Mathematical literacy ability with RME (realistic mathematics education) approach in fifth grade students

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Abstract. The framework of the 2012 Mathematical PISA, mathematical literacy is defined as an individual's ability to formulate, use and interpret mathematics in various contexts. The level of Madrasah Ibtidaiyah needs an understanding of mathematical literacy. The purpose of this research is to know the ability of mathematical literacy of fifth grade students in Madrasah Ibtidaiyah Darul Ulum Ngaliyan Semarang 2017. The research method used is mixed methods. The study was conducted in grade 5 students. The quantitative analysis is tested by the average difference test with dk 56 and 5% of real level then obtained \( t_{table} = 1.674 \). The result of t-test \( t_{count} = 1.087 \). So compared between \( t_{count} \) and \( t_{table} \) then \( t_{count} < t_{table} \) so that \( H_0 \) is accepted, it means there is no difference on the average of students' mathematical literacy skills taught by using the RME approach with the average ability of students' mathematical literacy using the expository method. The result of the mathematics literacy test of fifth grade students in Salman MI Darul Ulum is still in low category Qualitatively, after interviewing 6 students, it can be seen that the ability of students' mathematical literacy is still lacking and there is no habituation of mathematics literacy in learning.

1. Introduction

Learning is an attempt to make students learn, which is an effort made by teachers in choosing, establishing and developing methods to achieve the desired results. Learning is like the heart of the educational process. Good learning tends to produce good graduates as well.

Learning in primary school or Madrasah Ibtidaiyah is a very important process of learning because it’s the basis of the next learning process up to college level. Lessons learned should not be perfunctory. Active, creative and fun learning is a learning that needs to be applied.

According to the curriculum, mathematical learning has a goal to develop problem-solving skills, communication, reasoning, critical thinking, creative thinking, connection, and literacy. Within the framework of the 2012 Mathematical PISA, mathematical literacy is defined as an individual's ability to formulate, use and interpret mathematics in various contexts. Including the ability to perform reasoning mathematically and using the concepts, procedures, facts, as a tool to describe, explain and predict phenomena or events. Mathematical literacy can help people to recognize the role of mathematics in the real world and as a basis for consideration and decision-making required by society [1]. A report from the
Human Development Index (HDI) survey of the United Nations Development Program (UNDP) showed that Indonesia's HDI is 0.600 in 2010 and ranks 108 out of 169 countries [2]. The Indonesian people still face difficult problems, especially those relating to the quality of education, relevance, and efficiency. The quality of education of a country is greatly used to measure the country development. Hall and Matthews [3] show that the educational aspect has an important role in the progress of a country. Indonesia's ranking in mathematics according to the PISA is ranked 39 of 40 countries in 2003, ranked 38th out of 41 countries in 2006, and ranks 61 out of 65 countries in 2009 [4]. The ability of mathematical literacy in Indonesia has not developed yet, so in primary school, it is important to note.

One of the primary schools in Indonesia is the Madrasah Ibtidaiyah. The level of Madrasah Ibtidaiyah needs an understanding of mathematical literacy. Nevertheless, not all Madrasah Ibtidaiyah apply 2013 curriculum. Mathematical literacy is closely related to the 2013 curriculum. One of the Madrasah Ibtidaiyah that uses the new curriculum is Madrasah Ibtidaiyah Darul Ulum Wates Ngaliyan. Madrasah Ibtidaiyah Darul Ulum Wates Ngaliyan has been a partner of USAID for 5 years as well as Fakultas Ilmu Tarbiyah dan Keguruan partner Universitas Islam Negeri Walisongo until now. Where the teachers of Madrasah Ibtidaiyah Darul Ulum Wates Ngaliyan get training on active learning and literacy. So that researcher tries to apply a learning with Realistic Mathematic Education approach to cultivate the ability of student math literacy of Madrasah Ibtidaiyah Darul Ulum class, on the fractional material.

Cronbach, as quoted by Suryabrata [5], states that learning is shown by behavioral changes as a result of experience. Learning is a process of activity that leads to a change of behavior. According to Hamalik [6], learning is a process of changing individual behavior through environmental interaction. Learning is a process of change of behavior directed by individual interaction. The characteristics of behavior change in the sense of learning are (1) change occurs consciously; (2) changes in learning are continuous and functional; (3) change in learning is positive and active; (4) changes in learning are not temporary; (5) changes in learning aimed or directed; and (6) change covers all aspects of behavior.

Bloom, as quoted by Sudjana [7], proposed three taxonomies called learning spheres, namely: the cognitive domain, the affective domain, and the psychomotor domain. This study emphasizes the cognitive domain and affective domain.

According to Jean Piaget, a child progresses through four stages of cognitive development, between birth and adulthood, ie sensorimotor, operational, concrete, and formal operations. The rate of development of each individual through the sequence of each stage is different and no individual skips one of those steps. Each stage is marked by the emergence of new intellectual abilities that enable people to understand the world in an increasingly complex way.

Piaget's developmental theory represents constructivism, which views cognitive development as a process whereby children actively build systems of meaning and understanding of reality through their experiences and interactions.

Piaget is convinced that physical experiences and environmental manipulation are important for a developmental change. Meanwhile, social interaction with peers, especially arguing and discussing helps to clarify the thinking that ultimately contains the thought becomes more logical.

From Piaget's theory, it is clear that the lecturer should be able to create the condition of the students who are able to learn by themselves. This means that the lecturer of the subjects does not fully teach a teaching material to the students, but the lecturers can develop students who are able to learn and actively participate in learning. This constructivistic theory suggests that students must find and transform complex information by themselves, check new information with old rules and revise it if they are no longer appropriate. According to constructivistic theory, one of the most fundamental principles in educational psychology is that the lecturer not only provides knowledge to the students, the student must build his own knowledge in his mind. Lecturers can provide convenience for this process, by giving students opportunities to discover or apply their own ideas, and teach students to become aware and consciously
use their own strategies for learning. Course lecturers can provide students a ladder that leads students to a higher level of understanding, with a note, the students themselves who must climb the ladder.

Vygotsky's theory emphasizes the sociocultural nature of learning. According Vygotsky by Trianto [8] that learning occurs when children work or learn to handle tasks that have not been studied but the tasks are still within reach of its ability or the tasks are in the zone of proximal development. Zone of proximal development is a slight improvement over the current development of people. Vygotsky believes that higher mental functions generally arise in conversation or cooperation between individuals, before the higher mental functions are absorbed into the individual.

The mathematical literacy within the 2012 Mathematical PISA framework is defined as the individual's ability to formulate, use and interpret mathematics in various contexts. Including the ability to perform reasoning mathematically and using the concepts, procedures, facts, as a tool to describe, explain and predict phenomena or events. Mathematical literacy can help people to recognize the role of mathematics in the real world and as a basis for consideration and decision-making required by society [1].

Literacy is a basic human right and basic for lifelong learning, covering various aspects of life. One such aspect is the need for mathematical literacy. In PISA 2015, mathematical literacy is defined as follows:

"Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that constructs, constructs and reflects citizens."

Mathematical literacy is the capacity of individuals to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and the use of concepts, procedures, facts and mathematical tools to describe, explain, and predict phenomena. This leads individuals to recognize the role of mathematics in life and make good judgments and decision-making needed by constructive, reflective people.

There are eight characteristics of mathematical cognition on the PISA problem, namely mathematical thinking and reasoning, mathematical argumentation, modeling, problem posing and solving, representation, symbols and formalism, communication, and use of means and tools [9].

Based on the results of The Third International Mathematics and Science Study (TIMSS) in 2000. According to Freudenthal, the main activities of RME learning implementation in the Netherlands include:

a. Finding contextual questions or problems (looking for problems) and problem solving
b. Organizing teaching materials (organizing a subject matter).

These can be realities that need to be mathematically organized as well as mathematical ideas that need to be organized in a broader context. This organizing activity is called mathematization. Mathematization in realistic mathematics learning is a very important process. Treffler distinguishes mathematization into two types namely, horizontal mathematization and vertical mathematization. Horizontal mathematics deals with real-world changes, become symbols in mathematics or mathematical problems, whereas vertical mathematization deals with changing symbols, to other mathematical symbols, or problem solving using a number of mathematical rules accordingly.

According to Freudenthal related to mathematical activity in learning mathematics, Freudenthal, H., 1973, Freudenthal, H. 1991, Van den Heuvel-Panhuizen, M. 1985, Van den Heuvel Panhuizen, M. 1996: 11) describes two types of mathematization namely horizontal and vertical mathematization with the following:

a. Horizontal mathematization involves the process of transforming real or everyday problems into symbolic form.

Example:
Horizontal mathematization is the identification, formulation, and visualization of problems in different ways by students.

b. Vertical mathematization is a process that occurs within the scope of the mathematical symbol itself.

Example:
Vertical mathematization is the presentation of relationships in formulas, refining and adjusting mathematical models, the use of different models, the formulation of mathematical models and generalization.

Two processes of mathematization formulated by Treffers in realistic learning are described as follows:

a. Horizontal mathematization
The process of math, at the stage of changing everyday problems, becomes a matter of mathematics, so that it can be solved, or the real situation is transformed into symbols and mathematical models. Or the process by which students with their knowledge (mathematics tools) can organize and solve real problems in everyday life, for example: identification, formulation, transformation of real world problems to the problem of mathematics.

b. Vertical mathematization
The process of mathematics, at the stage of the use of symbols, the symbol of general mathematical rules. Or activities to formulate math problems, into various mathematical solutions, through a number of principles or rules that exist in mathematics. Or the process of reorganization in the mathematical system itself, for example: finding a short way in the relationship between concepts and strategies, then applying that strategy, the representation of relationships in the formulas, improvements and adjustments of mathematical models, the use of different models, and generalization.

2. Methods
This research is a combination of qualitative and quantitative research. The combination model used in this study is a concurrent triangulation type. Concurrent triangulation is a research method that combines both qualitative and quantitative methods by mixing the two methods equally [10]. The results of this research will be more complete, valid, reliable, and objective because using data collection techniques that are triangulation.

This research was conducted at Madrasah Ibtidaiyah Darul Ulum located in District Ngaliyan Semarang. The number of fifth grade students is fifty eight, consisting of thirty one men and twenty seven women. The researcher will conduct an analysis of mathematical literacy ability of fifth grade students in Madrasah Ibtidaiyah Darul Ulum Ngaliyan Semarang in the semester gasal/I academic year 2017/2018. The number of fourth grade students of Abdurahman is thirty four.

Appropriate data collection techniques, is expected to provide the results of appropriate research, and can be accounted for. Data collection techniques used in this study are observation, tests, interviews. Data validity criteria according to Moleong [11] are credibility, transferability, dependability, and confirmability. Data analysis conducted in this study is the analysis of learning devices, analysis of research instruments, preliminary data analysis, final data analysis. Analysis of qualitative research results that is through data reduction, data presentation, and drawing conclusions.

3. Results and Discussion
Initial data analysis, normality test of initial value in experiment class, for significant level α = 5% with dk = 31 - 1 = 30, obtained \( \chi^2_{\text{count}} = 43.0667 \) and \( \chi^2_{\text{table}} = 43.773 \). Because \( \chi^2_{\text{count}} < \chi^2_{\text{table}} \) then it can be said that the data is normally distributed. Meanwhile, the initial value normality test, in the Control class for the significant level α = 5% with dk = 27 - 1 = 26, obtained \( \chi^2_{\text{count}} = 37.9770 \) and \( \chi^2_{\text{table}} = 38.885 \).
Because \( \chi^2_{\text{count}} < \chi^2_{\text{table}} \), then it can be said that the data is normally distributed. Homogeneity test, \( F_{\text{count}} \) for posttest of experimental math literacy skill 0.97067. For significant level \( \alpha = 5% \) with \( \text{df}_{\text{numerator}} = n_b - 1 = 31 - 1 = 30 \), and \( \text{df}_{\text{denominator}} = n_k - 1 = 27 - 1 = 26 \), obtained \( F_{\text{table}} = 1.9010 \). Since \( F_{\text{count}} < F_{\text{table}} \), both groups are homogeneous distributed. Two average equality tests in the experimental class and control class were obtained, \( t_{\text{count}} = -0.803 \) and \( t_{\text{table}} = 0.2003 \) with significance level 5% and \( \text{df} = n_1 + n_2 - 2 = 31 + 27 - 2 = 56 \). Because \( t_{\text{hitung}} < t_{\text{table}} \), it means the average ability of the mathematical literacy between the fifth grade students of salman and fifth gradestudents of abdurrohman is the same. The final data analysis is the normality test, where \( \chi^2_{\text{count}} = 43.084 \) and 37.997 the two samples are less than \( \chi^2_{\text{table}} \), so \( H_0 \) is accepted. This means that the two samples, which are student’s mathematics literacy ability score data that is given by RME and conventional learning (using expository method) is normally distributed. The homogeneity test is known \( F_{\text{count}} = 1.870 \), and \( F_{\text{table}} = 1.901 \) It appears that \( F_{\text{count}} < F_{\text{table}} \) with \( \text{df} = 56 \) and 5% significance level, so \( H_0 \) is accepted. That means both samples have the same variance or the sample data is homogeneous, ie, the results obtained, for the ability of the experimental class mathematics literacy, using the RME approach, obtained an average of 43.773 and the standard deviation (SD) was 114.43, while for the control class with conventional learning model, 41.481 and the standard deviation (SD) is 47.028. By \( \text{df} = 31 + 27 - 2 = 56 \) and the real level of 5% is obtained \( t_{\text{hitung}} = 1.674 \) From the result of \( t\)-test \( t_{\text{count}} = 1.087 \). So compared between \( t_{\text{count}} \) and \( t_{\text{table}} \) then \( t_{\text{count}} < t_{\text{table}} \) so that \( H_0 \) is accepted, meaning that there is no average effect of the students' mathematical literacy ability, taught by using the RME approach, with the average ability of students' mathematical literacy, which using expository methods.

Qualitative analysis of mathematical literacy skills on subjects selected from the experimental grade based on posttest results.

**Figure 1. Problem number one**

**Communication**

a. Stating ideas / mathematical ideas which suitable with the problem  
   Score 3  
   Write down ideas on the problem correctly but not complete

b. Understand, interpret and evaluate mathematical ideas relating to problems  
   Score 4  
   The formula is correct, the calculation is correct, the result of the calculation is correct.

**Mathematising**

Converting the problem from the real world to a mathematical form (formulating a mathematical model)  
Score 3  
Converts the problem from the real world to a mathematical form but there is a lack of proper definitions.

**Representation**

Reproduce the problem by creating an image  
Score 1  
Draw a fractional sketch of the problem and not write down the description correctly.
Reasoning and argument
Think logically to make conclusions, check, or justify the statement or solution of the problem
Score 1
Wrong in concluding and giving reasons.

Devising strategies for solving problems
Apply completion steps in order to resolve the problems.
Score 4
The steps of completion are correct, sequence writing, correct formula, and correct calculation.

Using symbolic, formal and technical language and operations
Using symbols, formal languages and technical languages as well as count operations to formulate, solve or interpret mathematics.
Score 3
Writing letters/symbols true, writing the numbers true, writing is not clear.

Using mathematical tools
Using mathematical tools, eg taking measurements
Score 4
Can use the calculation tool correctly, draw fractions with the ruler, fractional shapes correct, and neat.

Communication
1. Stating ideas / mathematical ideas which suitable with the problem
   Score 3
   Write down ideas on the problem correctly but not complete
2. Understand, interpret and evaluate mathematical ideas relating to problems
   Score 4
   The formula is correct, the calculation is correct, the result of the calculation is correct.

Mathematising
Converting the problem from the real world to a mathematical form (formulating a mathematical model)
Score 3
Converts the problem from the real world to a mathematical form but there is a lack of proper definitions

Representation
Reproduce the problem by creating an image
Score 2
Draw a fractional sketch on a problem with a disproportionate size and not write down the description correctly.

Reasoning and argument
Think logically to make conclusions, check, or justify the statement or solution of the problem
Score 1
Wrong in concluding and giving reasons.
Devising strategies for solving problems
Apply completion steps in order to resolve the problems.
Score 4
The steps of completion are correct, sequence writing, correct formula, and correct calculation.
Using symbolic, formal and technical language and operations
Using symbols, formal languages and technical languages as well as count operations to formulate, solve or interpret mathematics.
Score 3
Writing letters/symbols true, writing the numbers true, writing is not clear.
Using mathematical tools
Using mathematical tools, eg taking measurements
Score 3
Can use the calculation tool correctly, draw a fraction with a ruler, the shape of a true fractional image, but not tidy.

The results of the mathematics literacy skills test of fifth grade Salman are as follows, the interval score from 25-32 there are 7 students, the interval value from 33-40 there are 3 students, the interval value from 41-48 there are 4 students, the interval value from 49-56 there are 13 students, the interval score of 57-64 there are 3 students, the interval value from 65-72 there is 1 student. Seen the results of TKLM is still relatively low, because the value above 65-72 there is only 1 student.

There are 7 indicators of research of mathematical literacy ability test, after interviewing 6 students of fifth grade, the result is

a. Students solve the story problem type in a direct way not by communicating the first of things that students understand from the problem, immediately replied with the symbol of mathematics.
b. Students rarely use pictures or sketches in solve the math stories problem. The Answers to which the image is deemed necessary, from the five questions that need to be drawn is a matter of No. 2 and 4.
c. The student answers briefly without the steps to do, without involving the counting operation in the fraction, directly only one number that he answered.
d. Students answer the question but there are steps that are missed, the beginning is correct, the middle is wrong and at the end of the process is correct, it turns out this student way of thinking is influenced by the answer of his/her friend.
e. Students completing the problem with the appropriate response steps that are taught by the teacher only, the creativity to answer is less.
f. After finishing the answer, every question has no sentence that emphasizes the truth or does not make a conclusion.
g. Students answer the problem with one number only because this student does not care in doing the problem given by the teacher who is not the teacher of his/her class.
h. The student represents the answer incorrectly; the way the image is split is not correct. Because the material is fractional, then the drawing should be balanced.
i. Students can answer correctly when questioned about the basic concepts of how to interrupt direct-distribution operations, but when students are faced with problems, students become confused.

4. Conclusions
Based on the description, various conditions and activities of learning process related to the implementation of this research entitled "Analysis of literacy ability of fifth grade students in Madrasah Ibtidaiyah Darul Ulum Ngaliyan Semarang in 2017" hence researcher can give conclusion quantitatively
that the applied learning model has not had a positive impact because the application of learning model only happens twice, habituation will be seen if the process is often used in everyday learning, seen from the test of average difference with dk 31 + 27 - 2 = 56 and 5% real level then obtained $t_{table} = 1.674$. From the result of $t$-test $t_{count} = 1.087$. So compared between $t_{count}$ and $t_{table}$ then $t_{count} < t_{table}$ so that $H_0$ is accepted, it means there are no influence of average ability of student's mathematics literacy which taught by using RME approach with average ability of student's mathematical literacy which using expos itory method. The result of the mathematics literacy test of fifth grade salman MI Darul Ulum is still in low category seen from the TKLM score that below the value of <65 which is still 30 students, and there is one student above the value of 65. Qualitatively, after interviewed 6 students, it can be seen that the ability of student's mathematical literacy is still lacking and there is no habituation of mathematical literacy in learning.

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