The Effect of Blended Learning Model with Realistic Mathematics Education (RME) Approach on Concept Understanding and Mathematics Problem Solving Ability of Students of Junior High School 11 Bengkulu City

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Abstract. This study aims to determine the effect of the learning model Blended Learning with the Realistic Mathematics Education (RME) approach on students' conceptual understanding and problem solving abilities. This type of research is an experimental study with a quasi-experimental design which was carried out at SMPN 11 Bengkulu City in the even semester of the 2020/2021 academic year with the research population being all students of class VIII totalling 248 students and the research sample totalling 60 students consisting of 2 classes namely class VIII VIII.E as the experimental class and VIII.F as the control class. The instrument of this research is a test of concept understanding and a test of problem solving ability. Based on the Mancova statistical test, the results showed that there was an effect of the learning model Blended Learning with the Realistic Mathematics Education (RME) approach on understanding mathematical concepts and mathematical problem solving abilities together by controlling students' initial abilities.

Keywords: Blended Learning Model · Realistic Mathematics Education · Concept Understanding · Mathematics Problem Solving Ability

1 Introduction

The importance of understanding concepts and problem-solving skills in learning mathematics is stated in Permendikbud Number 22 of 2016 which states that the objectives of learning mathematics in schools are: (1) understanding mathematical concepts, explaining the relationship between concepts and applying concepts efficiently, flexible, accurate, and precise in solving problems, (2) reasoning patterns of the nature of mathematics, developing mathematics in formulating mathematical arguments and statements, (3) solving mathematical problems which include the ability to understand

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problems, develop mathematical solutions models, solve mathematical problems, and provide appropriate solutions. (4) communicate ideas to clarify problems, and (5) have an attitude of appreciating the use of mathematics in life as well as tenacious and confident in problem solving.

Based on the Minister of Education and Culture, it is very important for students to have conceptual understanding and problem solving skills in mathematics. Students must learn mathematics with understanding, actively building new knowledge from experience and previous knowledge. This is where the importance of conceptual understanding in learning mathematics, students can become effective learners. They will be able to recognize the importance of reflecting on their thinking and learning from their mistakes, so that students can solve the problems they face.

Wibowo, Hanifah, and Muchlis [1] stated that conceptual understanding is part of mathematical understanding. According to Killpatrick, Swafford, & Findell [2] understanding mathematical concepts is the ability to understand concepts, operations and relationships in mathematics. The characteristics of mathematics that have abstract objects require students to derive meaning from these abstract ideas. This means that the material provided by the teacher is not only rote but knowledge that can be understood by students. Furthermore, students can develop their understanding. This shows that students who do not understand mathematical concepts will have difficulty in working on various math problems. On the other hand, students who master these concepts can solve new, more diverse problems. Tamara et al. [3] states that understanding concepts is an important component in proficiency. Understanding concepts is very important because mastering concepts will easily develop students' ability to understand mathematics.

Learning math with understanding makes subsequent learning easier. By learning comprehension, learning mathematics makes more sense and is easier to remember and apply when students relate to new knowledge. By learning to understand the concept, the main goal of learning mathematics to create student independence can be achieved.

The indicators of concept understanding in this study are as follows: (1) restating a concept, (2) identifying examples and non-examples, (3) classifying objects according to certain properties, (4) presenting concepts in the form of mathematical representations, (5) developing the necessary or sufficient conditions for a concept, (6) utilizing and selecting certain operations, and (7) applying the concept in problem solving.

Problem solving abilities are skills and abilities that students develop when they learn to think critically and creatively, look for alternative ideas and specific steps to solve problems. (Referring to problem solving, Pólya says that to solve a problem, we will get a great discovery. Our curiosity will trigger inventive power if we solve it ourselves [4]. In this study, the problem solving indicators follow the pattern revealed by Polya. The indicators are Understanding the problem, Prepare a plan, Execute the plan, and See backwards (Checking Back Reader).

However, the reality is that in class VIII SMPN 11 Bengkulu City, class VIII students are still very difficult understand math problems let alone solve problems in problems. This can be seen from the results daily test in the form of concept understanding and problem solving problems. More from those who are not finished. This is because mathematical objects are abstract. So they have difficulty in learning it. The low value is

due to the learning that has been carried out so far is still not optimal. In learning, students should be actively involved. In addition to creating active learning, mathematics learning must be more meaningful, where teachers do not only transfer knowledge, but involve students in the implementation of learning. Learning will be more meaningful if it starts from things that are close to students. Therefore, we need an approach that is considered to make learning more meaningful. One approach to learning mathematics that is believed to be able to solve the problem is the Realistics Mathematics Education (RME) approach.

Realistic Mathematics Education (RME) is an approach in learning mathematics based on the view that mathematics is an activity. Learning mathematics means doing mathematics, of which solving contextual problems is an important part [5]. In RME theory, lessons begin with contextual materials that are real in terms of student experience [6]. Furthermore, Sembiring [6] states that RME is widely used to make children enjoy doing math, solving math problems, and developing math skills and knowledge. Arnellis et al. [7] stated that the RME approach started from contextual problems which eventually led to mathematical concepts. A mathematics teacher must be able to accommodate informal strategies proposed by students that can be used as a tool to gain formal mathematical knowledge. According to Haji and Abdullah [8], a realistic mathematics approach is an approach in learning mathematics that views mathematics as a human activity that can solve the problem.

From the various opinions above, it can be concluded that learning with Realistic Mathematics Education (RME) approach is a more meaningful learning approach, where learning starts from using contextual problems (real world) as a starting point in learning mathematics. This approach emphasizes student activities to find and build mathematical concepts, while the teacher only acts as a facilitator in learning.

According to Gravemeijer [5] there are three key heuristic principles of RME for instructional design, namely (1) Guided Reinvention through progressive mathematization. Students should be given the opportunity to build their own mathematical knowledge on the basis of the learning process through the mathematics topics presented. (2) Didactical Phenomenology, in learning mathematics, these topics must be taught by relating them to everyday phenomena, and (3) Emerging Models. Through the RME approach, students can develop their own by solving contextual problems. The mathematical model created and developed by the students serves to bridge the gap between informal knowledge and formal mathematics, which comes from the knowledge that students already have.

The results of previous research by Haji and Abdullah [8]), research by Setiani, Hanifah, and Muchlis [9], research by Oktizasari and Haji [10], research by Yulfitri, Haji and Nirwana [11], research by Arnellis et al. [7], as well as research by Widiarti [12] showed that learning with the RME approach was able to improve students' mathematical communication, arouse students' motivation and creativity to learn mathematics, improve higher order thinking skills, and improve mathematical problem solving abilities student. So that RME is also expected to be able to develop students' understanding of concepts and problem solving abilities optimally.

However, the Covid-19 had many impacts on various activities of people's lives. Both social activities, health, economy, and so on. In the world of education, teaching and learning activities that were previously usually done face-to-face, now have to be done online (online). Of course, this change in learning style raises various kinds of efforts and challenges that must be faced. One of them is the selection of a learning model that is appropriate to the current situation.

Classroom learning and e-learning each have their advantages and disadvantages. For example, the lack of learning in the classroom tends to be limited by space and time, but the advantage is that by meeting the teacher, students can immediately get feedback from the teacher on the achievements they have made. Vice versa, learning to use the internet (E-learning) is indeed not limited by space and time, but the drawback is that due to the absence of an accompanying teacher, students do not receive immediate feedback from the teacher about their achievements and students tend to experience misunderstandings. So with the combination of the two methods, Blended Learning can be the answer as a method of learning trends in the future.

Blended Learning consists of the words blended and learning. The most common meaning of Blended Learning refers to learning that combines or mixes face-to-face learning and computer-based learning. Thorne [13] describes Blended Learning as a learning activity by integrating technological advances in online with interaction and participation in conventional learning. Meanwhile, Bersin [14] defines Blended Learning as a learning activity led by traditional trainers by combining various online.

Cronje [15] stated that Blended Learning which is based on face-to-face dimensions and technology-mediated teaching. Meanwhile, Graham in Hendarita [16] mentions Blended Learning more simply as learning that combines online with face-to-face. Chaeruman [17] states that Blended Learning is a learning that combines the most relevant synchronous and asynchronous learning activities to create an optimal learning experience. In line with this opinion, Long and Hanh [18] also stated that Blended Learning is a learning approach that combines traditional face-to-face learning experiences and online.

Based on the opinions of some of these experts, it can be concluded that Blended Learning learning activities in such a way online namely online by utilizing various media and technology to support independent learning and provide learning experiences to students with offline learning, namely online learning. Conventional: with lectures, assignments, question and answer and demonstration methods, or other methods.

The Blended Learning has three important components, namely 1) online learning, 2) face-to-face/virtual learning, and 3) independent learning. Through Blended Learning, we can create a positive learning environment for interactions between fellow students, and students and their educators without being limited by space and time.

In this study, researchers will combine the Blended Learning syntax Blended Learning and incorporate RME characteristics. The syntax of learning activities with the Blended Learning with the RME approach is as follows:

a. Seeking information
   In this activity, students will be given contextual problems and students will seek information from various sources, both online delivery/demonstrations face to face in class. So that students can understand the contextual problem.

b. Acquisition of information
In this activity, students interpret and elaborate the information they get to solve problems given by the teacher.
c. Synthesizing of Knowledge
In this activity, students reconstruct knowledge through the process of assimilation and accommodation starting from the results of analysis and discussion. At this time, students can compare their answers with peers and can conclude from the information obtained through face-to-face meetings or e-learning.

Based on the description of the background above, the title of this research is Model Blended Learning Approach Realistic Mathematics Education on Concept Understanding and Mathematical Problem Solving Ability of Students of SMP Negeri 11 Bengkulu City".

2 Method

Type of research is *Quasi Experiment*. According to Arifin in Arikunto [19] *quasi experimental* research is a research design that aims to predict the situation through actual experiments, but only controls a few variables. The research design is presented in Table 1.

Description: X1 is learning model Blended Learning with Realistic Mathematical Education (RME) approach, Y1 is Final ability (posttest) understanding of mathematical concepts, Y2 is final ability (posttest) math problem solving ability, X2 is Conventional learning model.

This research was conducted at SMP Negeri 11 Bengkulu City for the 2020/2021 academic year. The researcher took class VIII in the first semester of the 2020/2021 academic year, which amounted to 248 students as the research population. The sampling technique in this study is a purposive sampling, sampling which technique by determining certain criteria or considerations [19]. In this study, a sample of 60 students was selected. The data collection technique used was a test sheet.

The instrument used was a concept understanding test and problem-solving ability test. Concept understanding is measured by a concept understanding test consisting of 8 questions with 7 indicators of concept understanding. The analysis of students' understanding of mathematical concepts is presented in detail according to the achievements of the experimental class and control class students. Analysis of problem solving abilities is presented in detail for each indicator to see clear results for each indicator. The score of each indicator is obtained from the results of the assessment of each student's answer on the problem-solving ability test. As for the steps of data analysis in the study

Table 1. Research Design

Experiment			Class Control Class		
Initial Ability	Treatment	Posttest	Initial Ability	Treatment	Posttest
X1	Y1	Y2	X2	Y1	Y2

consists of (1) descriptive analysis, (2) prerequisite tests (normality, homogeneity, and linearity tests), (3) hypothesis testing, namely using the Mancova test.

3 Result and Discussion

3.1 Description of Research Result Data

Initial Ability
Initial capability is the ability that has been owned by the students before the students follow the lessons given by the teacher. The students' initial ability in this study was the average pretest of understanding concepts and students' mathematical problem solving abilities before receiving treatment in learning. The following is the initial ability data of the experimental class and control class students is the lowest initial ability value in the experimental class is 10 and the highest value is 28.5. The average initial ability is 15.57 with a standard deviation of 4.64189. While in the control class, the lowest score in the initial ability was 5.5 and the highest value was 29.5. The average initial ability is 15.20 with a standard deviation of 5.91.

Understanding of Mathematical Concepts
Data for understanding students' mathematical concepts are the results of post- tests on understanding students' mathematical concepts. Posttest this was given after the two classes received different treatment. The following is data on understanding mathematical concepts of experimental class and control class students. In the experimental class, the lowest score was 58 and the highest score was 94. The average final test score for understanding mathematical concepts was 75.67 with a standard deviation of 9.55. Meanwhile, in the control class, the lowest score was 45 and the highest score was 89. The average value of the concept understanding test in the control class was 68 with a standard deviation of 12.70.

Concept understanding is measured by a concept understanding test consisting of 8 questions with 7 indicators of concept understanding. The analysis of students' understanding of mathematical concepts is presented in detail according to the achievements of the experimental class and control class students. The analysis of the understanding of the mathematical concepts of the experimental class students is presented in Fig. 1.

Based on Fig. 1 shows students' mathematical concept understanding scores on indicators of a concept to get an average value presentation of 100%, the indicator identifies examples and non-examples to get an average value percentage of 93%, on the indicator to classify objects according to certain properties the average value percentage is 100%. Furthermore, on the indicator presenting concepts in various forms of mathematical representation, the percentage of the average value is 77% and on the indicator of developing the necessary and sufficient conditions for a concept, the percentage of the average value is 76%. Next on the indicator of using, utilizing and selecting certain procedures or operations, the percentage of the average value is 70%. In the last indicator, namely applying the concept or algorithm to problem solving, the percentage of the average value is 65%. So we can conclude that the percentage of the highest average value of understanding students' mathematical concepts is in 2 indicators, namely the indicator restating a concept and classifying objects according to certain properties, which is

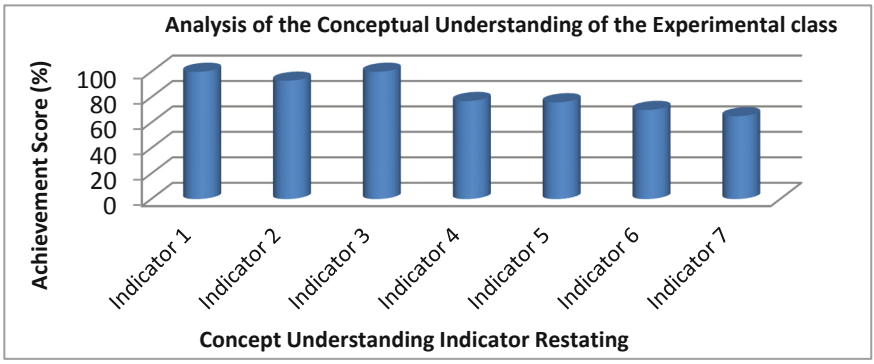

Fig. 1. Analysis of Students' Mathematical Concept Understanding Experiment Class

100% and the percentage of the average value understanding of students' mathematical concepts is lowest on the indicator. Apply concepts or algorithms to problem solving by 65%.

The high ability of students in the aspect of restating concepts and classifying objects according to certain properties is because students have good memorization skills, making it easy for them to restate a concept and classify the object according to certain properties. This can be seen when learning takes place, namely during the activity Seeking of information. Where in this activity, students will be given contextual problems and students will seek information from various sources both online, books, and delivery/demonstrations face to face in class. So that students can understand the contextual problem and can answer correctly for the problem of restating concepts and classifying objects according to certain properties.

The aspect of applying concepts or algorithms to problem solving in this study is the aspect with the lowest category among other aspects. This low aspect is because students are less able to solve problems even though they already know the operations or formulas.

In the control class, analysis of concept understanding is also presented in detail from seven indicators. The achievement of understanding students' mathematical concepts in the control class can be seen in Fig. 2.

Based on Fig. 2 shows the score of students' understanding of mathematical concepts on the indicator restating a concept obtaining an average value presentation of 100%, on the indicator identifying examples and not an example of getting an average value percentage of gets an average value percentage 90%, the indicator for classifying objects according to certain properties of 88%. Furthermore, on indicators presenting concepts in various forms of mathematical representation, the percentage of average value is 65% and on indicators of developing necessary and sufficient conditions for a concept, the percentage of average values is 65%. Next on the indicator of using, utilizing and selecting certain procedures or operations, the percentage of the average value is 61%. In the last indicator, namely applying the concept or algorithm to problem solving, the percentage of the average value is 54%. So we can conclude that the percentage of the highest average value of understanding students' mathematical concepts on restating

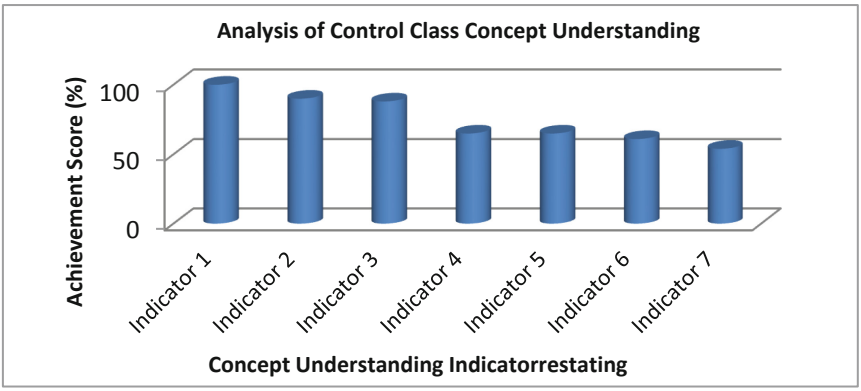

Fig. 2. Analysis of Control Class Students' Mathematical Concept Understanding

a concept is 100% and the percentage of the lowest average value of understanding students' mathematical concepts on the indicator of applying concepts or algorithms to problem solving is 54%.

From the results above, it can be seen that the understanding of the concepts of students who are taught with the conventional learning model is still low compared to the understanding of the concepts of students who are taught with the learning model Blended Learning with the RME approach.

Problem Solving Ability

Data on students' mathematical problem solving abilities are the results of post- tests on students' mathematical problem solving abilities. This was given after the two classes received different treatment. The following is the data on the mathematical problem solving ability of the experimental class and control class students. The experimental class, it can be seen that the highest score obtained in problem solving ability is 89 and the lowest value obtained is 55. For the average value of 71.70 with a standard deviation of 9.58. While in the control class, the lowest value of problem solving ability is 40 and the highest value is 85. For the average obtained is 63.53 with a standard deviation of 12.59.

Students' mathematical problem solving ability is measured by a problem solving ability test which consists of 8 questions with 4 problem solving indicators. The analysis of students' mathematical problem solving abilities is presented in detail according to the achievements of the experimental class and control class students. Analysis of the mathematical problem solving ability graders experiment presented in Fig. 3.

Based on Fig. 3 shows the score of students' problem solving ability on the indicator of understanding the problem of obtaining the average value percentage is 100%. Furthermore, on the indicator of preparing the plan, the percentage of the average value is 84% and on the indicator of running the plan/solving problems, the percentage of the average value is 78%. Next, on the indicator to check again, the percentage of the average value is 38%. So we can conclude that the percentage of the average value of the highest problem solving ability of students on the indicator of understanding the problem is

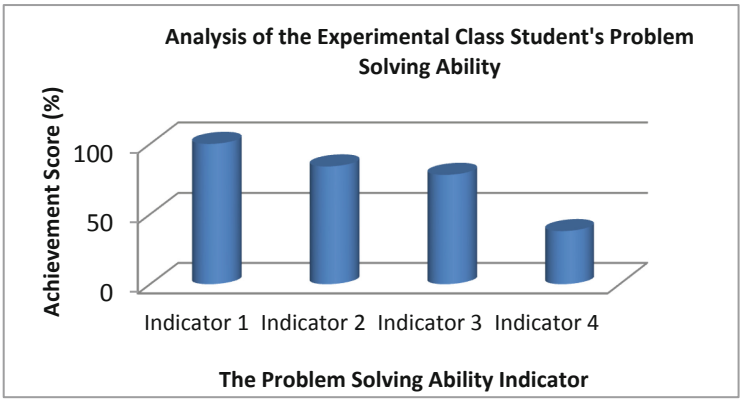

Fig. 3. Analysis of the Experimental Class Student's Problem Solving Ability

100% and the percentage of the average value of the lowest student's problem solving ability on the indicator of checking again with a percentage value of 38%.

The high ability of students in the aspect of understanding the problem is because students have good abilities in reading/literacy questions. This can be seen when learning takes place during the activity seeking of information. Where in this activity, students will be given contextual problems and students will seek information from various sources both online, books, and delivery/demonstrations face to face in class. So that students can understand the contextual problem and can answer correctly for the questions. In addition, from the post-test results, students' answers were more correct in understanding the problems in the questions.

The aspect of checking again in this study is the aspect with the lowest category among other aspects. The low aspect of re-examining students' problem-solving abilities is because students are less accustomed to double-checking whether their answers are right or wrong. Usually after solving problems and making conclusions, the questions are considered complete without checking whether their calculations are correct or incorrect.

From the results above, it can be seen that students can work on the questions quite well. However, the problem solving ability of students who are taught using conventional learning models is still low compared to the problem solving abilities of students who are taught using the learning model Blended Learning with the approach Realistic Mathematics education (RME).

In the control class, problem solving skills are also presented in detail according to the student's achievements in 4 indicators. Analysis of the mathematical problem solving ability control class is presented in Fig. 4.

Based on Fig. 4, it shows the score of students' math problem solving ability on the indicator of understanding the problem gets an average value presentation of 100%, the indicator prepares a plan to get an average score percentage of 93%, the indicator solves the problem gets an average score percentage of 59%. Furthermore, on the indicator of re-checking, the percentage of the average value is 34%. So we can conclude that the percentage of the highest average value of students' mathematical problem solving

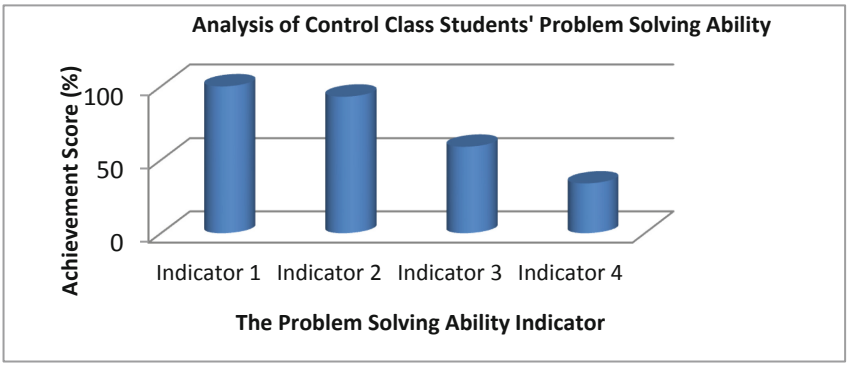

Fig. 4. Analysis of Control Class Students' Problem Solving Ability

abilities in understanding the problem is 100% and the percentage of the average value of students' problem solving abilities is lowest on the indicator. Check back by 54%.

From the results above, it can be seen that students can work on the questions quite well. However, the problem-solving ability of students who are taught using the conventional learning model is still low compared to the problem-solving abilities of students who are taught the model Blended Learning with the approach Realistic Mathematics education (RME).

3.2 Research Data Analysis

Prerequisite Test for Data Analysis

Before testing the hypothesis, the research prerequisite test was first carried out. 1) Normality Test. 2) Homogeneity Test. 3). Linearity Test. 4) Linearity Between Covariates and Each Dependent Variable in each learning method. 5) Linearity Test Between Initial Ability and Problem Solving Ability.

Hypothesis Testing Hypothesis

The results of hypothesis testing, based on the SPSS Mancova test output as follows:

H0: There is no effect of the learning model Blended Learning with the Realistic Mathematics Education (RME) approach on understanding mathematical concepts and mathematical problem solving abilities together by controlling the ability early students. H1: There is an effect of the learning model Blended Learning with Realistic Mathematics Education (RME) approach on understanding mathematical concepts and mathematical problem solving abilities together by controlling students' initial abilities.

Based on Table 2 in the Learning Model row, from the four tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root) the calculated sig value (0.000) is smaller than the reference sig (0.05). Thus, it can be concluded that the learning model *Blended Learning* with the approach *Realistic Mathematics Education* (RME)

Table 2. Multivariate Testing

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squares
Learning model	Pillai's Trace	0,319	13,139[a]	2,000	56,000	0,000	0,319
	Wilks' Lambda	0,681	13,139[a]	2,000	56,000	0,000	0,319
	Hotelling's Trace	0,469	13,139[a]	2,000	56,000	0,000	0,319
	Roy's Largest Root	0,469	13,139[a]	2,000	56,000	0,000	0,319

has a significant effect on understanding concepts and students' problem solving abilities together by controlling students' initial abilities.

The results of this study support relevant previous studies, including research on *Blended* Learning conducted by Wen Lin, et al. (2016) entitled "*The Effect of Blended Learning in Mathematics Course*". The results of this study indicate (a) the application of blended learning has a significant effect on student achievement in grade VII, and learning achievement does not differ due to gender and ability, (b) blended learning pedagogy shows a significant positive effect on attitudes towards mathematics for grade seven students. Most of the students in the experimental group supported *blended learning*.

Likewise with the research on RME conducted by Haji and Abdullah [8] entitled "*Implementation of realistic mathematics education learning model with outdoor approach in elementary school: Study of presenting and processing data*". *The results of this study shows that* the Realistic Mathematics Education learning model with an Outdoor Approach can improve the ability to understand mathematical concepts about Presenting and Data Processing material.

This study is very relevant to the results of research which states that students' initial abilities and learning models affect the understanding of concepts and problem solving abilities together. So that the model *Blended Learning* with the RME approach is very good to apply.

4 Conclusion

There is an effect of the learning model Blended Learning with the Realistic Mathematics Education (RME) approach on understanding mathematical concepts and mathematical problem solving abilities together by controlling students' initial abilities.

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