

The development of materials based on realistic mathematical approach to improve mathematical reasoning ability and emotional Intelligence students of mts s muhammadiyah Sei apung jaya

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Abstract : *There were three objectives of this research, namely; (1) to describe the validity, practicality and effectiveness of realistic mathematics approach-based materials to improve students' math reasoning skill and emotional intelligence, (2) to improve students' math reasoning skill through developing materials, (3) to improve students' emotional intelligence through developing materials. In order to achieve the objectives of the research, this developing research used the modification of 4-D development model. There were four stages performed, namely; define, design, develop, and disseminate. The experiment was conducted in grade VII-1 and VII-2 containing 35 students of MTs S Muhammadiyah Sei Apung Jaya. After experiment I and II, this research found that (1) the validity of material was valid based on the experts, the practicality of materials met the standards in which the validator stated that the materials can be used by doing some revision, the result of the observation also showed that the material was high category level, the material had proper worksheet, and the effectiveness of materials could be showed from three sides; the number of students' completeness, the active participation of students, and the positive feedback of students, (2) there was the significant improvement of students' math reasoning skill in which experiment II with 70.97 was higher than experiment I with 65.63, and (3) there was the significant improvement of students' emotional intelligence in which experiment II with 2,82 was higher than experiment I with 2,75.*

Keywords – material, 4-D model, realistic mathematics approach, math reasoning, emotional intelligences

I. INTRODUCTION

An education is said to be of quality if the educational processes can produce individuals or human resources that benefit society and nation development. Given that mathematics is one of science that underlies the progress of science and technology (science and technology), so that mathematics is seen as a science that is structured and integrated, the science of patterns and relationships, the science of how to think to understand the world around. In learning mathematics, students get the opportunity to develop systematic, logical and critical thinking in communicating ideas or solving of a mathematical problem encountered.

According to the Ministry of National Education (Depdiknas : 2006) states there are several indicators that need to be developed in learning mathematics, such as mathematical understanding, problem solving, and reasoning and reasoning. The ability of mathematical reasoning is one of the important skills in learning mathematics, where mathematical ability which is a high thinking pattern that includes logical and systematic thinking or a way of thinking to draw conclusions, both general conclusions drawn from the things that are specific and general things can be a conclusion that is special..

Baroody (Rohana, 2015) mentions at least four important reasons why reasoning is important for mathematics and everyday life. First, The reasoning needed to do mathematics, This means reasoning plays an important role in the development and application of mathematics. Second, The need for reasoning in school mathematics It is clear that to master mathematical concepts correctly requires reasoning in mathematics learning. Third, Reasoning involved in other content area, meaning reasoning skills can be applied to other sciences. It can be said that reasoning supports the development of other sciences. Fourth, Reasoning needed foe everyday life. This means reasoning to solve problems in life in everyday life.

There are two theories which discussed about mathematical reasoning skill. Firstly, Shivakumar dan Suvarna (2014:1) stated that *Reasoning skills develop gradually though a person's lifetime and at different rates for different individuals Reasoning skills are recognized as the key abilities for human being to create, learn, and exploit knowledge. These skills are also an important factor in the process of human civilization. Therefore, the importance of reasoning skills has been of great concern in educational settings and the world of work.* Then, according to Wahyudin (Rohana, 2015) *reasoning ability is very important to understand mathematics and mathematically reasoning is thinking habit. This result of reasoning then poured into systematical concepts in mathematics. Those concepts continually developed to become concepts which more complex and advance even can be used to solve various problems in life.*

Yet, the observation conducted in MTs S Muhammadiyah Sei Apung Jaya through circle material showed that students' mathematical reasoning skill is still low even lower. It is supported by the research of Simanullang (2014:74)

conducted in Grade VII State Junior High School SMP 17 Medan found that there were only 6 students with fair mathematical reasoning skill, while others were very low with the average achieved 2,06 (lowest category). It means that mathematical reasoning skill can be achieved if the students understand the material and concept very well, and the students are able to think rationally or it is also called Intelligence Quotient (IQ).

In addition to students mathematical reasoning ability, students emotional intelligence in learning also contributes to the learning process. The learning process of school is a complex and thorough process. Emotional intelligence can be done if the students have an understanding of the material or concept and have the courage to do. This understanding can occur based on the result of rational thinking which is cognitive and intellectual intelligence, better known as Intelligence Quotient (IQ). Many people argue that to attract high achievement in learning, one must have a high IQ because intelligence is a potential stock that will facilitate the learning, and in turn will result in optimal learning achievement.

According to Hasrattuddin (2011: 2), Emotional Intelligence is the ability of a person to control his own emotions and others, to distinguish one other emotion and use that information to guide the process of thinking and behavior. The same thing that is stated Goleman (Hidayat, 2014: 55), emotional intelligence is the ability of a person to manage his emotional life with intelligence (to manage our emotional life with intelligence); maintaining emotional harmony and expression through the ability of self-awareness, self-control, self-motivation, empathy and social ability. However, intelligence does not mean anything if the emotions are in power. Emotional intelligence adds much more qualities that make us more humane. Mathematical learning accompanied by grinding emotional intelligence of students is also expected to improve learning achievement, because emotions provoke one's actions against what he faced.

Although IQ is viewed as the standard measurement of someone's success, most students with high intelligence still have low achievement, while the students with low intelligence can achieve the high result. It is showed that intelligence is not the main factor determining students' success, since there are other factors affecting the success. According to Goleman (Uno, 2005:70), Intelligence Quotient (IQ) only contributes 20% determining the success of someone, and 80% comes from other factors including: Emotional Quotient (EQ). Based on the first observation undertaken by the researchers through questionnaire relating to Emotional Quotient (EQ) with 5 questions provided, namely; completely agree, agree, disagree, and extremely disagree, it was found that there were 30 students of grade VII Private Junior High School MTs S Muhammadiyah Sei Apung Jaya with a very low emotional intelligence. As Hidayat (2014:55) said that there are two kinds of students, they are; the students with high intelligence yet they have low achievement, and the students with low intelligence yet they have higher achievement.

This happens because mathematic learning process is focused on teachers so the students are not being able understand the concept with their awareness of thinking and they are not familiar with the problems involving mathematical reasoning skill and emotional intelligence. Absolutely, this kind of situation has an impact to students' mathematic achievement, then the teachers are expected to teach creatively in order to let the students involve the teaching learning process actively so the students are able to understand any concept with awareness of thinking. in addition, teachers are demanded to elaborate mathematic learning process through teaching materials. Teaching material is the essential component which determines the success of teaching learning process in the classroom prepared by the teachers before teaching learning process. Hamdani (2010:218) stated that teaching material is any material used to help teachers or instructors in performing teaching learning process in the classroom.

According to Nieveen (2007:26) there are three standards of material, they are; validity, practicality and effectiveness. Yet, the observation held in Private Junior High School MTs S Muhammadiyah Sei Apung Jaya showed that the materials used by the teachers do not increase students' math reasoning skill and emotional intelligence yet. The books used still focused on worksheet with monotonous pattern and exercise. Thus, it can be inferred that the book used do not meet the standards of materials; valid, practical and effective. The book used is not valid because it is never validated by teacher and headmaster of MTs S Muhammadiyah Sei Apung Jaya which based on one of teacher who said that "the book used was from publisher and it was never designed by teacher". Relating to fact above, this research will focus on material development used by teachers and students in MTs S Muhammadiyah Sei Apung Jaya in order to increase students' mathematical reasoning skill and emotional intelligence so the students are able to understand the concept with their awareness of thinking through realistic mathematical approach. According to Borich (Yamin, 2013:230) realistic mathematical is the strategy to carry out, and to monitor model of thinking involving reasoning ability.

Realistic mathematics approach is a mathematics learning based on view that mathematics is a human activist (Gravemeijer, 1994). Realistic mathematics approach is learning that goes from 'real' things to students, emphasizes skills, discusses and collaborates, argues with classmates so that they can find their own and ultimately use that math to solve problems both individually and in groups. In this lesson the role of the teacher is nothing more than a facilitator, moderator or evaluator while students think, communicate ideas, train the nuances of democracy by respecting the opinions of others.

In general, the theory of realistic mathematics approach by Gravemeijer (1994: 114-115) consists of five characteristics: (1) phenomenological exploration; (2) bridging with vertical instruments; (3) student contributions; (4) interactivity; and (5) linkages. The essence of this characteristic of realistic mathematics education basically emphasizes that the learning of mathematics starts from realistic problem. Thus, this characteristic corresponds to the expected learning in the SMP / MTs mathematics curriculum (BSNP, 2006: 139): "In every opportunity, mathematical learning should begin with the introduction of contextual problems. By posing contextual problems, learners are gradually guided to master the mathematical concept ". By using realistic mathematics education that links real-world problems or problems imaginable by students with learning materials so that learning becomes meaningful and fun for students. This will improve students' mathematical reasoning ability.

Based on the description of the problems that has been described previously, the authors need to examine in improving students' mathematical reasoning ability So this research entitled "The Development Of Materials Based On Realistic Mathematical Approach To Improve Mathematical Reasoning Ability and Emotional Intelligence Students Of MTs S Muhammadiyah Sei Apung Jaya"

II. RESEARCH METHOD

The method of the research is Research and Development (R & D) with 4-D model developed by Thiagarajan consists of four stages: define, design, develop and disseminate. This research develops teaching materials based on realistic mathematical approach to improve mathematical reasoning ability and emotional intelligence of students of MTs S Muhammadiyah Sei Apung Jaya. The developing products involve teacher's and student's books. The subject of the research are grade VII-1 and VII-2 students of MTs S Muhammadiyah Sei Apung Jaya respectively 35 students. Then, the instruments and tools for collecting data in this research are validation sheet, questionnaire and observation sheet. The detail is shown in Table 1

Table 1. Result of Validity

Evaluating Aspects	Instruments	Data Observation	Respondents
Validity	Validation sheet	Teachers' book validity (BG) and students' book validity (BS)	expert
Practicality	Validation sheet	Teachers' book practicality (BG) and students' book practicality (BS)	Expert
	Observation sheet	Teaching materials implementation	Observer
Effectiveness	Test	Classical completeness	Subjects
	Observation sheet	Students' activity	Observer
	Questionnaire	Students' feedback	Subject

The criterion states that realistic mathematical approach-based material has high degree of validity, if the validity of the minimum level achieved is valid with level ($4 \leq Va < 5$). Then, the criterion states that realistic mathematical approach-based material has good practical level, consisting of 2 indicators namely (1) all validators / experts stated that realistic mathematical approach-based material can be used with "minor revision" or "no revision". Meanwhile, to see the ability of realistic mathematical approach-based material implementation is high reliability with coefficient 0.75 or 75%. Furthermore, the criterion of instructional realistic mathematical approach-based material developed effectively with 85% students who follow the test of mathematical reasoning skill and emotional intelligence with some standards; the lowest average score is 56 or in category C. then, considering students' activity, four of six criteria of tolerance criteria should be achieved through all categories 1, 2, 3, 4, 5 and 6 are met. Note that the tolerance criteria of 3 and 4 must be met, and a minimum of 80% of the subjects studied provide a positive response to the component of the developed learning material.

III. RESULT AND DISCUSSION OF RESEARCH

After conducting the research, there are some findings found, namely; the validity, the practicality, and the effectiveness of teaching materials, improving students' mathematical reasoning skill, and improving students' emotional intelligence.

MATERIAL VALIDITY OF TEACHING MATERIALS

The validity of instructional materials is measured by the experts. Based on the results of expert materials analysis, realistic mathematical approach-based material for both teachers' and students' books obtained the average value of total validity as shown in Table 2.

Table 2. The Validation of Teacher's and Student's Books

Aspects	Aspect Average (A_i)		Total (V_0)		Validity Degree
	Teacher's Book	Student's Book	Teacher's Book	Student's Book	
Template	4.50	4.31	4.21	4.21	Valid
Language	4.10	4.13			
Illustration	4.00	4.04			
Content	4.25	4.34			

Based on Table 2 above, the average value of the total validity of realistic mathematical approach-based material is at intervals: $4 \leq Va < 5$. It means that the development of realistic mathematical approach-based material is valid.

PRACTICALITY OF INSTRUCTIONAL MATERIALS

The practicality of teaching materials based on development of realistic mathematical approach-based material is seen in 2 (two) aspects, namely: (1) expert / practical assessment of the developed teaching materials can be used with minor revision; (2) the results of observation of the implementation of teaching materials in the classroom is quite high category (teaching material is applicable). Based on the result of observation data analysis of realistic mathematical approach-based material, the average value of observation of teaching materials implementation for each meeting in experiment I shown in Table 3.

Table 3. The Average of Observation of the Implementation of Material in Experiment I

The Average of All Experts	Meetings $\overline{P_2}$			Total $\overline{P_3}$	Note
	1	2	3		
EXPERIMENT 1	3.70	3.82	4.01	3.84	High (Practical)

Based on Table 3, the average of observers of teaching material is in the high category ($3 \leq P \leq 4$) with the interval: $4 \leq Va < 5$. Based on the criteria of implementation, it means that the development of realistic mathematical approach-based materials developed is categorized as practical.

THE EFFECTIVENESS OF INSTRUCTIONAL MATERIALS

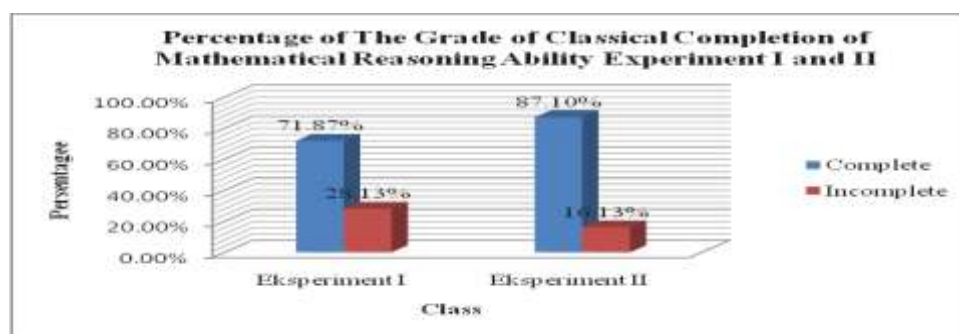
The criteria for determining the effectiveness of realistic mathematical approach-based materials in Experiment I and II consisted of three indicators as discusses as follows:

Completeness

Based on the finding of research in experiment I and II, the results obtained the completion as in Table 4:

Table 4. The Grade of Classical Completion of Mathematical Reasoning Ability in Experiment I and II

Categories	Mathematical Reasoning Ability			
	The total of students		Percentage	
	Experiment I	Experiment II	Experiment I	Experiment II
Complete	23	27	71.87%	87.1%
Incomplete	9	5	28.13%	16.13%
Total	32	31	100%	100%



Based on Table 4, it is showed that posttest result of mathematical reasoning ability in Experiment I test did not met the criteria of classical completeness achievement. In accordance with the students' learning completeness criteria in classical is at least 85% of students who follow the learning achieving ≥ 71 . Thus, the posttest result of mathematical reasoning skill in experiment II completely met the criteria of classical achievement. This is supported by Anggo's research (2015: 140) who concludes "Student's math learning outcomes through the test in the application of learning with realistic mathematical strategies is increasing". It implies that students' mathematics learning outcomes through tests in the application of learning with realistic mathematical strategies are increasing. Furthermore, Yulianti's research (2013) which also concludes students' classical mastery of mathematical reasoning ability with Model-Eliciting Activities learning is better than expository learning.

Students' activity

Student activity's in learning is effective, if four of the six criteria for tolerance of achievement of the ideal time used in categories 1, 2, 3, 4, 5 and 6 are met. The tolerance criteria for 3 and 4 must be met. Based on the results of research in experiment I and experiment II, the results obtained from student activities are as follows:

Table 5. The Percentage of Analysis Results of Student Activity in Experiment I and II

Meetings	The Percentage of Students' Activity (%)					
	1	2	3	4	5	6
Experiment I	26.56	15.1	17.19	27.6	10.42	3.13
Experiment II	27.08	14.58	18.75	26.04	8.33	5.21
Experiment III	27.6	10.94	20.83	26.56	8.85	0.52
% Average	27.08	13.54	18.92	26.73	9.20	2.95

Based on the data in Table 5, it can be showed that the result of the percentage of student's activity in the experiment I and experiment II did not meet the standard. While, percentage of student activity for each indicator in experiment III successfully met the standard of students' activity

Students' Feedback

Students' feedback criteria can be effective, if there are 80% research subjects showed positive feedback against component of developing teaching material. Based on the results of research on experiment I and II, students give positive feedback to the content of teaching materials developed. This is reinforced by Mawaddah's research (2015: 10) found that students show positive feedback for learning mathematics model with discovery learning and realistic mathematical approach.

IMPROVEMENT OF MATHEMATICAL REASONING SKILL

To know the improvement of mathematical reasoning skill, the data obtained from experiment I and trial II were analyzed by comparing the mean score of students. the description of improving students' mathematical reasoning skill using realistic mathematical approach-based material developed in experiment I and II shown visually in Table 6.

Table 6. Description of the Results of Mathematical Reasoning Ability

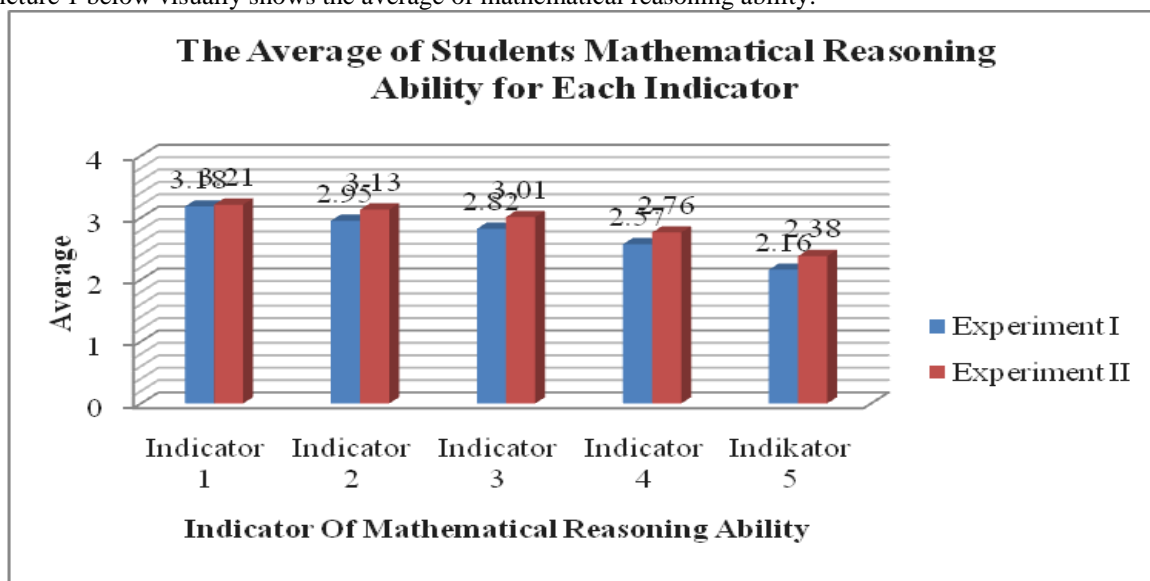
Description	Experiment I	Experiment II
Highest Score	83	88
Lowest Score	53	55
Average	65.63	70.97

Furthermore, a description of the enhancement of students' mathematical reasoning skill by using developing realistic mathematical approach based material experiment I and II for each student's mathematical reasoning indicator can be shown in Table 7.

Table 7. The Average of Student Mathematical Reasoning Skill for each indicator

Indicators	Average		
	Experiment I	Experiment II	Improvement
present a written mathematical statement	3.18	3.21	0.03
Presenting prediction	2.95	3.13	0.18
Composing proof, giving the reason of the solution	2.82	3.01	0.19
Checking the validity of argument	2.57	2.76	0.19
Drawing conclusion	2.16	2.38	0.22

Picture 1 below visually shows the average of mathematical reasoning ability.



Picture 1 Students' Mathematical Reasoning Skill for each Indicator

Based on Table 7 and Figure 1 above, it can be concluded that students' mathematical reasoning ability from experiment I and II by using developing realistic mathematical approach teaching materials increase significantly. Then, Wijaya (2012: 32) The context in realistic mathematics education is aimed at building or rediscovering a mathematical concept through the process of mathematical. The stages of problem solving is a part must be experienced by students in the process of developing mathematical communication in writing and also in the learning process with Realistic Approach.

Furthermore, a research by Dewi (2016) concluded that the increasing of students' mathematic reasoning ability by using geometrical learning material based on the constructivism at the grade VII of SMP Negeri 3 Padang sidimpunan was on the medium category.

Here is an example of student answers from question number 1:

Problem:

1. There are two parks; A and B are circular. There are tree planted around the park every 2 meters. The numbers of trees in each garden are as many as 88 trees and 77 trees.
 - A. Which garden diameter is shorter? Explain your opinion?
 - B. Prove the shorter garden diameter?
 - C. The park is shorter than the number of trees planted as many as 88 trees. Is it true?
 - D. What can you conclude from the number of trees?

Student's Answer Sheet:

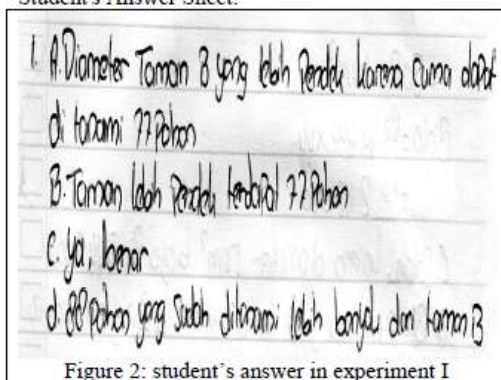


Figure 2: student's answer in experiment I

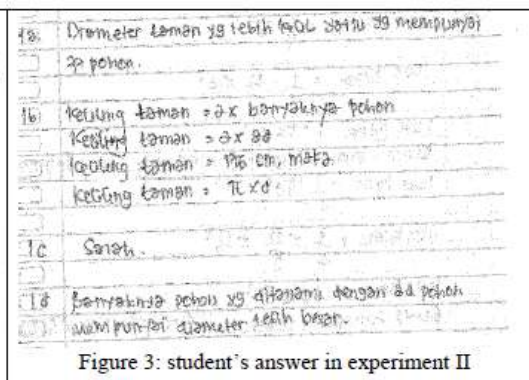


Figure 3: student's answer in experiment II

From Figure 2 and Figure 3, there is an improvement in student's feedback between experiment 1 and II which shown from each indicator. In experiment 1, students' answers to the 2nd indicator were not able to prove which diameter was shorter and the 3rd indicator was wrong. But in the 2nd trial, the student's answer to the 2nd indicator of the student could prove the answer according to the formula but not completed. It is suggested o the students to be able to know the appropriate formula. In the indicator 3, students correctly answer although the students can't compose reason correctly, it is suggested to the students to review the previous questions so they will be able make the reasons correctly.

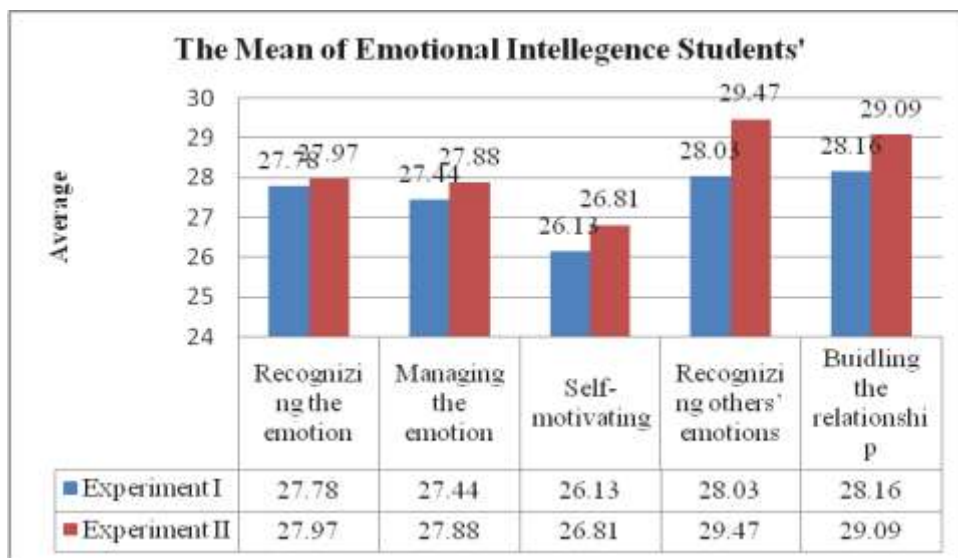
IMPROVEMENT STUDENTS' EMOTIONAL INTELLIGENCE

Based on the results of experiment I and II, it is obtained the result of questionnaire of students' emotional intelligence. This questionnaire is given at the end of each meeting which aims to see students' emotional intelligence. Then obtained data from the results of questionnaire emotional intelligence experiment I and II were analyzed to determine the improvement of students' emotional intelligence by comparing the average score of students obtained from the questionnaire attitudes emotional intelligence experiment I and II. The descriptions of improvement of students' emotional intelligence after the application of developing realistic mathematical approach based material are shown in table 8.

Table 8. The Mean of Emotional Intelligence Students'

No	Indicators	Mean for each indicator		Mean
		Experiment I	Experiment II	
1	Recognizing the emotion	27.78	27.97	0.19
2	Managing the emotion	27.44	27.88	0.44
3	Self-motivating	26.13	26.81	0.68
4	Recognizing others' emotions	28.03	29.47	1.44
5	Building the relationship	28.16	29.09	0.93
The mean of each indicator		2.75	2.82	
The mean of emotional intelligence improvement from experiment I and II				0.07

Detailly, it is visually shown in picture 2



Based on Table 8 and Figure 4 above, it can be concluded that the average result of questionnaire of students' emotional intelligence significantly increased experiment I to experiment II. It is supported by Hasratuddin (2012: 65) shows that there is a difference in the increase of emotional intelligence between students who are given mathematics learning through realistic mathematical approach with students who are given regular learning. It is clearly seen in Figure 4, the indicator of recognizing other's emotions is higher than the other indicators because the feelings among students play a role in learning so that psychological insight and understanding of students in reasoning are able to capture hidden social signals indicating what is needed or desired by others. So it can be concluded that realistic mathematical approach-based material improved students' emotional intelligence.

ANSWER PROCESS

Student response process is seen based on indicators of each mathematical reasoning ability. Here are examples of student processes and errors based on indicators present a written mathematical statement for each class:

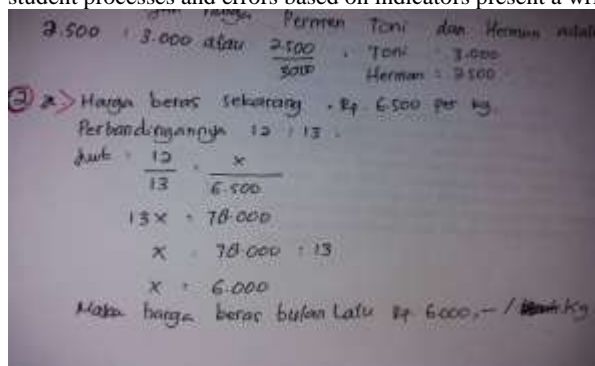


Figure 4 The process of student answers to the Experiment I Class t

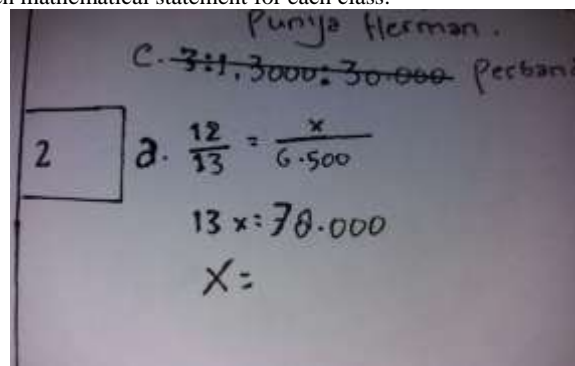


Figure 5 The process of student answers to the Experiment I Class

Based on the results of the student's answer process analysis found that, the process of student answers on eksperiment I to get "good" assessment criteria. The process of student answers to eksperiment I is structured, systematic as well as in accordance with indicators of mathematical reasoning ability when compared with the student's answer process in eksperiment II.

IV. CONCLUSION

Based on discussion of the research, the conclusions are drawn as follows:

1. The validity of developing instructional materials belongs to valid category. It means that realistic mathematical approach-based material meets the practical criteria reviewed from: (1) expert / practitioner who state that realistic mathematical approach-based material can be used with minor revision; And (2) the implementation of teaching materials has reached high category, that is in experiment I with 3.82 and experiment II the implementation of teaching materials has reached higher category with 4.06, and the observation sheet of the reliability of implementation of realistic mathematical approach-based material was very go in which in the experiment I was 71.87% and experiment II was 87.1%. in other words, realistic mathematical approach-based material has met the effective criteria. Effective criteria reviewed from: (1) students' learning mastery has been achieved 89.19% classically in experiment II; (2)

- student activity during learning activities meets the criteria of ideal time tolerance set; And (3) positive students' feedback to the components of learning materials and learning activities developed.
2. Students' mathematical reasoning ability significantly increased from experiment I to experiment II using realistic mathematical approach-based material
 3. Students' emotional intelligence significantly increase from experiment I to experiment II using realistic mathematical approach-based material

SUGGESTIONS

Based on the conclusion above, some suggestions are offered:

1. Realistic mathematical approach-based material successfully met the aspects of validity, practicality and effectiveness, so the teachers are suggested to use this component of teaching materials in order to develop students' mathematical reasoning ability, especially grade VII Junior High School SMP / MTs. Students.
2. For other researchers who want to do research to measure mathematical reasoning ability in order to pay more attention to the ability of students on indicators to compile evidence and check the validity of an argument.
3. For other researchers who want to conduct research to measure the emotional intelligence of students in order to find other emotional intelligence indicators in order to enrich the science of the researchers about emotional intelligence.

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