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The Effect of the Realistic Mathematics Education Approach with the Problem-Solving Learning Model on Student Learning Outcomes

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***Abstract**: Model Problem Solving merupakan suatu model pembelajaran yang didalam merumuskan masalah yang ada dalam pembelajaran dimulai dari membuat hipotesis dari masalah yang ada kemudian mencari informasi malalui pengumpulan data-data dan mengetes hipotesis yang ada dengan data-data setelah itu membuat suatu kesimpulan. Tujuan penelitian ini adalah untuk mengetahui pengaruh Realistic Mathematic Education (RME) dengan model pembelajaran Problem Solving terhadap hasil belajar siswa pada pokok bahasan Sistem Persamaan Linier Dua Variabael . Subjek penelitian adalah seluruh siswa kelas VIII SMP Negeri 3 Tondano dan diambil 2 kelas yang diasumsikan homogen, yaitu kelas VIII B sebagai kelas kontrol dan kelas VIII C sebagai kelas eksperimen . Data diambil dari hasil belajar siswa yang diperoleh dari selisih soal pre – test dan post – test. Karena thitung (5.89) > ttabel (1.7247), sehingga H0 ditolak dan H1 diterima. Dengan demikian dapat disimpulkan bahwa terdapat pengaruh positif terhadap hasil belajar siswa dengan Pendekatan Realistic Mathematic Education (RME) Dengan Model Pembelajaran Problem Solving pembelajaran matematika materi Sistem Persamaan Linear Dua Variabel.*

INTRODUCTION

Education is a stick of history that determines the nation's identity because it has a very important role in educating the nation's life, creating quality human resources and a forum to foster and develop basic human abilities to be optimal and qualified. As for this, it is very closely related to schools, which are educational institutions that teach and coach students, who are the sprouts of the nation's hope (Iskarim, 2016; Feby, 2020). A quality school accompanied by a big vision can give birth to a generation of people who are intelligent, virtuous and skilled (Rahmat, 2016; Triyono, 2019)). However, in reality, there are still problems found in learning where students have not maximally absorbed the lessons they have learned in school, especially lessons about mathematics (Marsudi, 2020).

Mathematics has a very close role in daily life. Mathematics is widely applied in real life and is said to be the mother of knowledge (Ranti, 2015; Kaka & Sunita, 2022). However, the problem is that some students consider mathematics a difficult and boring subject, so there is less interest in learning mathematics, which also affects mathematics learning outcomes (Kholil & Zulfiani, 2020; Aprillia & Fitriana, 2022). In addition, the use of media and learning models also still uses a direct learning model where the learning process is only centred on the teacher (Unsman, 2018; Yanti, 2019). Based on interviews with teachers and students at SMP Negeri 3 Tondano about mathematics lessons, some say mathematics is fun. This is not a problem, but a good thing and must be improved. However, the problem is that some students say mathematics is a boring and scary subject, and some students are even forced to learn it. They are saturated with learning mathematics, resulting in their mathematics learning results that are not satisfactory and have not reached competency standards. This can be seen from the average learning of grade VIII students, which consists of 60 students; only 22 students can achieve KKM scores. Meanwhile, 38 other students who have not reached it are said to have passed, while 63.33% of other students have not graduated. One of the material topics that attracted my attention in this odd semester was the Two-Variate Linear Equation System material.

Based on the interview results, students said that during the learning process, especially in the Two-Variate Linear Equation System material, teachers only use package books without teaching materials or other learning tools such as LKPD that can support the mathematics learning process. In addition, the learning model used at SMP Negeri 3 Tondano has a KKM (Minimum Completeness Criteria) score, especially in the field of mathematics study in grade VIII for the 2022/2023 school year, odd semesters, which is 65. This means that only 36.67% of students whose learning outcomes can be a direct learning model, namely lessons, are still teacher-centred. Therefore, students become less active and less interested in learning mathematics.

Following up on the above problems, applying and using a mathematical approach and learning model that is not boring in teaching and learning activities is necessary, where these learning approaches and models can provide positive values not only to students but also to others who are closely related to daily life.

One of the alternative learning options is to use the Realistic Mathematic Education (RME) approach with the Problem-Solving learning model. Realistic Mathematic Education (RME) is an approach that departs from existing reality based on experiences in daily life (Chisara et al., 2019; Juliawan et al., 2022). This shows that mathematics can be applied to things that are real for human life (Idris & Silalahi, 2016; Anggraini & Huzaifah, 2017). Therefore, students must be allowed to learn to do activities on topics in mathematics so that learning can seem good, effective, innovative and fun. Meanwhile, Problem-solving is a learning model in which formulating problems in learning starts from making hypotheses from existing problems and then searching for information by collecting data and testing existing hypotheses with data, after which a conclusion is made (Anugrah et al., 2020; Hulu et al., 2023).

For this reason, this study describes using the Realistic Mathematic Education (RME) approach with the Problem-Solving learning model. It expects to improve student learning outcomes on the subject of the Two-Variable Linear Equation System. Thus, research was carried out as experiments on grade VIII students of SMP Negeri 3 Tondano.

METHOD

The research to be carried out is experimental research, namely using the RME approach with a Problem-Solving learning model on the subject of the Two-Variable Linear Equation System in grade VIII of SMP Negeri 3 Tondano. The research time will be carried out in the even semester of the 2022/2023 school year and by adjusting the subject time at school.

The population in this study is grade VIII students of SMP Negeri 3 Tondano for the 2022/2023 school year, which are spread across parallel classes, namely class VIII C and class VIII D. In the study, sampling was carried out using random sampling, where two classes were taken to be used as experimental classes, namely class VIII C and class VIII D.

The variable in this study is student learning outcomes. The conceptual definition of student learning outcomes in this study is students' ability to acquire through the learning process. Variable Operational Definition: The learning outcome data in this study was obtained through the final test (posstest) using the RME approach with the Problem-Solving learning model and the final test (posstest) with the direct learning model.

The instruments in this study are learning implementation plans (RPP), junior high school mathematics books for grade VIII, written questions in the form of objective questions, and essays given to research subjects. The design of this study is shown in Table 1 below:

Table 1. Pretest Research Design – posttest Control Group Design

Group	Pretest	Treatment	Posttest
Experimental Classes (E)	O_1	X	O_2
Control Classes (K)	O3		O4

Information :
O1 : Experimental class given pre-test
O2 : Experimental class given post-test (after being given treatment)
O3 : Control class given pre-test
O4 : Control class given post-test (after treatment)
X : Treatment in the form of using the RME approach with the Problem-Solving learning model
\- : Treatment using the lecture method (conventional).

RESULTS AND DISCUSSION

This study is an experimental research using two groups as research samples, namely class VIII C as a control class with a total of 20 students and class VIII D as an experimental class with a total of 20 students, where the two classes are given different treatments, class VIII C plays the role of a control class that applies a direct learning model. In contrast, class VIII D is an experimental class that applies the *Realistic Mathematic Education* (RME) with *a Problem-Solving* Learning Model.

Table 2. Control Class Data

Total	738	1565
Minimum Score	32	70
Maximum Score	43	83
Average	36.9	78.25
Standard Deviation	3.74	4.17
Varians	13.99	17.36

Table 3. Experiment Class Data

Total	847	1657
Minimum Score	38	75
Maximum Score	50	90
Average	4235	82.85
Standard Deviation	3.75	5.02
Varians	14.03	25.19

The results of data analysis in Tables 1 and 2 show that the pre-test in the control class carried out before the teaching and learning activities was obtained at 36.9, while the pre-test in the experimental class was obtained at 42.35. Furthermore, the average score of the post-test in the control class, which was carried out after the implementation of teaching and learning activities with a direct learning model, was obtained at 78.25, while the average score of the post-test in the experimental class after applying the *Realistic Mathematic Education* (RME) Approach with the *Problem-Solving* Learning Model, 82.85 was obtained.

1. Data Normality Test

The data normality test is a test about the normality of the data distribution. The purpose of the data normality test is to find out whether the data taken is normally distributed data or not. The normality test used in this study is the liliefors test using the help of Ms Excel 16. The results of the normality test of the control class and the experiment can be seen in the table presented below.

Table 4. Results of the Normality Test of Pre-test Data of the control class

No	X	F	Z	F(z)	S(z)	S(z)- F(z)	MaxS(z)- F(z)
1	38	2	- 1.1614	0.12274	0.10	- 0.0227	0.187
2	38	2	- 1.1614	0.12274	0.10	- 0.0227	
3	39	3	- 0.8944	0.18555	0.25	0.0644	
4	39	3	- 0.8944	0.18555	0.25	0.0644	
5	39	3	- 0.8944	0.18555	0.25	0.0644	
6	40	3	- 0.6274	0.26519	0.40	0.1348	
7	40	3	- 0.6274	0.26519	0.40	0.1348	
8	40	3	- 0.6274	0.26519	0.40	0.1348	
9	41	1	- 0.3604	0.35926	0.45	0.0907	
10	42	4	- 0.0934	0.46278	0.65	0.1872	
11	42	4	- 0.0934	0.46278	0.65	0.1872	
12	42	4	- 0.0934	0.46278	0.65	0.1872	
13	42	4	- 0.0934	0.46278	0.65	0.1872	
14	43	2	0.1735	0.56889	0.75	0.1811	
15	43	2	0.1735	0.56889	0.75	0.1811	
16	45	2	0.76038	0.76038	0.85	0.0896	
17	45	2	0.76038	0.76038	0.85	0.0896	
18	49	1	1.7755	0.97935	0.90	- 0.0621	
19	50	2	2.0424	0.97945	1.00	0.0206	

20	50	2	2.0424	0.97945	1.00	0.0206	

The results of the analysis of the normality test of pre-test data in the control class can be seen in Table 3. It can be seen that the value of {Lcount = the largest value of│S(zi)│ – │ F(zi)│} is 0.187, where the value of Ltable in the Liliefors table of significance (0.05) is 0.190, then 0.187 < 0.190 so that H0 is accepted minus H1.

Table 5. Results of the Control Class Post-test Data Normality Test

NO	X	f	Z	F(z)	S(z)	S(z)-F(z)	MAX S(z)-F(z)
1	70	1	-1.9803	0.02383303	0.10	0.0762	0.127
2	70	1	-1.9803	0.02383303	0.10	0.0762	
3	73	1	-1.2602	0.1037964	0.20	0.0962	
4	73	1	-1.2602	0.1037964	0.20	0.0962	
5	75	2	-0.7801	0.217656767	0.30	0.0823	
6	75	2	-0.7801	0.217656767	0.30	0.0823	
7	77	1	-0.3001	0.382069303	0.35	-0.0321	
8	79	2	0.1800	0.571435619	0.45	-0.1214	
9	79	2	0.1800	0.571435619	0.45	-0.1214	
10	80	4	0.4201	0.662783117	0.65	-0.0128	
11	80	4	0.4201	0.662783117	0.65	-0.0128	
12	80	4	0.4201	0.662783117	0.65	-0.0128	
13	80	4	0.4201	0.662783117	0.65	-0.0128	
14	81	2	0.6601	0.74540876	0.75	0.0046	
15	81	2	0.6601	0.74540876	0.75	0.0046	
16	82	3	0.9002	0.815980215	0.90	0.0840	
17	82	3	0.9002	0.815980215	0.90	0.0840	
18	82	3	0.9002	0.815980215	0.90	0.0840	
19	83	1	1.1402	0.87289685	1.00	0.1271	
20	83	1	1.1402	0.87289685	1.00	0.1271	

The results of the analysis of the normality test of post-test data in the control class can be seen in Table 4. It can be seen that the value {Lcount = the largest value of │S(zi)│ – │ F(zi) │} is 0.127, where the value of Ltable in the Liliefors table of significance (0.05) is 0.190, then 0.127 < 0.190 so that H0 minus H1 is accepted.

Table 6. Results of the Normality Test of Pre-test Data for Experimental Classes

NO	X	f	Z	F(z)	S(z)	S(z)-F(z)	MAX S(z)- F(z)
1	32	3	-1.31007	0.095086	0.15	0.054914376	0.181
2	32	3	-1.31007	0.095086	0.15	0.054914376	
3	32	3	-1.31007	0.095086	0.15	0.054914376	
4	33	3	-1.04271	0.148541	0.30	0.151458899	
5	33	3	-1.04271	0.148541	0.30	0.151458899	
6	33	3	-1.04271	0.148541	0.30	0.151458899	
7	34	2	-0.77535	0.219067	0.40	0.180933310	
8	34	2	-0.77535	0.219067	0.40	0.180933310	
9	37	3	0.02674	0.510665	0.55	0.039335079	

10	37	3	0.02674	0.510665	0.55	0.039335079	
11	37	3	0.02674	0.510665	0.55	0.039335079	
12	39	2	0.56146	0.712758	0.65	-0.062757910	
13	39	2	0.56146	0.712758	0.65	-0.062757910	
14	40	5	0.82882	0.796397	0.90	0.103602711	
15	40	5	0.82882	0.796397	0.90	0.103602711	
16	40	5	0.82882	0.796397	0.90	0.103602711	
17	40	5	0.82882	0.796397	0.90	0.103602711	
18	40	5	0.8288229	0.796397	0.90	0.103602711	
19	43	2	1.63091	0.948545	1.00	0.051454992	
20	43	2	1.63091	0.948545	1.00	0.051454992	

The results of the analysis of the normality test of pre-test data in the experimental class can be seen in Table 5. It can be seen that the value {Lcount = the largest value of │S(zi)│ – │ F(zi) │} is 0.181, where the value of Ltable in the Liliefors table of significance (0.05) is 0.181, then 0.181 < 0.190 so that H0 is accepted minus H1.

Table 7. Results of the Normality Test of Post-test Data of the Experimental Class

NO	X	f	Z	F(z)	S(z)	S(z)-F(z)	MAX S(z)-F(z)
1	75	2	-1.5642	0.05889	0.10	0.0411	0.165
2	75	2	-1.5642	0.05889	0.10	0.0411	
3	76	1	-1.3649	0.08614	0.15	0.0639	
4	79	2	-0.7671	0.2215	0.25	0.0285	
5	79	2	-0.7671	0.2215	0.25	0.0285	
6	80	4	-0.5679	0.28506	0.45	0.1649	
7	80	4	-0.5679	0.28506	0.45	0.1649	
8	80	4	-0.5679	0.28506	0.45	0.1649	
9	80	4	-0.5679	0.28506	0.45	0.1649	
10	82	1	-0.1694	0.43275	0.50	0.0672	
11	83	2	0.0299	0.51192	0.60	0.0881	
12	83	2	0.0299	0.51192	0.60	0.0881	
13	85	1	0.4284	0.66582	0.65	-0.0158	
14	86	1	0.6277	0.73489	0.70	-0.0349	
15	88	2	1.0262	0.84759	0.80	-0.0476	
16	88	2	1.0262	0.84759	0.80	-0.0476	
17	89	2	1.2254	0.88979	0.90	0.0102	
18	89	2	1.2254	0.88979	0.90	0.0102	
19	90	2	1.4247	0.92288	1.00	0.0771	
20	90	2	1.4247	0.92288	1.00	0.0771	

The results of the analysis of the normality test of pre-test data in the experimental class can be seen in Table 5. It can be seen that the value of {Lcount = the largest value of │S(zi)│ – │ F(zi) │} is 0.165, where the value of Ltable in the Liliefors table of significance (0.05) is 0.190, then 0.165 < 0.190 so that H0 minus H1.

2. Homogeneity Test

The homogeneity test was carried out to determine whether the sample data came from a homogeneous or heterogeneous population between two groups, namely the experimental group and the control group. The homogeneity test used in this study is the Fcount test using the help of Microsoft excel 2016. The results of the homogeneity test can be seen in Table 8.

Table 8. Results of Pre-test and Post-test Homogeneity Test for Control and Experimental Classes

Homogeneity	Pretest	Posttest
Smallest variance	13.99	17.36
Largest variance	14.03	25.19
Fcount	1.00	1.45

Based on the results of the homogeneity of the pre-test and post-test data in Table 6, the Fcount value for pre-test data is 1.00, and the Fcount value for post-test data is 1.45. The value of Ftable with a significant level of 0.05 is 2.17, where the numerator (df) value is n-1= 20-1 = 19. The denominator value (df) is n-1=20-1=19 because Fcount (pre-test data) < Ftabel = 1.00 < 2.17, then accept H0 minus H1 or the pre-test data of the two classes is homogeneous because Fcount (post-test data) < Ftabel = 1.45 < 2.17 then accept H0 minus H1 or the post-test data of both classes is homogeneous. Thus, it can be concluded that both samples come from homogeneous data.

3. Hypothesis test

After conducting a prerequisite test, the analysis resulted in the data's conclusion being normally distributed and having a homogeneous variance. Hypothesis testing was carried out to determine whether the Realistic Mathematic Education (RME) Approach with the Problem-Solving Learning Model affects student learning outcomes in mathematics learning of the Two-Variable Linear Equation System material.

Table 9. Difference between Pre-test and Post-test data / Gain Score of Control Class and Experimental Class

No	Data Difference	
	Control Classes	Experimental Classes
1	33	56
2	32	43
3	34	40
4	31	46
5	41	38
6	33	40
7	37	48
8	44	42
9	40	47
10	35	48

11	40	52
12	38	46
13	41	46
14	27	58
15	41	48
16	40	49
17	29	43
18	41	46
19	25	36
20	36	47
Sum	718	919
Minimum Score	25	36
Maximum Score	44	58
Average	35.9	45.95
Standard Deviation	5.29	5.49
Varians	27.99	30.16

Based on the results of the Gain Score data hypothesis test using the help of Ms. Excel 2016, the value of the Tcount > Ttable was obtained. The Tcount value obtained was 5.89, while the Ttable value obtained was 1.7247; in accordance with the test criteria, H_0 was accepted. Thus, it can be concluded that the Realistic Mathematic Education (RME) Approach has a positive influence with the Problem-Solving Learning Model for learning mathematics material of the Two-Variable Linear Equation System.

CONCLUSION

Based on the results of this study and the discussion that has been described, it can be concluded that the hypothesis in this study is that there is an influence of the Realistic Mathematic Education (RME) Approach with the Problem-Solving Learning Model on student learning outcomes in mathematics learning material of the Two-Variable Linear Equation System.

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