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Influence a Realistic Mathematics Education Approach and Motivation on Students' Mathematical Reasoning Ability

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Abstract

The purpose of the research was to provide knowledge of the effect of the Realistic Mathematics Education (RME) approach and motivation on students' mathematical reasoning abilities. This quasi-experimental study employed a pretest-posttest control group design, focusing on fifth-grade students at SDN Lulut 05, Klapanunggal District. Class VA was selected as the experimental group, while class VB served as the control group using purposive sampling. Data analysis involved the *N*-gain formula and *t*-test. The results shown: (1) There is a difference in the increase in students' mathematical reasoning ability after being given the RME approach indicated by the N-gain value of 55.5 in the medium category and for the experimental class 36.8 in the low category, then the control class in the *t*-test (independent) so that the Sig value is obtained. 0.001<0.005, as for deciding in the independent sample *t*-test. It is concluded that there is a significant difference between the average score mathematical reasoning ability by students treated with the RME approach and the Conventional approach. (2) There is an influence of the RME approach on students' mathematical reasoning abilities with an effect size score of 1.44 which is in the high category.

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INTRODUCTION

Educational goals can optimally be realized by presenting quality learning, for this there are several points to pay attention to, including planning student-centered learning, especially related to the skills or competence of educators (Charoline et al., 2020). Educators are facilitators in learning, meaning that educators provide direction and facilities for students to develop their potential, to become effective educators according to (Stronge, 2007) "effective educators demonstrate high expectations for students and select strategies to propel the students' learning. Beyond planning and preparation of materials, effective organizing for instruction also involves the development of a conscious orientation toward teaching and learning as the central focus of classroom activity. Teaching and learning as a focus must be consistently communicated to students in the classroom and to observers that effective educators display high expectations for students and choose strategies to encourage student learning. Beyond planning and preparing materials, effective organizing for teaching also involves developing a conscious orientation towards teaching and learning as the primary focus of classroom activities. Teaching and learning as a focus must be communicated consistently to students in class and to observers.

According to Freudenthal, mathematics is not a body of mathematical knowledge, but the activity of solving problems and looking for problems, and, more generally, the activity of organizing material from reality or mathematical material - which is called "mathematizing". he clarified what mathematics was: "mathematics without mathematization does not exist". For this reason, educators need to find out the context, create appropriate contexts support students to construct mathematical knowledge. some other suggestions for educators to find and create contexts for learning mathematics, namely: the history of mathematics in context; context in real life (life of elementary school students: games, shopping, saving and using money, movies,...; social issues: traffic, weather forecast, lottery, ...); integrated education (mathematics Physics, Chemistry, Information Technology, etc.) (Trung, Thao, & Trung, 2019).

Another opinion argues that realistic mathematics learning is the use of reality as well as the environment so that students can understand it so that the mathematics learning process can run optimally, and achieve the goals of mathematics education better than in the past and approaches in learning use contexts that can make students describe their learning and real in the minds of students. This is in accordance with the stages of development of elementary school students who are in the concrete operational stage, especially elementary school students aged 7-12 years (Herzamzam & Rahmad, 2020; Rimadona, Fitriani, & Robandy, 2018; Suprayogo, Sutrisno, & Supandi, 2019). The RME model focuses on learning mathematics which focuses on the daily lives of students (contextual) which presents things that are essentially real to be taught to students using the RME approach and its principles

Mathematics learning is expected to be based on contextual problems, so that students understand more about mathematical material, and it will not be difficult for students to understand abstract mathematical material. Gusnarsi, Utami, and Wahyuni (2017), Putri, Isrok'atun, and Kurnia (2017), Hasan, Pomalato, and Uno (2020), Ariati and Juandi, (2022) the role of the educator must be able to carry out the RME approach. According to Trung et al. (2019) several important principles of teaching Mathematics based on RME as follow. The first, activity Principle. The learner as an active subject in the teaching process whose activity is a key factor for the outcome of this process. Therefore, the best way to learn Mathematics is by solving mathematical problems. The second is the reality principle. Requires students to apply mathematical knowledge by solving practical problems and mathematics education must start from meaningful practical situations with learners in order to provide opportunities to work with these meanings into the structure of mathematics in the minds of students. The third is the principle of levels. It is emphasizing cognitive development with various levels of learning mathematics: from non-mathematical contexts that involve knowledge, with symbols, diagrams, to the content of pure mathematical knowledge. This approach to learning is important as a means between informal experience, the mathematical context involved, and pure mathematical knowledge. The approach here can be understood as mathematical modeling.

Fourth, the principle of interweaving: Students are placed in various situations where they can perform various types of interrelated tasks (reasoning, calculating, statistics, performing algorithms, etc.), using many Mathematical knowledge and tools from different disciplines, even other sciences. Fifth, principle of Interactivity: encourage interpersonal and group activity to create opportunities for individuals to share skills, strategies, inventions, ideas, etc. with other students. In return, they can benefit from others for cognitive and personal development. Sixth, the principle of guidance can be described as a guided reinvention process in mathematics instruction. In particular, educators need to design scenarios or situations (or contexts) that are potentially rich in activities, the implementation of which can create meaningful cognitive leaps for students.

So important is the role of educators in presenting lessons, especially mathematics, it is not uncommon for some students to dislike mathematics because thinking about mathematics is a subject that has been considered difficult so far. Based on this, effective educators will be able to increase student motivation and present lessons that arouse the interests and needs of students, with high motivation in a lesson, the hope for the realization of learning will be achieved optimally, this is in line with the opinion of Suprayogo et al. (2019) that students who have high learning motivation, have enthusiasm and have high enthusiasm in learning and do not give up easily solving problems, the higher the learning motivation of students, the better their learning achievement. Students who have high learning motivation will easily understand the questions and determine the direction of solving the problems being worked on.

To turn on learning motivation, a learning approach is needed so that it answers the characteristics of abstract mathematics through an approach that is based on real or realistic, this approach is known as the realistic math education (RME) which is a solution that is considered appropriate in answering these characteristics of mathematics, because realistic mathematics which allows learning emphasizes all aspects of the potential of students to develop, here the role of the educator again becomes an important thing in generating motivation through the approach realistic math education (RME). Another is how the approach is expected to be able to turn on motivation and improve mathematical reasoning abilities.

Motivation as a mental drive can move and give direction to human behavior, one of which is learning behavior. In motivation there is a desire that makes active, moving, channeling, and, giving direction to the attitudes and behavior of a person learning (Dimyati & Mudjiono, 2006), based on this, educators must be able to build student motivation to enjoy and like a subject (Rahman & Mirati, 2019) is in line with their opinion. According to Munawaroh, Santosa, and Wahyuningrum (2020) motivation has a large influence on teaching and learning activities carried out by educators. learning and in education. To be able to bring out the motivation of students in learning,

In general, motivation is an encouragement to change the energy within yourself into the form of real activity in order to achieve the goals you want to achieve. The function of motivation itself, including: (1) giving encouragement so that behavior or actions arise, if motivation is not visible then an action does not appear as an example of learning; (2) as a direction, the intention is to move actions towards achieving the desired goal; (3) as a mover. Motivation has a role like a machine, meaning that the amount of motivation can determine the speed in a job (Octavia, 2021).

Reasoning ability is one of the important mathematical abilities in mathematics, according to what is stated in the book (Van de Walle, Karp, & Bay-Williams, 2014) namely "Reasoning and Proof Standard Instructional programs from prekindergarten through grade 12 should enable all students to Recognize reasoning and proof as fundamental aspects of mathematics, Make and investigate mathematical conjectures, Develop and evaluate mathematical arguments and proofs, Select and use various types of reasoning and methods of proof"that the Reasoning and Proofing Standards Instructional programs from kindergarten to grade 12 should enable all learners to recognize reasoning and proof as basic aspects of mathematics, make and investigate mathematical conjectures, develop and evaluate mathematical arguments and proofs, select and use different types of reasoning and the method of proof.

According to Nababan (2020) that mathematical reasoning can be classified into two types, namely inductive reasoning and deductive reasoning. Inductive reasoning is based on cases or examples to observe and draw general conclusions. This reasoning makes it easier to map the problem so that it can be used for other similar problems. Other forms of inductive reasoning include: analogy conclusions, generalizations, evaluation or assessment of answers and the process of solving and forming hypotheses. Inductive reasoning is classified into low or high mathematical reasoning depending on the complexity of the situation. Deductive reasoning is a reasoning process derived from general knowledge of principles or experience to conclusions about something specific (Ramdani, 2012). Deductive considerations include: Performing arithmetic operations, drawing logical conclusions, providing explanations about patterns, facts, properties, relationships or patterns.

Improving students' logical abilities during the learning process is the main aspect in the framework of successful learning. The higher the students' reasoning, the faster learning indicators can be achieved. Every math lesson, educators must always practice and expand mathematical thinking. Mathematical thinking is important both when creating proving or testing programs, but also when educators think with artificial intelligence systems (Nababan, 2020). In addition, according to Afinadhita and Abadi (2022) mathematical reasoning can make students think logically, critically, effectively and efficiently. This way of thinking can train students to be able to solve problem-based questions.

RESEARCH METHODS

The research was carried out at SDN Lulut 05, Klapanunggal District, Bogor Regency for fifth grade students in the even semester of the 2023-2024 academic year. Descriptive research pattern, with a quantitative approach. the research object and these variables must be defined in the operational form of each variable. This research is a quasi-experimental research that aims to see the effect of the RME approach, motivation and reasoning abilities on mathematics learning outcomes. The research population consisted of all fifth grade students at SDN Lulut 05, consisting of 63 students, with a composition of 31 male students and 32 female students. Sampling technique using purposive sampling; based on needs if it is suitable as a data source or sample with certain aspects that are believed to be able to produce maximum data. This sampling was based on consideration of the homogeneity of students which was also supported by statements from school principals, educators, and school staff. which said that the two classes used as samples had the ability to use them as research samples. In this study, the sample used was 31 students in the VA class which was the control class and VB class which consisted of 32 students at SDN Lulut 05 which was the experimental class.

RESULT AND DISCUSSIONS

The results of the research that will be presented are in the form of students' mathematical reasoning abilities on the subject of fractions using RME approach and students' learning motivation towards learning by using a RME learning model for the results of students' mathematical reasoning ability tests in this study were obtained from the results of students' pretest and posttest answers in both the experimental class and the control class. The value calculation data pretest and posttest students in the experimental class and control class can be seen in Table 1.

Tabel 1. Recapitulation of the *N*-Gain Test of Mathematical Reasoning abilities Experiment Class and Control Class Students

Class	Average Value		Gain	Category
	Pretest	Posttest		
Experiment	67.5	85.3	55.5	Currently
Control	63.7	77.7	36.8	Low

From the results of the pretest and posttest that have been carried out in the experimental class and the control class, the results show that mathematics learning using a RME approach on fractional teaching materials can improve students' mathematical reasoning abilities. This can be seen through the results of students' mathematical reasoning ability tests in the form of pretest and posttest which includes four indicators of mathematical reasoning ability including (1) the ability to present mathematical statements orally, in writing, pictures and diagrams, (2) the ability to make conjectures, (3) the ability to manipulate mathematics and (4) draw conclusions from statements.

Table 2 Data Normality Test Recapitulation

Data	Kolmogorov Smirnov			Shafiro Wilk		
	Statistic	*df*	*Sig.*	Statistic	*df*	*Sig.*
Pretest Eksperimen (RME)	.127	32	.200	.934	32	.052
Posttest Eksperimen (RME)	.140	32	.112	.934	32	.088
Pretest Control (Conventional)	.146	31	.093	.945	31	.113
Posttest Control (Conventional)	.209	31	.001	.843	31	.000

In the experimental class given treatment using a RME learning model, obtained result spretestie 67.5 increased to 85.3 so that an n-gain value of 5.55 was obtained in the medium category. As for the control class that uses a learning model conventional, obtained result spretestie 63.7 increased to 77.7 so that an n-gain value of 36.8 was obtained in the low category. This shows an increase between the experimental class and the control class is different. Therefore, homogeneity tests and normality tests were carried out as prerequisites for conducting the *t*-test. The results of the data normality test can be seen in Table 2.

Based on the output results above, it is known that the significance of Shapiro Wilk for the Pretest and Posttest variables is greater than 0.05, so it can be concluded that the variables are normally distributed. Then the *t*-test was carried out and the results of the *t*-test calculations can be seen in Table 3.

Table 3 The Calculation Results

	Levene's Test analysis		*t*-test analysis		
	F	*Sig*	*t*	*df*	*Sig*. (2-tailed)
Equal variances assumed	.360	.551	3.642	61	.001

It can be seen from the table that the *Sig*. Levene's Test for equality of Variances of 0.551>0.05 so that it means that the data variant is between group A and group B are homogeneous or the same. And based on the Independent Sample Test table in section Equal Variances assumed known value of Sig. 0.001<0.005, then as the basis for taking decision in the independent sample *t*-test it can be concluded that H_0 is rejected and Ha is accepted, so there is a significant difference between the average learning outcomes of students with the treatment by RME approach and the conventional approach. The results of the research are fully based on the learning theory put forward by Piaget that the basis for developing one's knowledge is the ongoing adjustment of one's mind to the surrounding reality and it can be concluded that learning uses the RME is able to improve students' mathematical reasoning abilities. From the results of calculations using effect size gain value effect size of 1.44 this shows the influence of the RME approach on students' mathematical reasoning abilities in Fractional language class V with high criteria.

The results of the last discussion are the learning motivation of all students towards learning using the RME approach through the results of the student learning motivation questionnaire which consists of 10 statements and students answer with what they feel, especially after receiving the learning process. The results of the student learning motivation questionnaire can be seen in Table 4.

Table 4. Recapitulation of Student Learning Motivation Questionnaire

Total	Average	Category
1320	45.20	High

The results of the student learning motivation questionnaire show that the RME approach has an influence to motivate students' learning. This can be seen through the results of the overall student learning motivation questionnaire of 45.20. If we relate it to the motivational questionnaire assessment criteria that 45.20 lies between $40.81<X\leq 50.40$ this shows the learning motivation of students who are in the high category and it can be said that the RME learning approach has an influence on students' learning motivation.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that: 1) there are differences in the increase in students' mathematical reasoning abilities after using the RME learning model in learning mathematics. This is evidenced by the N-gain value obtained, which is equal to 55.5 with the moderate category in the experimental class and 36.8 with the low category in the control class and the t-test (independent) obtained Sig values. 0.001<0.005, then referring to the basis of decision making in the independent test sample T Test it can be concluded that Ho is rejected and Ha is accepted, so there is a significant difference between the average learning outcomes of students treated with the RME approach with the Conventional; 2) There is the influence of the RME learning model on students' mathematical reasoning abilities which can be proven by the acquisition of the Effect Size score, which is equal to 1.44 in the high category; 3) There is the influence of the RME learning model on the motivation of students which can be proven by the acquisition of an average score of learning motivation of students as a whole which is equal to 45.20 in the high category.

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