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The Effect of Realistic Mathematic Education (RME) in Improving Primary School Students' Spatial Ability in Subtopic Two Dimension Shape

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Abstract

This study aims to determine: (1) students' spatial ability through Realistic Mathematics Education (RME) and ordinary learning; (2) students' spatial ability before taught by Realistic Mathematics Education (RME); and (3) the improvement students' spatial ability taught by Realistic Mathematics Education (RME). This research is a quasi-experimental research. Samples in this research are 69 students at class three, 81 Sate Primary School, Pekanbaru. The instruments in this research are spatial ability test which is analyzed using one-way Independent Samples T-Test. It shows: (1) students' spatial ability through Realistic Mathematics Education (RME) learning is better than ordinary learning; (2) students 'spatial ability before being taught with Realistic Mathematics Education (RME) is similar to students' spatial skills before being taught with ordinary learning; and (3) students' spatial ability taught by Realistic Mathematics Education (RME) improve more well and also has higher percentage of students than students taught by ordinary learning.

Keywords: Spatial ability, two dimension shape, Realistic Mathematics Education (RME)

1. Introduction

Mathematics is one of the basic sciences that has very important influence in life, because it can prepare and develop students' ability to think logically, sociably, and appropriately to solve a problem that occurs in their daily lives. Formal education in Indonesia has not given enough stimuli to the development of children's intelligence, since it only develops certain abilities, which focus more on the function and role of the left brain, and less stimulates the function and role of the right brain.

One of spatial ability is an abstract concept which includes spatial relationships (the ability to observe the relationship of the position of objects in space), the frame of reference (the sign used as a benchmark for determining the position of objects in space), the projective relationship (the ability to see objects of various point of view), distance conservation (the ability to estimate the distance between two points), spatial representation (the ability to represent spatial relations by cognitive manipulation), mental rotation (imagining the rotation of objects in space) that have a very important influence in everyday life especially in geometry lessons.

Intelligence is a special gift possessed by humans. With the existence of humans' intelligence, it is easier to solve daily problems, especially related to mathematics. However, the measure of intelligence is always seen from the intelligence (IQ). One's intelligence can be seen from the test results. It is opposed by Hodward Gadner, he asserts that the scale of intelligence that has been used, it has many limitations that cannot predict a successful performance for one's future. Spatial ability can prepare and develop students' ability to think logically, sociably, and appropriately to solve a problem that occurs in their daily lives.
Spatial ability is a collection of cognitive skills. Skills are consisted of declarative forms, perceptions of knowledge and some cognitive operations that can be used to transform, incorporate, or operate on this knowledge. The concept of spatial thinking is interesting enough to be discussed, as many previous studies find that many students have difficulties to understand two dimension shapes.

Spatial thinking is a collection of cognitive skills which consisted of a combination of three elements: spatial, representation, and reasoning (National Academy of Science, 2006). Viewed from the context of mathematics, especially geometry, spatial ability is very important to be improved; it refers to the results of research National of Scince (2006) suggests that every student should try to develop the ability and spatial sensing which is very useful in understanding relationships and traits in geometry to solve math and day life problem. Spatial ability is needed to solve various problems encountered in everyday life. For example, understanding two dimension shape in the learning of geometry in grade III primary school.

One of the importance of spatial abilities conveyed by Barke et al (200 spatial ability is a major intelligence factor that is not only important for math and science but also necessary for success in many professions. Gagner reveals that spatial intelligence is the ability to perceive the world and spatial accurately. This intelligence includes sensitivity to the colors, lines, shapes and relationships between them. Syahputra (2011) mentions that "in the context of cross-science relations, spatial ability is very necessary. It does not only enable students to solve problem briefly and accurately but also to see and observe the sign of natures.

Looking at the spatial abilities of students who have been developed according to the level of spatial knowledge and skills in the way of thinking and acting spatially, as for the characteristics of spatial abilities as follows: 1. Students have spatial thinking habits so they know where, when, how, students think spatially. 2. Students practice thinking spatial in searching for information so they have a broad and deep knowledge of spatial space. Spatial reasoning uses a variety of ways of thinking and acting spatially and well to be used as supporting tools and technology. 3. Students take a critical attitude for thinking spatial so it can evaluate the quality of spatial data based on source and possible accuracy and reliability. It can use spatial data to build, articulate, and maintain a line of reasoning or point of view in solving problems and answering questions and it can evaluate the validity of arguments based on spatial information.

Hereditary and environment factors greatly affect the students' spatial abilities. The meaning of the surrounding environment includes family, community and school. It is supported by Gardner's opinion in his research at Harvard University, states that spatial abilities can be developed through the surrounding environment including the educational environment in the family and at school. Spatial thinking can be trained through the variety of activities that students experience directly.

Observing the importance of spatial ability, researchers understand that the purpose of learning mathematics ranging from elementary school until senior high school. Based on Education Unit Level Curriculum, there are some purposes of learning mathematics: 1). To comprehend mathematics concept, to explain the relationship among the concepts, and to apply concept or algorithm accurately and efficiently in solving the problem, 2). To use reasoning in pattern and attitude, to have mathematics manipulation in generalization, to arrange the proof, or to explain idea and mathematics statements, 3). To solve the problem includes the ability of understanding the problem, designing and accomplishing mathematics model, and interpreting the achieved result, 4). To communicate idea and symbol, table, diagram, or others media to explain condition or problem, 5). To respect the use of mathematics in daily life namely: having high curiosity, attention, and interest in learning mathematics as well as confidence in solving the problem (National Education Department, 2006:346).

Furthermore, Mulyana (2008:2) explains Unites Nation Educational Scientific and Cultural Organization (UNESCO) determine four pillars or guides in learning mathematics namely, 1). Learning to know, it means that learning process must lead students to master the technique in acquiring knowledge, 2). Learning to do, it means that learning process must give opportunity to students to develop their ability to think in solving the problem, 3). Learning to live together, it means that learning must demand cooperation on order to achieve the aims, 4). Learning to be, it means that learning process must lead students to have personality, responsibility, and independence.

According to education unit level curriculum and UNESCO, the ideal purpose of learning mathematics is not matched in reality. Researchers acquire data by observation, it shows that teachers and students do not comprehend the importance of spatial ability that required in learning process especially in subtopic of two dimension shape due to teachers do not have linear certificate. They assume that teaching mathematics is merely routine activity. They teach in monolog style, explain informatively, and give exercises. Rusman (2011: 187) depicts that learning is still dominated by the sight that sates knowledge is a fact to be memorized. Teachers do not deepen and teach spatial ability to students. The lowness of students' spatial ability in subtopic of two dimension shape at 81 Sate Primary School, Pekanbaru in class 3, academic years 2016/2017 can be seen in figure 1.1.

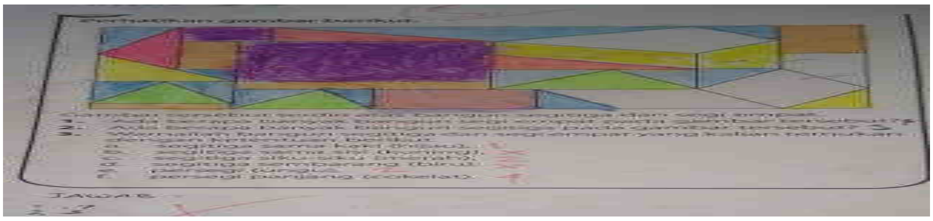

Figure 1.1 Student Problems A.

Student A has not been able to answer the number 1 problem because the student has difficulty in determining the two dimension of rectangular. Similarly in question number 2 students has not been able to answer how many triangles in the picture above and at number 3 students has difficulty in providing the right color for each two dimension shape which is shown in Figure 1.1.

It is due to the student has not been able to know and distinguish the properties of two dimension shape above. Furthermore, the problem also occurs in Figure 1.2.

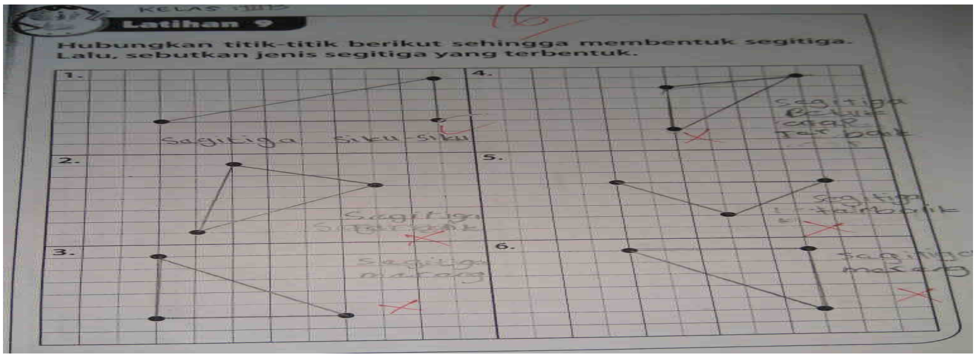

Figure 1.2 Student Problems B.

Student B has not been able to mention the type of triangle that is rotated in several directions. She has not been able to determine which one is a right triangle, an equilateral triangle and an arbitrary triangle. Student B assumes that the type of triangle is named according to the position of the triangle image. The percentage of test result from 36 students of class III in 81 State Primary School, Pekanbaru is 25% (9 students) students get value above minimum graduation category in material of two dimension shape, while 75% (27 people) students get value below minimum graduation category. It requires students to take remedial exams on Competence Standards on two dimension shape. From the above explanation, it can be concluded that the students in class III 81 State Primary School, Pekanbaru have low spatial ability on the material two dimension shape.

Basically, knowledge is not just theoretical but also how the knowledge becomes a learning experience that can solve the actual problems in students' daily life. Some areas of mathematical problem solving are related to spatial abilities. The good spatial conceptualization is an asset for understanding mathematical concepts. Spatial ability is a collection of cognitive skills, consisting of a combination of three elements: spatial concepts, representational tools, and reasoning processes (National Academy of Science, 2006: 12).

In mathematics learning process, teachers need a learning approach to activate students and cultivate students' desire to learn mathematics. Active students do not only memorize concepts and rules, but also solve math problems by thinking creatively and apply it in daily life. Scientific approach is believed to be the golden bridge of the development of attitudes, skills and knowledge of students. In an approach or work process that meets the scientific criteria, scientists prefer to put forward inductive reasoning rather than deductive reasoning. Scientific-approach based learning more effective than conventional learning.

Some observations say that the weaknesses in the learning still use approaches that tend to be normative, less creative teachers in digging methods that can be used in mathematics , it causes the implementation of learning tends to ne monotonous. Other words, teachers only explain the formulas and continued by students to do exercises. The methods used in learning have one important role in learning. Learning without methods will not achieve the desired goals, for that method is an effort to implement the plan in real activities for the objectives that have been prepared to be achieved optimally.

Sukan (2010: 18-19) states Learning methods in developing mathematics are based on learning theories, so it is not mistaken in the choice of methods. According to Heruman (2007: 1) elementary school students ranged between 6 or 7 years, up to 12 or 13 years. They are in a concrete operational phase, the apparent ability of this phase is that children will be able to think logically about concrete events and classify objects into different forms, Piaget (in Desmita, 2011: 101). Furthermore, Wahyudin (2012: 198) adds that at this stage, children begin to build systems of thought but still function at concrete and learning levels in sequence. This suggests that primary school students have the ability to link knowledge and solve problems that they encounter in everyday life by thinking spatially about concrete events through the learning in school.

Syahputra (2013: 362) expresses his opinion on the research entitled *Improving Spatial Ability of Students through Applying Realistic Mathematics Learning* that the approach of realistic mathematics learning on geometry topics with the help of computer 3-D cabri program can improve students' spatial ability in good and medium categorized schools. Other research, Susanti (2012: 145) entitles *Learning Model RME (Realistic Mathematics Education) To Improve Student Learning Outcomes of 4th Grade Students of SD Krapyak 2 2011/2012*. She explains that RME learning model can improve mathematics learning outcomes.

Some of the above research results prove that RME can influence various cognitive domains of students in mathematics and it influences indirectly to students' affective domain. RME orientates constructivism of Vyogotsky views that human construct mathematics concept adapt to their social environment. Vygotsky in Choir (2010: 6) students in construction one concept needs to pay special attention to social environment.

2. Theoretical Based

2.1. Scientific Approach

Mathematics learning process, teachers need a learning approach to activate students and cultivate the desire to learn mathematics students. Active students not only memorize concepts and rules, but also solve math problems by thinking creatively and can apply it in everyday life. Scientific approach is believed to be the golden bridge of development and development of attitudes, skills and knowledge of students. In an approach or work process that meets the scientific criteria, scientists prefer to put forward inductive reasoning rather than deductive reasoning. Learning Scientific Approach is more effective than conventional learning.

This scientific approach has the characteristics of "*doing science*". It makes easier for teachers or curriculum developers to improve the learning process by breaking down the process into steps in detail containing instructions for students to carry out learning activities (Atsnan, 2013: 430).

2.2. Realistic Mathematics Education (RME)

The term of realistic mathematics originally appeared in mathematics learning in Netherlands, known as Realistic Mathematic Education (RME), this method of learning is a reaction to the learning of modern mathematics (New Math) in America and previous mathematics learning in the Netherlands which is seen as *Mechanistic Mathematics Education* (Shoimin, 2014: 147). The realistic terms here are not always related to the real world, but the presentation of the problem in a context that students can reach. The context can be real world, fantasy world, or the formal mathematical world as long as it is real in the minds of students (Wijaya, 2012: 19).

Purwoko (2013: 49) explains that student creativity can be developed through teachers with Realistic Mathematics Education (RME) approach. RME is a mathematical learning approach that uses contextual problems, so that teachers can equip students with logical, analytical, systematic, critical and creative thinking skills and students' cooperative skills can be achieved. Marsigit (2010: 1) explains that realistic mathematics emphasizes construction from the context of concrete objects as a starting point for students to acquire mathematical concept. According to Wijaya (2012: 21) in realistic mathematics education, realistic problems are used as a foundation in constructing mathematical concepts or also called a source for learning. Azizah (2015: 3) argues that RME is a mathematical learning approach that uses contextual problems, so that teachers can equip students with logical, analytical, systematic, critical and creative thinking skills and students' cooperative skills can be achieved.

Based on the above explanation, it can be concluded that Realistic Mathematic Education is a learning that uses realistic problems in the form of real events in the minds of students as a stimulus. It reconstructs mathematical concepts so that students become subjects learn in their own way.

2.3. Spatial Ability

Intelligence is a special gift possessed by humans. Other beings have limited intelligence while humans do not. By having intelligence, human becomes easier in solving daily problems, especially related to mathematics. However, so far the size of intelligence is always seen from the intelligence (IQ). One's intelligence can be seen from the test (value). It is opposed by Gadner, he asserts that the scale of intelligence that has been used turned out to have many limitations that can less predict a successful performance for one's future, according to Gagner IQ alone is not enough. So Gagner suggests Intelligence into 8 types (Multiple Intelligence), one of them is spatial intelligence. The concept of spatial thinking is interesting enough to be discussed considering many previous studies states that the children find many difficulties to understand the object or the image of the geometry.

According to Abdurrahman (in Apriani, 2007: 56) there are five types of spatial abilities namely: (1) Spatial relations shows the perception of the position of various objects in space. This dimension of visual function implies the perception of the place of an object or symbol (image, letter and number) of the relationship of the room which is united with its surroundings. (2) Visual discrimination shows the ability to distinguish an object from another object, for instance, to distinguish between rectangular and square images. (3) Figure - ground discrimination refers to the ability to distinguish an object from the background that surrounds it. Children have a deficiency in this field, they cannot focus on an object because the surrounding object influences their attention. (4) Visual Clouser shows the ability to remember and identify an object, although the object is not considered as a whole. (5) Object recognition refers to the ability to recognize the nature of various objects as they look. The introduction includes various geometric shapes.

Based on the above description, it can be concluded that the spatial ability is very important. Where the ability can help students in teaching and learning process and recognize the surrounding environment. For example the spatial ability to understand two dimension shape is very important part in learning mathematics especially geometry. (Nurkholis, 2012) classifies Indicators of spatial ability as follows:

Table 2.2 Spatial Capability Indicator.

Number	Indikators
1	Able to imagine the position of an object of geometry after it undergoes rotation, reflection or dilation.
2	Able to compare the relation of the logical connection of the elements of two dimension shape
3	Able to predict accurately the shape of the object viewed from a particular point of view
4	Able to define a suitable object at a certain position of a series of space geometry objects
5	Able to construct a model related to an object of space geometry
6	Able to present geometry-shape models illustrated on surface

2.4. Scientific Approach based on Realistic Mathematic Education

The process of applying the RME method that contains 5 components and collaborated with a scientific approach is a complementary collaboration. It can be seen in the following learning schemes:

1. Teacher asks previous matter with daily question as manifestation of material relation with real life. (use of context),
2. Teachers divide students into small groups consisting of 5 students,
3. Teachers divide props to observe each group and it contains concept invention, props as models and questions which is commonly solved in groups (interactive and use of student context),
4. Students associate and present the work of the group with one person explaining in front of the class (associating),

5. Conclusion in conjunction with the teacher,
6. Work on the problems independently (special assignment)

2.5 The Effect of Realistic Mathematic Education toward Spatial Capacity in Improvement Mathematics Subjects.

Mathematics subject is less favored by most students. It has special characteristics, abstract, deductive, consistent, hierarchical, and logical. The characteristic of mathematical abstraction is not simple; therefore students do not like it.

There are several factors that cause the spatial ability of students is not good, they are from internal and external. From internal of the students need spiritual physical health, explore their talents, motivate and require how to learn that is easy to understand and fun for students. External factors that can support the success of learning are one of the qualities of learning that has a better influence.

By using a scientific approach in learning is due to the equation between RME and scientific approach. It can also complement from RME, this scientific approach has criteria one of them is learning materials based on facts or phenomena that can be explained by certain logic or reasoning, it is not fantasy, legend, or fairy tale.

RME is suitable for conveying urgent materials, such as geometric material (elements in square, rectangular and triangular) because there is a great deal of knowledge and benefit that must be known and understood by the students, so that method needs to be chosen to teach students. The students know and understand about the geometry material (elements in the square, rectangular and triangular). The expectation with RME learning process can be fun and students can apply it in daily life.

From the above description, it can be concluded that the realistic between scientific approach and RME with students 'spatial ability in the mathematics lesson greatly supports the improvement of students' spatial ability.

2.6. Relevant Learning Theory

Learning theory is very important in the implementation of education because it is a systematically related proposition with a relatively permanent behavior change as a result or learning experience. According to Khadija (2013: 97) in general learning theories are grouped into four streams of behaviorism theory, humanism, cognitivism and constructivism.

The results of study by Zulfahmi, Syahputra and Fauzi (2017) conclude that the improvement of students 'spatial ability using learning tools based on the average achievement of students' spatial ability in trial I was 3.15 increased to 3.51 in trial II. In addition, the average of each student's spatial indicator is increased from trial I to trial II.

Behaviorism theory is a leaning theory emphasizes the change of behavior and as a result of the interaction between stimulus and response. Learning is a process of behavioral change as a result of the interaction between stimulus and response. A person is considered to have learned if he can show changes in his behavior.

According to the theory of humanistic, learning must be initiated and devoted to the interests of humanizing. Humanistic learning theory is abstract in nature and it is closely related study of philosophy. It talks deeply about concepts. Learning is a process that begins and directed to the interests of humanization of human beings. Humanization of human beings is to achieve self-actualization, self-understanding, and self-realization of people who learn optimally. In this case, humanistic theory is eclectic.

3. Research Methods

3.1. Location and Time of Study

The study is conducted on third grade students at 81 Sate Primary School which is located at Jalan Gabus No.06 Marpoyan Damai Sub-district, Pekanbaru, Riau Province. The research is conducted in odd semester 2017/2018.

3.2. Population and Sample Research

The population in the studies is all third grade students at 81 Sate Primary School Pekanbaru 2017/2018 which amounts to 105 students. Third Grade A is 35 students, Third grade B is 34 students and third grade C is 36 studetns. Arikunto (2010: 135) If the study population is less than 100 then the samples taken are all, but if the population is more than 100 then the sample can be taken between 10-15% or 20-25% or more. Thus, the number of samples in this study is 69 students which are distributed in two classes namely class III.a and III.b. This study is conducted in one school so that researchers can do simultaneously to prevent the leakage about the test.

3.3. Research variable

This study has two types of research variables, namely independent variables and dependent variables. The independent variables in this study are conventional learning (X1) and Realistic Mathematic Education (RME) (X2). Variable bound in this research is spatial ability (Y1).

3.4. Types and Research Design

The type of this research is quasi experiment, which deliberately attempt the emergence of variables and then controlled to see the effect on spatial ability. Basically this research is the formation of two groups of comparison. The group given treatment is an experimental group while the group not given treatment is a control group.

The experimental design used is the nonequivalent control group design. In this research, there are two research groups that are experimental group that get RME treatment and control group by using conventional learning. Group determination is done by randomization so it is obtained that class III a served as control group and class III b served as experiment group. Thus, to know the influence of ability spatial students conducted research with the design presented in Table 3.1;

Table 3.1 Experimental Design

class	***Pre-test***	***Treatment***	***Post-test***
Control	O_1	-	O_2
Experiment	O_3	X	O_4

Source: (Sugiyono, 2013: 111) has been adapted to the needs of research

3.5. Research procedure

The implementation procedure in this research consists of three stages:

1. Preparation and Planning Phase;

a. Make a preliminary observation to find out the problems that occurs in 81 State Primary School, Pekanbaru,

b. Consultation to supervisor and formulate research problem,

c. Create a Learning Implementation Plan and supporting tools adapted to RME learning,

d. Develop Spatial Capability Testing Instruments,

e. Determining the class that used as research sample at 81 Sate Primary School Pekanbaru, that is class III.a and class III.b,

f. Develop a research proposal.

2. Implementation Phase;

a. Conduct pre-test in both classes before treatment is given,

b. Conduct pre-test data analysis,

c. Conduct learning activities and examine students' spatial skills using observation sheets: In class III.a using conventional learning, in class III.b using RME,

d. Disseminate post-test in both classes after treatment,

e. Conducting post-test data analysis.

3. Reporting Stage;

a. Develop data analysis and discussion of research results,

b. Compile conclusions and suggestions,

c. Prepare a final report or thesis.

3.6. Data Collection Instruments

Instrument data collection aims to obtain research data adapted to the research variables. The instrument used in this study is a spatial ability test.

3.7. Data analysis technique

Each research instrument should be analyzed using statistics that can answer the problem formulation and research hypotheses correctly. In this study used descriptive statistical analysis and inferential statistical analysis.

4. Research Results and Discussion
4.1. Research result

Data in this research is obtained from spatial ability test. Spatial ability test is given to class III A and III B students at 81 State Primary School Pekanbaru. Class III A is a control class that apply conventional learning and class III b is an experimental class that apply learning RME. Research result on test spatial abilities is analyzed using SPSS 21.0 for windows software.

4.1.1. Data Analysis of Spatial Capabilities Pretest

From the control class data and experimental class, it can be said to be relatively the same if it is analyzed based on the average and standard deviation of pretest score, but the comparison has not proved that the two classes (control and experiment) have met the prerequisite test of analysis, namely: normal and homogeneous. Therefore, normality and homogeneity tests are performed.

4.1.1.1. Data Normality Analysis of Spatial Capability

Based on result of normality analysis indicate that pretest data of control class have sig value. (= 0.119) is greater than the value of α (= 0.05) and the experimental class students have the sig value. (= 0.091) which is also greater than the value of α (= 0.05) so that H0 is received. It can also be seen that the average value point of each data is located adjacent to a straight line or a normal line. Thus, it is proved that the control class and the experimental class have distribution of normal data.

4.1.1.2. Data Homogeneity Analysis of Spatial Ability Pretest

From the homogeneity analysis shows that pretest data has sig value. (= 0.433) is greater than the value of α (= 0.05), and $F_{hitung(lavene\ statistic)}$ (= 0.622) is smaller than the $F_{tabel(\alpha;1;67)}$ (= 3.98) so that H0 is accepted. Thus, it is proved that the control class and the experimental class have a homogeneous data variance.

4.1.2. Data Analysis of Spatial Capability Posttest

Data of spatial ability posttest from control class and experimental class are presented in Table 4.4 and Figure 4.3.

Table 4.4 Data of Spatial Ability Posttest

Control class			Experimental class		
Score	**F**	**f relative (%)**	**Score**	**F**	**f relative (%)**
35-45	1	2,86	35-45	5	14,71
46-56	9	25,71	46-56	4	11,76
57-67	6	17,14	57-67	10	29,41
68-78	18	51,43	68-78	6	17,65
79-89	9	25,71	79-89	6	17,65
90-100	1	2,86	90-100	6	17,65
Amount	69,05	122,9	**Amount**	77,29	94,12
Average	13,69		**Average**	15,37	
Simpangan Baku	187,52		**Simpangan Baku**	236,38	

Table 4.4 show that the mean posttest score of students' spatial ability in the control class (= 69.05) is lower than the experimental class (= 77.29), as well as the standard deviation in the control class (= 13.69) lower than the experimental class (= 15. 37). Thus, the experiment class data is higher or better than the control class if analyzed based on the mean and standard deviation posttest score, but the comparison has not been able to answer the problem formulation or the correctness of the research hypothesis. Hence, hypothesis testing is performed.

4.1.3. Hypothesis Test Results Analysis

The hypothesis test aims to answer the research question by verifying the acceptance or rejection of H0 through the one-way Independent Samples Test (t-test). H0 is accepted if t_{count} is larger than $t_{tabel(dk=n1+n2-2,\ \alpha=0,05}$ (= 15,668). The result of hypothesis shows that t_{count}(= 2.353) is smaller than t_{table} (= 15,668) and t_{count} is positive, so H0 is rejected and Ha is accepted. Viewed from the mean posttest score of spatial ability, the students' scores in the experimental class (= 77.29) are higher than the students in the control class (= 69.05). Comparative analysis of the average score is in line with the results of hypothesis test analysis that the experimental class is better than the control class. Thus, it can be concluded that students' spatial ability through learning Realistic Mathematics Education (RME) is better than students who are given regular learning.

4.1.4. Analysis of Spatial Ability of Students before being taught with Realistic Mathematics Education (RME)

Spatial skills of students before being taught with Realistic Mathematics Education (RME) are analyzed based on the average percentage of scores obtained by students on each spatial ability indicator. The analysis results show that the average percentage of pretest score of spatial ability on indicator:

1. The ability to observe two dimension shape placed in horizontal and vertical position for students in control class (= 68. 57 %) is higher than student in experiment class (= 59. 80 %).

2. The ability to provide an overview of the change or displacement of parts in two dimension shape for the students in the control class (= 51. 43 %) is lower than the students in the experimental class (= 57. 84 %).

3. The ability to rotate an appropriate two dimension shape for students in the control class (= 59. 05 %) is higher than the students in the experimental class (= 54. 90 %).

4. The ability to understand the form of an object and its relation between one part with another part based on the reflection for the students in the control class (= 68. 57%) is lower than the students in the experimental class (= 68. 63 %).

5. The ability to understand the shape of an object and its relation between one part and another based on the combination of two dimension shape for the students in the control class (= 55. 24 %) is lower than the students in the experimental class (= 62. 75 %).

6. The ability to determine two dimension shape viewed from several points of view for students in the control class (= 35. 24%) is lower than the students in the experimental class (= 36. 27 %).

From the above description, it is concluded that students 'spatial ability before being taught with Realistic Mathematics Education (RME) has different scores for each indicator. In the first and third indicators, students' spatial ability before being taught with Realistic Mathematics Education (RME) has a percentage average score lower than ordinary learning. In the second, fourth, fifth and sixth indicators, students' spatial ability before being taught with Realistic Mathematics Education (RME) has an average percentage of scores higher than ordinary learning. Thus, more indicators of students 'spatial abilities before they are taught with Realistic Mathematics Education (RME) are getting a higher percentage of students' spatial abilities before they are taught with ordinary learning, but the percentage difference is not much different.

From the average of the overall percentage, it is found that students' spatial ability before being taught with Realistic Mathematics Education (RME) has a score (= 56. 70 %) is slightly higher than ordinary learning (= 56. 35%). Thus, it can be concluded that students' spatial ability before being taught with Realistic Mathematics Education (RME) is similar to ordinary learning, since the difference in percentage average score is only a decimal count or less than 1%.

4.1.5. Data Analysis of the Improvement of Spatial Capability taught by Realistic Mathematics Education (RME)

Spatial capacity improvement data obtained from test. It indicates that the percentage increase in the average spatial ability score on the indicator:

1. The ability to observe two dimension shape placed in horizontal and vertical position for students in control class (= 8. 57 %) is lower than student in experiment class (= 30. 39 %).

2. The ability to provide an overview of the change or displacement of parts in two dimension shape for the students in the control class (= 16. 19 %) is higher than the students in the experimental class (= 14. 71 %).

3. The ability to rotate an appropriate two dimension shape for students in the control class (= 10. 48 %) is lower than the student in the experimental class (= 17. 65 %).

4. The ability to understand the form of an object and its relation between one part with another part based on the reflection for the students in the control class (= 9. 52 %) is lower than the students in the experimental class (= 10. 78 %).

5. The ability to understand the form of an object and its relation between one part and another based on the combination of two dimension shape for the students in the control class (= 12. 38 %) is lower than the students in the experimental class (= 13. 73 %).

6. The ability to determine two dimension shape viewed from several points of view for students in the control class (=19. 05 %) is lower than the students in the experimental class (= 36. 27 %).

From the above description, it is concluded that the spatial ability of students taught with Realistic Mathematics Education (RME) has a different score increase for each indicator. In the second indicator, the spatial ability of students taught by Realistic Mathematics Education (RME) has an increase in percentage average score is lower than ordinary learning. In five indicators: first, third, fourth, fifth and sixth indicators, students' spatial skills taught with Realistic Mathematics Education (RME) have an average percentage increase in scores higher than ordinary learning. Thus, more indicators of students' spatial skills taught with Realistic Mathematics Education (RME) gained a higher percentage increase than the spatial abilities of students taught by ordinary learning, but the percentage is not much different.

From the average overall improvement, it is found that students' spatial ability taught with Realistic Mathematics Education (RME) has a score (= 20. 59 %) is higher than ordinary learning (= 12. 70 %). Thus, it can be concluded that the improvement of students' spatial skills taught by Realistic Mathematics Education (RME) is better than ordinary learning, because the difference in average increase reaches 7. 89 %.

The percentage of the number of students who experienced improvement or not increased overall spatial ability score not based on the indicators presented in Table 4.8 and Figure 4.6.

Table 4.8. Percentage of Number of Students

Criterion	Relative Frequency of Control Class (%)	Relative Frequency of Experimental Class (%)
Students who have score increase	85,71	94,12
Students who have not score increase	14,29	5,88

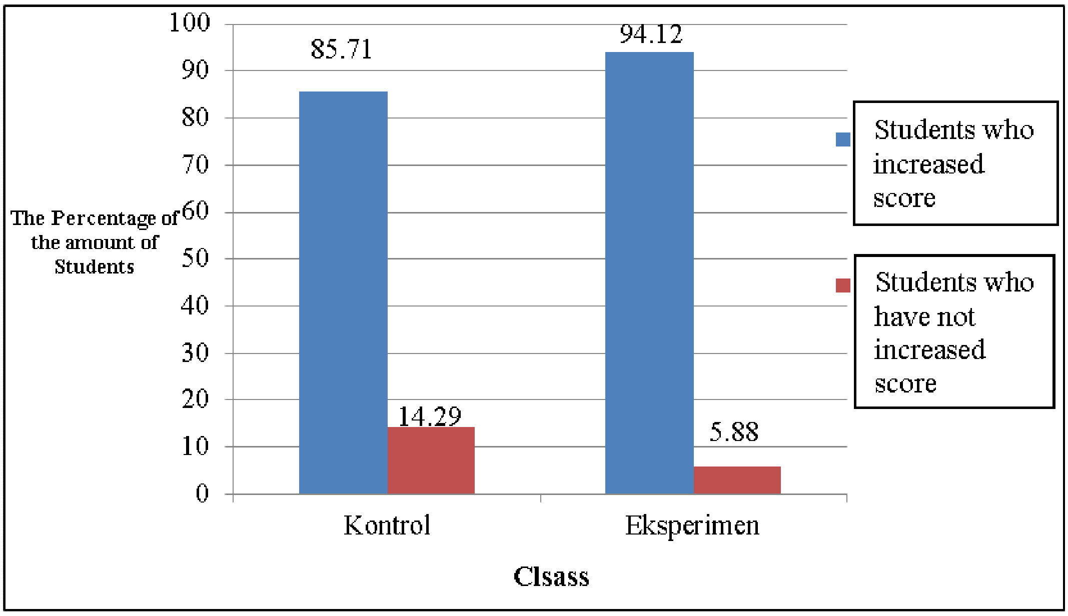

Table 4.8 shows that the percentage of students who have increased students' spatial ability score in the control class (= 85.71%) is less than the experimental class (= 94.12%). From Figure 4.6 shows that the histogram percentage of the number of students who have increased spatial ability score in the control class is lower than the experimental class. Thus, it can be concluded that students studying with Realistic Mathematics Education (RME) have improved the score of spatial ability better and also have percentage the number of students who have more scores increases than students who learn with ordinary learning.

4.2. Discussion

4.2.1. Spatial Ability of Students through Realistic Mathematics Education (RME) Learning is better than Ordinary Learning

From the research results obtained that the value of t_{count} (= 2.353) is smaller than t_{table} (= 15. 668) and t_{count} is positive, so H0 is rejected and Ha accepted. Based on the mean posttest score of spatial ability, the students' scores in the experimental class (= 77.29) are higher than the students in the control class (= 69. 05). Comparative analysis of the average score is in line with the results of hypothesis test analysis that the experimental class is better than the control class. Thus, it can be concluded that students' spatial ability through learning Realistic Mathematics Education (RME) is better than students who are given regular learning.

The results of this study are supported by the results of several previous studies, Syahputra (2013) concludes that the approach of Realistic Mathematics Learning on Geometry topic with the aid of computer Cabri 3 D program can improve students' spatial ability in good and medium category . The research results by Kesumawati (2014) show that IRME (Indonesian Realistic Mathematics Education) approach gives a better impact on the ability of creative thinking mathematically compared with conventional learning. It means that the Indonesian Realistic Mathematics Education gives better influence to the creative thinking ability of Mathematics compared with conventional learning.

The above description is contrary to the learning of Mathematics by conventional learning. In Conventional learning, students do not have the opportunity to rediscover the ideas of Mathematics; even the concept of Mathematics itself is meaningless for students because of the lack of interactivity and the interrelationship of the concept of Mathematics, other concepts and the environment of the students. According to Trianto (2011: 6) conventional learning in the classroom learning process tends to be teacher-centered so that students become passive and students have not been taught how to learn, think and motivate themselves and applications in everyday life. Thus, RME learning makes students more active learning compared with conventional learning.

In terms of the used learning theory also can be seen a significant learning difference between RME and conventional learning. RME learning combines several active learning theories such as theory of learning cognitivism and constructivism, whereas conventional learning is contrary to the theory of learning cognitivism and constructivism. Cognitivisme emphasizes how the learning process takes place, whether the learning process is done alone or not, not just pay attention to learning outcomes. Bruner's cognitive theory is not only based on the stages of learning Mathematics, but also applying the principles of learning Mathematics. Bruner in Srinita (2013: 9) argues that "there are four principles of mathematical learning called the theorems, namely:

1. The drafting theorem states that the best way to learn concepts and principles in mathematics is to do the compilation of representations. Memory is obtained not by reinforcement but because of the understanding that caused the memory to be achieved;

2. The Notation Theorem reveals that notation plays an important role in the presentation of concepts and adapted to the stage of cognitive development of students;

3. The contrasting and diversity theorem states that changing the concrete representation to a more abstract representation. The conceptual representation is done by explaining the example rather than the example or by various examples and questions; and

4. The Connection Theorem (Connectivity) reveals that in mathematics, between one concept and another there is a close relationship. One material may be a prerequisite for another, or a certain concept is necessary to explain another concept.

The four theorems are not meant to be applied one by one and sequentially, but they are applied simultaneously in the learning process on a particular Mathematical material. This is based on the characteristics of the Mathematics material studied and the characteristics of the learning students. So the learning activity of the cognitivism learning theory applied to RME is more complex than that of conventional learning which does not take into account the four theorems.

Conventional learning also does not refer to constructivism learning theory because According to Trianto (2011: 6) conventional learning tends to be teacher-centered so that students become passive and students have not been taught how to learn, think and motivate themselves and applications in daily life. In the sense of conventional learning, students gain knowledge directly transferred by the teacher, while constructivism learning theory emphasizes that students construct their own knowledge gained from learning activities because everyone has their own schema in learning something. Thus, it is proven that Realistic Mathematics Education (RME) learning provides better mathematics learning compared to conventional learning, so that the influence of Realistic Mathematics Education (RME) learning on spatial ability is also better than conventional learning.

From the above description, it can be concluded that students' spatial ability through Realistic Mathematics Education (RME) learning is better than students who are given regular learning.

4.2.2. Students' Spatial Ability Before being taught with Realistic Mathematics Education

The results of this study indicate that the average percentage of students' spatial ability before being taught with Realistic Mathematics Education (RME) has a score (= 56. 70 %) is slightly higher than ordinary learning (= 56. 35%), almost the same as the difference the average percentage of a score is only a decimal count or less than

1%. Based on the spatial ability indicator that the spatial ability of the first and third indicators, students' spatial ability before being taught with Realistic Mathematics Education has an average percentage score lower than ordinary learning. In the second, fourth, fifth and sixth indicators, students' spatial skills before being taught with Realistic Mathematics Education (RME) have an average percentage of scores higher than ordinary learning. Thus, more indicators of students 'spatial abilities before they are taught with Realistic Mathematics Education (RME) are getting a higher percentage of students' spatial abilities before they are taught with ordinary learning, but the percentage difference is not much different.

The results of this study indicate that in the control class, students before being taught with ordinary learning and experimental classes have similar spatial ability so that the improvement of spatial ability of students obtained from posttest is the result of the learning itself, that is in the control class using ordinary learning and in the experimental class using RME learning.

In addition to the percentage of pretest, the similarity of students' spatial ability in the control class and the experimental class is also obtained from normality test and homogeneity test. The normality test proves that the control class and the experimental class have normal distributed data distribution with the sig value. (= 0.119) is greater than the value of α (= 0.05) for the control class students and the sig value. (= 0.091) which is also greater than the value of α (= 0.05) for the experimental class student so that H0 is accepted. From the homogeneity test it is evident that the control class and the experimental class have a homogeneous data variance with the sig value. (= 0.433) is greater than the value of α (= 0.05), and $F_{hitung(lavene\ statistic)}$ (= 0.622) is smaller than $F_{tabel(\alpha;1;67)}$(= 3.98) score so that H0 is accepted. Thus it can be concluded that the similarity of students' spatial abilities before being taught with ordinary learning and students before being taught with Realistic Mathematics Education is not only proven to have an average percentage of similarly identical pretest scores, but also has distributed data distribution of normal and homogeneous variables .

4.2.3. Improvement of Students' Spatial Ability taught with Realistic Mathematics Education

The results of this study indicate that the average increase in spatial ability of students taught by Realistic Mathematics Education has a score (= 20.59%) higher than the usual learning (= 12.70%). Thus, it can be concluded that improving students' spatial skills taught with Realistic Mathematics Education is better than conventional learning because the difference of average is 7.89%. Based on spatial ability indicators is obtained in the second indicators taught by RME has lower score than conventional learning. Meanwhile, in five others indicators (the first, third, fourth, fifth, and sixth indicators, students taught by RME has higher score than conventional learning. Thus, students' spatial ability taught by RME has more and higher indicators than conventional learning, but the difference is not much different

The result of this study is supported by some previous research. Syahputra (2013) concludes that realistic mathematics learning can increase students' spatial ability. Moreover, there is interaction between learning approach and school categories toward the increase of students' spatial ability. Rangkuti (2015) shows that The learning trajectory on Fraction Topics by using Realistic Mathematics Education Approach can be effectively used to improve the learning effectiveness on Fraction Topics in Primary School. Other words, in subtopic of fraction by using RME, it can improve students' learning activity in mathematics. Ekowati (2015) explains that by using RME, teacher successfully increases students' learning activity. Based on the previous result, it can be said that RME does not only increase students' spatial ability but also creates students to be more active and creative in mathematics. The result of this study also is supported by learning theory that states RME can improve students' spatial ability. It can be seen from the learning steps of RME.

RME learning uses a model tool which is made from paper that can be rotated by students. So students get easier to answer the questions. Thus, RME pay more special attention toward indicators of students' spatial ability in comparison with conventional learning. Nikolas (2012) spatial ability indicators are:1). Imagine position a geometry object after having rotation or reflection, 2). Compare logic relationship from the elements of two dimension shape, 3) assume accurately the form of object viewed from different points, 4). Determine the suitable object in certain position in sequence of the object of two dimension shape, 5). Reconstruct a model that relates to an object of geometry, 6). Present models of geometries that described in dimension shape.

Students are not given model tools in conventional learning since teachers only explain the example, while students only take a look toward teacher's explanation. Therefore, the result of this study, the amount of students has the increase of spatial ability score in control class (= 85.71%) is less than experimental class (= 94.12%).

Thus, it can be concluded that RME has the increase of spatial ability score and the percentage of student's score than conventional learning.

5. Conclusions and Suggestions

5.1. Conclusion

Based on the results of research and discussion, it can be drawn some conclusions research that answer the formulation of the problem, namely:

1. Spatial ability of students through Realistic Mathematics Education (RME) learning is better than ordinary learning. It is based on hypothesis test result that T_{count} (= 2,353) is smaller than T_{table} (= 15,668) and T_{count} is positive, so H0 is rejected and Ha is accepted. From the posttest score, the spatial ability also shows that the students' scores in the experimental class (= 77.29) are higher than the students in the control class (= 69.05).

2. Spatial ability of students before being taught with Realistic Mathematics Education (RME) is similar to students' spatial skills before being taught with ordinary learning. This is based on the average percentage of students' spatial skills before being taught with Realistic Mathematics Education has a score (= 56.70%) higher slightly with ordinary learning (= 56.35%), even about equal to the difference in percentage, the average score is only a decimal count or less than 1%.

3. Spatial skills of students taught with Realistic Mathematics Education (RME) improve better and also had a higher percentage of students than students taught with ordinary learning. This is based on the average increase in spatial ability of students taught by Realistic Mathematics Education (RME) has a score (= 20.59%) higher than ordinary learning (= 12.70%). From the percentage of students who increase their spatial ability score also show that the students in the control class who experience increased score (= 85.71%) are less than the experimental class (= 94.12%).

5.2. Suggestion

Based on the results of research and conclusion above, there are some suggestions namely:

1. In the application of the Realistic Mathematics Education (RME) learning model, teachers or other researchers should use props to support, not just contextual issues in the form of stories or drawings. It aims to facilitate students to obtain information and appropriate by Realistic Mathematics Education (RME), the learning that uses realistic problems as a stimulus and reconstruct mathematical concepts as a response.

2. For other researchers who will examine the RME learning model, it should be applied by creative teachers, teachers who are able to provide various ways of solving problems and also teachers who are able to arrange the timing of the implementation of learning.

3. Spatial ability is the ability of students to imagine the position of object of geometry, compare the relation of logical relationships of the elements of geometry, and determine the simple object embedded in a more complex image. Therefore, teachers or other researchers should design meaningful learning activities by using geometric objects that can be manipulated and realistically understood by students.

4. If other researchers do research with the same models and instruments but different research samples, then the trend of the results is not much different from the results of this study.

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