59.31, while the marginal mean for direct learning is 51.08. So it can be concluded that 59.31>51.08, so that the RME model is better for improving the ability to understand the draf mathematical.

b. Comparative Test of Means Between Cells in the Same Column

The third hypothesis is H_{0AB} rejected, a multiple comparison test will be conducted between cells in the same column to find out a good learning model for each personality type. The results of the post ANOVA follow-up test using the Scheffe method are presented in the Table 7.

Table 7. Calculation Results of the Average Comparison Test between Cells in the Same Column

H_0	F_{obs}	$7.F_{0,05;7;56}$	Decision
$\mu_{11} = \mu_{21}$	8.279	15.246	H_0 accpeted
$\mu_{12} = \mu_{22}$	9.086	15.246	H_0 accepted
$\mu_{13} = \mu_{23}$	18.309	15.246	H_0 rejected
$\mu_{14} = \mu_{24}$	10.267	15.246	H_0 accepted

a. $F_{11-21} = 8.279 < 7.F_{0,05;7;56} = 15.246$ then H_0 accepted. This means that students with idealistic personality types who are treated with the RME are as good as students who are treated with the direct learning.

b. $F_{12-22} = 9.086 < 7.F_{0,05;7;56} = 15.246$ then H_0 accepted. This means that students with the artisan personality type who are treated with the RME are as good as students who are treated with the direct learning.

c. $F_{13-23} = 18.309 > 7.F_{0,05;7;56} = 15.246$ then H_0 rejected. This means that there are differences between students with the rational personality type who are treated with the RME and students who are treated with the direct learning.

d. $F_{14-24} = 10.267 < 7.F_{0,05;7;56} = 15.246$ then H_0 accepted. This means that students with the guardian personality type who are treated with the RME are as good as students who are treated with the direct learning l.

Based on the two-way ANOVA test and the post-ANOVA follow-up test, it can be analyzed as follows.

The influence of learning models on the ability to understand mathematical concepts. Based on two-way ANOVA calculations test with unequal cells obtained $F_{A\ count} = 4.108 > F_{A\ table} = 4.01$. Because the value $F_{A\ count}$ is included in the critical area, it is H_0 rejected. Furthermore, further tests were carried out by looking at the marginal mean, the marginal mean for RME learning was 59.31, while in direct learning it was 51.08, meaning that the ability to understand mathematical concepts of students taught with RME model was better than of students treated by the direct learning.

Learning in the experimental class with RME model is carried out in groups and begins with contextual problems so that students construct their knowledge. In line with Ausubel's meaningful learning theory (Lestari & Yudhanegara, 2017), in realistic mathematics learning, students connect knowledge all around and complete problems the then, find a concept. So learning mathematics realistic or RME will be more meaningful. In addition, in group learning, students actively discuss and work together to help between

groups, so students who are embarrassed to ask the teacher can ask their group friends. The learning theory according to Piaget's (Lestari & Yudhanegara, 2017), wherein RME learning students are required to be active in learning.

While learning in the control class uses a direct learning model, learning is fully controlled by the teacher who provides material and explains it in detail. Towards the end of the lesson, the teacher allows students to ask questions if something is not understood. However, none of the students dared to ask questions and just kept quiet. When given practice questions, students feel confused and work by asking their friends, and have not been able to work independently. In addition, if students are given an exercise that is slightly different from the example, students feel confused.

This is to the results of research conducted by Chisara, Hakim, & Kartika (2019), the results show that the RME model affects the to ability understand draft mathematics participants learn, as well as the ability to understand draft mathematics taught with more RME good from to those who are taught with learning model straight away.

The influence of personality type on the ability to understand mathematical concepts. Based on two-way ANOVA calculations with unequal cells, the value of $F_{B\ count} = 1{,}267 \leq F_{B\ table} = 2{,}77$. Because the value $F_{B\ count}$ is not included in the critical area, it is H_{0B} accepted. That is, there was no effect of differences in personality types on the ability to understand mathematical concepts.

Each personality type has a different average, students with idealist personality types is 48.09; artisan personality type 42,86; rational personality type 54.46; and guardian personality type 52.98. The four personality types have different averages, but the differences are not too significant.

The four personality types have different characteristics, traits, and behaviors in the following learning (Keirsey, 1998). Students with idealistic personality types tend to like material about ideas, reading, and writing. Artisan personality type student prefer learning by discussion and presentation. Rational personality type student prefer explanations based on logic and can accept material with high intellectuality. Meanwhile, students with guardian personality types prefer explanations that are coherent, orderly, and based on concrete problems. But it only characterizes each and does not differ in the level of intelligence. Based on its characteristics, it cannot be concluded that students with rational personality types will be smarter than guardians or idealists and artisans. The occurrence of

differences in the average of each of these personality types can be made possible because of the level of seriousness and focus in participating in learning.

The results of this study are following the research conducted by Ayu (2021) which shows that there is no influence between students who have idealist, artisan, rational, and guardian personality types on the ability to understand mathematical concepts.

The interaction between learning models and personality types on the ability to understand mathematical concepts. Based on two-way ANOVA calculations with unequal cells obtained $F_{AB\ hitung} = 13{,}446 > F_{AB\ tabel} = 2{,}77$. Because the value $F_{AB\ count}$ is included in the critical region, it is H_{0AB} rejected. That is, there is an interaction between the learning model and the personality type in the ability to understand draf mathematical.

Sourced from the results of the calculation multiple comparisons between cells in the same column, the following results are obtained.

a. Students who have an idealist personality type, and the ability to understand mathematical concepts, and students who are taught using the RME learning model and direct learning models have the same ability to understand concepts as well. In other words, the learning model does not affect the ability to understand mathematical concepts in students with idealistic personality types.

   This is because, in RME learning, students study in groups so that students are active and can work together to help each other group members. The learning theory according to Piaget's (Lestari & Yudhanegara, 2017), wherein RME learning students are required to be active in learning. By its characteristics, where idealists prefer material ideas, reading, and writing. Learning in groups will provide a good understanding of the mathematical concepts of each personality type. While in the direct learning model, students are given a detailed explanation from the teacher (Asniah, 2020). So that each personality type will have the same effect on the ability to understand mathematical concepts of students. Therefore, for students with idealist personality types, the ability understand mathematical concepts of students treated with RME or direct learning is as good.

b. Students who have an artisan personality type, the ability to understand mathematical concepts, and students who are treated with the RME model and the direct learning have the same ability to understand concepts as well.

   This is because, in RME learning, all students are invited to actively participate in learning. The characteristics where artisan prefers to learn by discussion and presentation like to participate actively and likes to show his abilities (Keirsey, 1998).

While in the direct learning model, the material is given by the teacher. However, artisans who like to show their abilities and are active will have the same effect if they are given learning using a direct learning model. Therefore, for students with an artisan personality type, the understand mathematical concepts of students treated with RME or direct learning is as good.

c. Students who have a rational personality type, the ability to understand mathematical concepts of students treated by RME is better than treated by the direct learning model.

This is because, in RME learning, students are asked to construct their knowledge, the problems presented are also contextual. Its characteristics were rational like learning by discovery, problem-solving, and explanations based on logic. In RME learning, learning begins with the presentation of contextual problems. Meanwhile, in the direct learning model, the teacher acts as a complete conveyer of the material. Students with rational personalities do have the characteristics of being able to receive material with high intellectuality, and liking logical explanations. However, the weakness of this personality type will not pay attention to the material given or ignoring the material if the material is deemed unnecessary. Therefore, for students with the rational personality type, it would be better if they were taught using the RME than the direct learning for the ability to understand concepts mathematically.

d. Students who have a guardian personality type, the ability to understand concepts mathematically, and students treated with RME and the direct learning have the same ability to understand concepts as well.

This is because, in RME learning, students study in groups so that students can work together to help each other group members. Although based on the characteristics of the guardian's personality type, he prefers traditional type classes and does not like the discussion, the guardian likes learning whose material is based on real/concrete problems. By RME learning, where learning begins by presenting contextual/real (Rizkiani & Septian, 2019), problems so that it can encourage guardians to actively ask and discuss with their friends. While in the direct learning model, the material is given by the teacher and is always guided by the teacher. Suitable for guardian types who like learning with detailed and coherent explanations. Therefore, for students with the guardian personality type, the ability to understand mathematical concepts of students treated with RME or direct learning is as good.

These result are following the result of research by Sari (2012), which states that there is an interaction between learning models and student,s personality type. As well as

the result of research Astuti, et al. (2014), which states thet there is an interaction between the learning model and personality type on the ability to solve math story problems.

CONCLUSION

Based on the results of research and testing with ANOVA on two unequal cell paths and further testing using the Scheffe method, it can be concluded that (1) RME learning model is more efective than direct learning in the ability to understand mathematical concepts in rectangular material, (2) students with idealist, artisan, rational, and guardian personality types are equally good at understanding mathematical concepts, (3) there is an interaction between the learning model and the personality type of students in the ability to understand mathematical concepts. The interactions that occur are students with idealist, artisan, and guardian personality types treated with the RME learning model as well as students treated with a direct learning model on the ability to understand mathematical concepts. Students with the rational personality type will be better off if treated with RME learning model compared to the direct learning model on the ability to understand mathematical concepts.

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