Determination of Realistic Mathematics Education on Problem Solving with Numeracy Literacy Covariables

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Abstrak

Kemampuan pemecahan masalah dalam kehidupan sehari-hari merupakan kompetensi utama yang harus dimiliki oleh peserta didik pada abad ke-21 seperti saat ini. Pendidikan matematika realistik mampu menjembatani konsep abstrak matematika yang diperoleh di dalam kelas dengan dunia nyata. Maka dari itu penelitian ini bertujuan untuk menganalisis pengaruh pendidikan matematika realistik terhadap pemecahan masalah dengan kovariabel literasi numerasi pada siswa kelas IV sekolah dasar. Penelitian ini merupakan penelitian eksperimen dengan menggunakan desain The Posttest-Only Control-Group Design. Sebanyak 50 siswa dipilih sebagai subyek penelitian. Data literasi numerasi dikumpulkan menggunakan tes literasi numerasi dan data pemecahan masalah menggunakan tes pilihan ganda. Data dianalisis menggunakan analisis kovariat. Hasil penelitian menunjukkan bahwa terdapat pengaruh pendidikan matematika realistik terhadap pemecahan masalah sebesar 18,235, setelah kovariabel literasi terkontrol sebesar 30,464 dan besarnya kontribusi literasi numerasi terhadap pemecahan masalah sebesar 59,4%. Hasil penelitian ini memiliki implikasi pada implementasi kurikulum merdeka dalam peningkatan kemampuan pemecahan masalah dan literasi numerasi siswa.

Kata Kunci: Pendidikan matematika realistik, pemecahan masalah, literasi numerasi.

Abstract

The ability to solve problems in everyday life is the main competency that must be possessed by students in the 21st century. Realistic mathematics education is able to bridge the abstract concepts of mathematics obtained in class with the real world. This study aims to analyze the effect of realistic mathematics education on problem solving with numeracy literacy covariables in fourth grade students at elementary school level. This research is an experimental research with The Posttest-Only Control-Group Design. A total of 50 students were selected as research subjects. Numerical literacy data was collected using a numeracy literacy test and problem solving data using multiple choice tests. Data were analyzed using covariate analysis. The results showed that there was an effect of realistic mathematics education on problem solving of 18.235, after the controlled literacy covariable was 30.464 and the contribution of numeracy literacy to problem solving was 59.4%. The results of this study have implications for the implementation of the independent curriculum in improving students' problem-solving skills and numeracy literacy.

Keywords: Realistic mathematics education, problem solving, numeracy literacy.

1. INTRODUCTION

Mathematics is one eye very important lessons for children, where mathematics will help students to solve those problems exist in everyday life, as well Mathematics is a tool for thinking logical and clear (Arsana et al., 2019; Kasanah et al., 2019; Septiana et al., 2018). Given the importance of learning mathematics then, sought learning must be student-centered so the process learning is more meaningful so it can realizing an increase in the quality of education (Muliandari, 2019; Mulyati, 2016). For To realize this, then the role of the teacher necessary for learning mathematics easy for students to understand. However, the teacher in teaching mathematics did not vary, the learning was carried out using the lecture method, students took notes and gave assignments. Then students work on the problem by following the example explained by the teacher. This shows that learning mathematics is less meaningful. Learning is still centered on the teacher. So that students only listen to the

teacher's explanation and become passive. Students are not involved in classroom learning and are not given the opportunity to reinvent and construct their own mathematical ideas. The teacher's way of teaching mathematics makes mathematics a less attractive subject for students. Students think mathematics is a difficult subject. So that students are not enthusiastic about working on the practice questions given by the teacher. In addition, the low level of understanding of the concept of counting in mathematics lessons makes it difficult for students to work on math problems. Based on observations at SDN 1 Banjar Tegal, researchers obtained information that 75% of students had not achieved mastery learning, namely 75. After calculating the numeracy literacy, the average was 50. This fact shows that numeracy literacy at that school is still low. The results of interviews with subject teachers stated that students experienced difficulties in learning mathematics. This is because students are not fluent in using the arithmetic operations of multiplication, addition, subtraction and division. As well as not being careful in calculating it and when students don't understand they are embarrassed to ask in learning. In addition, the current curriculum at SDN 1 Banjar Tegal is dense with lots of lessons so students are burdened to master lesson after lesson. If left unchecked, this will have an impact on students numeracy literacy.

Previous study stated that problem solving abilities can be formally trained in schools through learning and assessment (Setiawan et al., 2020). Teachers should be able to create a learning climate that is able to facilitate the development of students' problem-solving abilities. Other study stated that creative thinking is a characteristic of skills that students must have to support problem-solving abilities (Malik et al., 2019). With high creativity, students have better problem solving abilities. They have various ways to solve problems either through modification activities or creating new ways that have never been done before. However, the teacher in teaching mathematics did not vary, the learning was carried out using the lecture method, students took notes and gave assignments. Then students work on the problem by following the example explained by the teacher. This shows that learning mathematics is less meaningful. Learning is still centered on the teacher. So that students only listen to the teacher's explanation and become passive. Students are not involved in classroom learning and are not given the opportunity to reinvent and construct their own mathematical ideas. The teacher's way of teaching mathematics makes mathematics a less attractive subject for students. Students think mathematics is a difficult subject. So that students are not enthusiastic about working on the practice questions given by the teacher. In addition, the low level of understanding of the concept of counting in mathematics lessons makes it difficult for students to work on math problems.

One of the efforts to overcome the problems previously described is through improving learning with an approach that allows for better student mathematics learning outcomes. The approach that can be used is the realistic mathematics education approach. The Realistic Mathematics Education (RME) is an approach to learning mathematics that starts with a real problem and then with a tiered mathematization process, is brought to a formal form with a pleasant learning atmosphere (Sulastri et al., 2017; Wahyuni et al., 2019; Wardono et al., 2018). This learning is different from mathematics learning so far which tends to be oriented towards providing information and using ready-made mathematics to solve problems. Through a realistic mathematical approach students are not only given problems found in everyday life, but students also have to solve these problems. In other words, a realistic mathematical approach will provide opportunities for students to discover and reconstruct mathematical concepts so that students have a strong conceptual understanding. The characteristics of PMR include, 1) using real-world contexts, 2) using models, 3) using production and construction, 4) using interactive, and 5) using relationships (Setiani et al., 2015; Tutiareni et al., 2021). According to previous study problems presented in subjects There are 2 types of mathematics (Suparman & Arifin, 2021), namely: (1)

problems that are routine in nature, generally problems that are used to test the application of certain mathematical concepts, formulas, or theorems. For solve routine problems, students only need to understand mathematical concepts and how to use it to solve the problem; (2) non-routine problems namely a new problem for students, meaning that the problem has different characteristics with problems that students often encounter before. To complete non-routine problems, requiring high innovation and creativity (Astriani et al., 2017; Istiana et al., 2020; Zulkipli & Ansori, 2018). Learners are not enough by imitating the steps of completion such problems as he had encountered. Students must take certain additional steps, for example modifying the solution to a problem that has been carried out or make the stages of solving non-routine problems into it known problem solving. It is also possible to do with transferring non-routine problems to problems he has known before (Fauzan et al., 2017; Lauren et al., 2018).

Problems that are not routine can be solved with skill higher-order thinking skills (HOTS). Previous study stated that the cognitive level included in the realm of higher order thinking skills includes the ability to analyze, evaluate, and create (Widana et al., 2020). Other study suggests that non-routine problem-solving stages can be formulated as follows: (a) identify and understand the characteristics of the problem, (b) group/organize known relevant data, (c) create a model problem formulation in the form of mathematical symbols; (d) choose an approach or strategy appropriate to solve problems, (e) create or develop approaches problem solving, and (f) conclude, interpret or interpret completion of the mathematical model obtained to solve the problem (Indrawanti et al., 2019).

RME corresponds to the concrete operational stage of students' thinking because teachers can present learning that is close to students' daily lives, and teachers can present concrete objects according to students' experiences. Mathematics learning starts from the reality that exists in everyday life. Contextual problems experienced by students can be used as a starting point for learning mathematics in helping students understand mathematics (Lady et al., 2018; Nirawati et al., 2021; Nurhasanah et al., 2019). This approach is appropriate to be applied in elementary schools because it can help students understand concepts in mathematics that are abstract in nature. Therefore learning mathematics with a realistic mathematics education approach needs to be applied to carry out an analysis regarding how much influence it has on students' mathematics learning outcomes in the material on KPK and FPB, which students initially considered difficult.

Some research that has conducted previously, including research that shows effective realistic approach to learning mathematics in terms of learning achievement and self-confidence students' mathematics but not effectively reviewed of problem solving ability (Sopia & Wutsqa, 2020). Realistic approach is more effective than conventional learning in terms of learning achievement, solving ability problems, and mathematical confidence student. Research conducted by other study show there is a difference in the increase in ability given problem solving learning mathematics with the RME and Discovery learning Autograph assisted tutoring (Lubis et al., 2020). Moreover there is study shows that characteristic intertwining in the mathematical approach realistic emphasis on learning sequences as a link in a network learning to be utilized in problem solving (Julie, 2016). Things are done teacher to form a network network learning is to make a series problem explored and solved students to formal knowledge of mathematics well accomplished. So, the RME approach will have a positive influence on the learning process. This research is focused on overcoming problems related to mathematic problem solving abilities and students' low numeracy literacy. The research objective was to analyze the effect of realistic mathematics education on problem solving with numeracy literacy covariables in fourth grade students at SDN 1 Banjar Tegal. With the application of RME, it is hoped that it will be

able to handle the problems faced by students related to mathematical problem solving skills and numeracy literacy.

2. METHODS

This research basically uses a single factor experimental research design with independent groups design with the use of covariates. The experimental research design used in this study was a single factor independent groups design with use of covariate. The design of this study can be presented in the following Table 1.

Table 1. Single Factor Independent Groups Design with Use of Covariate

A$_1$		A$_2$	
X	Y	X	Y

Information:
A1   : Treatment factor (realistic mathematics education)
A2   : Control factors (conventional learning)
Y   : Problem solving
X   : Numerical literacy covariable

The experimental design in this study used two groups, namely the experimental group and the control group. This research was conducted at SDN 1 Banjar Tegal in class IV students with a single factor design independent groups design with use of covariate. The population in this study was. Determination of the sample in the study was carried out by random sampling of the class. The sample in this study amounted to 50 people. The independent variable of this study uses realistic mathematics education. The dependent variable in this study is problem solving ability with numeracy literacy covariable. The data collected in this study are: 1) data on the attitude of the problem solving abilities of students who take part in realistic mathematics education. 2) Numerical literacy data of students participating in realistic mathematics education 3) Data of problem solving abilities of students participating in the conflict resolution learning model. 4) Numerical literacy data of students participating in conventional learning. Numerical literacy data was collected using a numeracy literacy test and problem solving data using multiple choice tests. Data were analyzed using covariate analysis. Research data were analyzed in stages. These stages are data description, prerequisite test, and hypothesis test. The prerequisite tests carried out were the data normality test and the variance homogeneity test. Data description of problem solving ability and numeracy literacy based on data tendencies, including: mean, median, mode, standard deviation, variance, maximum score range, and minimum score. Hypothesis testing was carried out by the F test through covariance analysis with the test criteria for a significance level of F = 5%. If the calculated F significance number is less than 0.05, then the null hypothesis is rejected, meaning that there is a significant difference and vice versa if the calculated F significance number is greater than or equal to 0.05, then the null hypothesis is accepted, meaning that there is no significant difference from the average gain the score (Candiasa, 2007; Setiani et al., 2015).

3. RESULTS AND DISCUSSION

Result

Based on the research conducted, it can be seen that the results of the tests posttest revealed that the average value of the experimental group was 70.333 and the average value

of the control group was 69.241. There were differences in learning outcomes in the two groups due to differences in treatment in learning. The experimental group applied a realistic mathematics education approach and the control group did not apply a realistic mathematics education approach. Based on the analysis of the normality test using the Chi-square formula, the tcount is 10.86 and the ttable with a significance level of 5% and dk = 5 is 12.070. This means that tcount < ttable, then the post-test results of the experimental group are normally distributed. Meanwhile, the tcount of the post-test results for the control group was 10.85 with a significance level of 5% and dk = 5 was 12.070. This means that t count < t table, then the data from the post-test results of the control group are normally distributed.

After carrying out the normality test, then the homogeneity test is carried out using the F-test formula. Based on the analysis of the homogeneity of variance test, it was obtained that Fcount = 1.267 while Ftable with a significance level of 5% and dk 28 and dk denominator 27 was 1.97. This means that Fcount <Ftable, so that the variance of the data on mathematics learning outcomes of the experimental group and control group students is homogeneous. Based on the results of the prerequisite test, namely the normality test and homogeneity test, the results obtained were: 1) the distribution of data on mathematics learning outcomes of students in the experimental group and control group was normally distributed, 2) the variances of the experimental group and the control group were homogeneous. Hypothesis testing was carried out in this study using the covariance analysis formula. The recapitulation of the results of calculating the scores of the four variables can be seen in Table 2 and Table 3.

Table 2. Hypothesis testing

Group	RJK	N	F	Sig
A1	1238.615	25	18.235	Sig
A2	135.828	25	12.721	Sig
A1	7300.677	25	30.464	Sig
A2	3721.729	25	22.738	Sig

Table 3. Hypothesis testing

Model	R	R squared	R Square alignment	std. error
1	0.771	0.594	0.295	10.72258

Based on Table 1, and Table 2 the results are obtained there was an effect implementing realistic mathematics education on solving unstructured problems with the numeracy literacy covariable of 18,235, after the controlled literacy covariable was 30,464 and the magnitude of the contribution of numeracy literacy to unstructured student problems was 59.4%. These results are expected to be input as reference in improving students mathematical problem solving abilities and numeracy literacy.

Test the hypothesis in this study using the Anakova formula. If it is known that there is an interaction between realistic mathematics learning and students' numeracy literacy on students' unstructured problem solving, then proceed with the Tukey test to find out which interaction effect is better. The results showed that there was an effect implementing realistic mathematics education on solving unstructured problems with the numeracy literacy covariable of 18.235, after the controlled literacy covariable was 30.464 and the magnitude of the contribution of numeracy literacy to unstructured student problems was 59.4%. These results are expected to be input as reference in improving students mathematical problem solving abilities and numeracy literacy.

Discussions

Based on the results of the research that has been described previously, there are differences between classes taught with RME and classes taught with conventional classes. The significant difference between groups of students who were taught using RME and groups of students who were taught using conventional learning models was due to differences in the treatment of the learning steps and the process of delivering the material. The application of this approach gives more opportunities for students to actively participate in learning. This is reflected in the steps of RME learning in the problem solving phase, presentation phase, work results, reflection and evaluation. In the problem-solving phase, students are given the freedom to think actively according to their own ideas and ideas in finding and understanding a concept and building their own knowledge.

In the presentation phase of the student's work, they present the results of solving problems on the problems given by the teacher using existing media. Thus students express their perspectives and understanding in solving problems so that students give reasons for their answers and provide responses to their friends' questions. Conditions like this will foster students' self-confidence. Self-confidence is a positive attitude of an individual that enables him to develop a positive assessment, both of himself and of the environment or situation he faces (Misyanto, 2017; Nurkidam, 2016). Having self-confidence in students will encourage students to learn and solve problems well. In other words, self-confidence will have an impact on what will be achieved by students, in this case the achievement of the desired learning outcomes. There is a positive relationship with a very strong and significant range of strength between self-confidence and learning outcomes (Dhayanti et al., 2018; Lauren et al., 2018). The purpose of realistic mathematics education is to provide opportunities for students to reinvent and reconstruct mathematical concepts by associating mathematical concepts with the real world, so that students have a strong understanding of mathematical concepts. Realistic mathematics education will operationally provide an understanding of the relevance and usefulness of mathematics (the material being taught) with and or in everyday life. All of these studies will be constructed independently and developed by students. In addition, problem solving does not have to be single and does not have to be the same between one student and another. Several previous studies have shown that realistic mathematics education is effective in improving students' mathematical abilities (Ahmad & Asmaidah, 2017; Alamiah & Afriansyah, 2017; Lisnani, 2019).

The realistic mathematics approach provides opportunities for students to be more active in solving learning problems and have a positive attitude towards mathematics. By solving problems on their own students will build their own knowledge and be able to develop their abilities in connecting the knowledge they already have with the problems given so that students' abilities are more complex (Tasmalina & Prabowo, 2018). By building their own knowledge the learning process will be more meaningful. This statement is supported by previous study the application of a realistic mathematical approach will help students to gain more meaningful concepts or knowledge (Astuti, 2018).

Learning with a realistic mathematics approach begins with real problems found in students' daily lives, so that the knowledge possessed by students is not abstract. This learning is in accordance with the stage of development of elementary school children who are in the concrete operational stage. At this stage, children's abilities will develop optimally if the learning process is assisted with real problems and concrete media (Nurfauziah et al., 2019; Sartika, 2019). The existence of learning with a realistic mathematical approach that is in accordance with the conditions and characteristics of children will help students to more easily participate in learning, so that this has an impact on student learning outcomes. In the reflection and evaluation phase students are invited to draw conclusions from the lesson at that time and at the end of the lesson students' work on evaluation questions on the learning

process to find out how far students understand the lesson that has taken place. This causes the learning outcomes of mathematics taught by the Realistic Mathematics Approach (PMR) to be higher than the learning outcomes of groups of students taught by conventional learning models. In line with the results of the study, the results of previous study indicate that there are differences in the effect of a realistic mathematical approach and a conventional approach on students' mathematical understanding and problem solving abilities (Fitriani & Maulana, 2016). The results of this study are supported by pre-existing research, namely research conducted that proving that there are significant differences in the competence of mathematical knowledge between the experimental group as the group taught using the PMRI approach and the control group as the group taught using conventional learning (Putu et al., 2020). The application of the PMRI approach can make students more motivated in learning and they can understand a mathematical concept through concrete media without having to think abstractly. Other research shows that a realistic approach can improve mathematical understanding abilities, by achieving and increasing the ability to understand mathematical concepts of students who get a realistic approach better than students who get a contextual approach (Tutiareni et al., 2021).

Research by the other one shows that a realistic approach is effective in learning mathematics in terms of learning achievement and students' mathematical confidence but ineffective in terms of problem solving abilities (Sopia & Wutsqa, 2020). A realistic approach is more effective than conventional learning in terms of learning achievement, problem solving abilities, and students' mathematical confidence. Research conducted by previous study showed that there were differences in the increase in problem-solving abilities given by mathematics learning using the PMR approach and Autograph-assisted Guided Discovery learning (Lubis et al., 2020). Supported by research shows that the characteristics of intertwining in a realistic mathematics approach emphasize learning sequences as a fabric of learning sequences that must be utilized in solving problems (Julie, 2016). The things that the teacher does to form the fabric of the learning series are to make a series of problems that are explored and solved by students until formal knowledge of mathematics is well achieve.

However, what is used to measure students' mathematical literacy skills in this study is only the communication aspect to devising strategies for solving problems because using symbolic, formal and technical language and operations is not suitable when applied at the Madrasah Ibtidaiyah or Elementary School level, because this aspect contains about involvement, understanding and use of formal constructions based on definitions, rules and formal systems and using algorithms, besides that the previous aspects have also been able to represent this aspect. While for aspect of using mathematical tools is also not suitable because it is at the Madrasah Ibtidaiyah or Elementary School level because at this level students are not allowed to use mathematical calculation aids such as calculators and computers. From all the description above, based on indicators of numeracy literacy ability, it can be seen that the class that was treated with the RME learning model had higher abilities compared to that which was treated with conventional learning models. In experimental class students whose learning uses the RME model generally prioritizes the use of contextual problems and students are given the freedom to find ways of solving the questions that have been given. aware of not going through the process of correct problem-solving stages. Students who are not accustomed to explaining the results and re-examining the results of the work make students' answers become more mistakes and deficiencies that are not in accordance with the indicators of numeracy literacy skills by using the RME learning model. This is supported by the results which states that "The use of RME steps can improve students' problem solving abilities, this is evidenced by an increase in the average value before the action is 55 with learning completeness 53 %, the average value of the first cycle is 64 with learning mastery of 69%, and the second cycle is 76 with learning completeness of

90% (Trisnawati et al., 2018). In addition to the research conducted by other stated that "The results of this study indicate that the average mathematical literacy ability of the experimental class students has achieved classical mastery, increasing the mathematical literacy skills of the experimental class students is more better than the control class (Negara et al., 2021).

By looking at the essence of realistic mathematics and conventional learning approaches and related to the characteristics of students who have high numeracy literacy, it seems that realistic mathematics is more suitable for students who have high numeracy literacy. Thus, for students who have high numeracy literacy, the unstructured problem solving of students who take realistic mathematics lessons is higher than students who take lessons with a conventional learning approach which has been proven in this study. Based on this description, an effective realistic mathematical approach is used to improve unstructured problem solving and numeracy literacy of fourth grade students at SDN 1 Banjar Tegal. Learning with the RME Approach has a positive influence on the learning process. Applying a realistic mathematical approach will help students learn how to solve problems found in their daily lives. By solving problems found in everyday life it makes students more active and of course student activity influences learning outcomes. If, this learning model is applied in accordance with the syntax, this learning will provide a solution to the learning outcomes of mathematics and can even be applied to subjects other than Mathematics

4. CONCLUSION

Based on the analysis and discussion as described above, the conclusions that can be drawn are the results showed that there was an effect implementing realistic mathematics education on solving unstructured problems with the numeracy literacy. The results of the study showed that the students' numeracy literacy achieved by the class that took part in realistic mathematics education was better than the class that took part in conventional learning. So it can be concluded that realistic mathematics education affects the ability to solve unstructured problems with numeracy literacy covariables. These results are expected to be input as reference in improving students mathematical problem solving abilities and numeracy literacy.

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