

Improving the Mathematical Connections Ability through Model of Indonesia Realistic Mathematical Education (Pmri) based Betawi Ethnomathematics In Sdn Batu Ampar 09 Pagi East Jakarta

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ABSTRACT

The purpose of this research is to improve mathematical connection ability of third-grade students of SDN Batu Ampar 09 Pagi East Jakarta. The method used is action research. Methods of data collection using observation sheets, test questions, interviews, and documentation. The result of data analysis is known that: (1) Indonesia realistic mathematics education model (PMRI) able to improve the ability of creative thinking to students especially on multiplication subject and division (2) linking learning mathematics with daily life. The suggestion that can be recommended is the effort that can be done to improve mathematical connection ability of student one of them is learning using Indonesia realistic mathematics education model (PMRI) based on Betawi ethno mathematics.

Keywords: Mathematical connection, PMRI, Betawi ethnomatematic.

1. INTRODUCTION

Development of science and life skills is an inseparable in the current era of globalization. The development should be supported by the ability of utilization, development and mastery of science technology and life skills in a balanced way. Life sciences and skills can be developed as a means of improving the quality of education, one of which is in the field of mathematics, because mathematics is the basis of other sciences.

The importance of learning mathematics can not be separated from its role in various aspects of life. In addition, by studying mathematics one accustomed to thinking systematically, scientifically, using logic, critical, and can increase the power of creativity. In addition, mathematics also has an important role in a person's way of thinking such as how mathematical thinking is systematic, through regular and specific sequences. by learning math, our brains are accustomed to solving problems systematically. So when applied in real life, we can solve every problem more easily.

One of the lessons taught in every level of education is mathematics. But in fact, the mathematics that has been used as one of the lessons in our education system has been more often taught partially, the stand-alone lessons as if apart from other lessons, other than that the material in learning mathematics was more to learning the concept theoretical and less attention to the meaningfulness of applications in everyday life.

This condition is also relevant to the results of TIMSS 2015. Mathematics Score 397, placing Indonesia at number 45 out of 50 countries, on Science, with score 397, Indonesia in 45th out of 48 countries, If using logical data table / graph only 4 percent right. From the data published by TIMSS can be explained that the results of math and science of Indonesian students is still very low. Researchers from Puspendik, Rahmawati said the ability of students can actually be optimized if the nature routine, familiarized and close to the daily life of students. This, in addition to requiring routine habituation but also requires the connection (connection) of learning between the learned in school with what is experienced in the daily life of students.

In learning mathematics there must be a link between the previous student's learning experience with the concept to be taught. However, the connection (connection) is one of the problems that like to arise in the students which is mostly caused by

the lesson taught mathematics intact to learners and in the learning process teachers tend to convey concepts and formulas directly. The low mathematical ability of the students is also demonstrated by Haety's study which states that in the learning process, there is still a lot of learning centered on teachers and students receiving finished materials without any element of student involvement in the learning itself. With this kind of learning, students become unaccustomed to associate learning mathematics with the concept of mathematics itself, with daily life and with other sciences. Having mathematical connection skills helps students provide mathematical models that illustrate the relationship between concepts, data, and real situations in their lives.

The problems in the mathematics subjects that have been described are also still found in students. Interviews and observations at several schools in East Jakarta showed that elementary students had low connection skills. This they reveal if mathematics is a lesson that is considered less interesting because it includes a difficult lesson. They also assume that one mathematical material has nothing to do with any other mathematical material. In fact, they do not realize the true learning objectives, do not know the benefits of learning for the future later. That's why many students still have low mathematical connection ability.

The ability of mathematical connections comes from the English word Mathematical Connection which was then popularized by NCTM in 1989 and used as one of the curriculum standards aimed at assisting the formation of student perceptions, by looking at mathematics as a whole of unity. As a stand-alone material and recognize the relevance and benefits of mathematics both at school and beyond school. NCTM (2014: 73) states that the ability of a mathematical connection is knowing, using and making connections between and among mathematical ideas and in an outside mathematical context to build a mathematical understanding.

Sumarmo (2015: 5) suggests indicators of mathematical connections: (a) Seek and understand the relationship of various representations of concepts and procedures. (b) Using mathematics in other study midwives or daily life. (c) Understanding the equivalent representation of the same concept or procedure. (d) Seek connection one procedure to another procedure in equivalent representation. (e) Using connections between mathematical topics and between mathematical topics and other topics.

One of the learning models that enable learners to recognize and understand this mathematical relationship is Indonesian Realistic Mathematics Education (PMRI). Various literature states that the Realistic Mathematics Education has the potential to improve students' mathematical understanding, thus providing opportunities for students to actively construct mathematical knowledge. Zakaria (2017: 33) The realistic approach is based on Freudenthal's ideas in Zacharias and Syamaunyang saying that mathematics is a human activity. Learning mathematics is viewed as a process. In solving a problem that begins with problems envisaged by students, students are given the freedom to find their own strategies, and gradually teachers guide students to solve the problem mathematically. Soedjadi (2017:92) realistic mathematics learning has several characteristics and components, among others:

- 1) *The use of context* meaning that in learning of realistic mathematics everyday environment or knowledge that has been owned by student can be made as part of contextual learning material for student.
- 2) Use models, meaning that problems or ideas in mathematics can be expressed in the form of models, both models of real situations and models leading to abstract levels.
- 3) Students contribution meaning problem solving or concept invention based on student idea contribution.
- 4) Interactivity meaning the learning process activities are built by the interaction of students with students, students with teachers, students with the environment and so on
- 5) Intertwining meaning different topics can be integrated so as to generate an understanding of a concept simultaneously..

The application of realistic mathematics learning in Indonesia is expected to improve the quality of student mathematics learning achievement to be increased, in line with the new paradigama form in the world of education. Zamroni (2017: 43) expresses the purpose or expectation in Indonesia's realistic mathematics education that is so that students have the characteristics:

- 1) In the classroom they are active in discussions, ask questions and ideas, and are active in finding lesson materials that support what is being learned.2. Be able to work together by creating study groups.
- 2) Be democratic, that is to dare to convey ideas, to defend ideas and also to accept other people's ideas, and also to be courageous
- 3) Have high confidence.

Untuk dapat menerapkan model matematika realistik perlu diketahui terdapat komponen dalam model PMRI, komponen tersebut memiliki tiga prinsip utama yang digunakan oleh model PMRI. Menurut Grevemeijer (2008:16) ada tiga prinsip kunci model RME yaitu Guided Re-invention, Didactical Phenomenology, dan Self-delevoped Model.

Guided Re-invention or rediscovered equally the teacher gives the students a chance to rediscover the mathematical definitions and formulas. Learning not only uses the definitions and formulas given by teachers, but students must also seek the origin of the formula.

Didactical Phenomenology or didactic phenomenon is making daily life problems as the beginning of learning so that students can solve problems in their own way. Teachers only guide students in order to solve problems. In solving the problem, students can use horizontal mathematical and vertical mathematization. Meaning on horizontal mathematization students can use

math to help solve problems in real world situations. In vertical mathematization is the process of organizing and operating in using the mathematical form itself.

Self-developed Models or models are constructed or individually construed by students in groups or independent forms, students are given the right of freedom to solve problems in their own way and by themselves will bring up different types of student-made problem solving models themselves.

After knowing the principle form, characteristics and objectives of the PMRI model, briefly explain the steps in applying PMRI model in the learning process in the classroom, the steps of PMRI model can be explained as follows (Supinah 2008: 34):

Initial Activity or Opening	<ol style="list-style-type: none"> 1. Submission of learning objectives 2. Submission of subject matter or relevance 3. Giving motivation lessons and doing apersepsi 4. Explanation of group division and way of learning
Core activities	<ol style="list-style-type: none"> 1. Starting with contextual or realistic problems. 2. Students are given the opportunity to solve problems by choosing or building their own strategies (submitted time limits). 3. Teachers facilitate, among others, by preparing props or other media such as sheets of problems, worksheets or task sheets. 4. After the time is up, some students explain how to solve the problem (informal). Do not intervene, let the students finish the idea. 5. Class discussion led by teacher 6. Submission of the following tasks: <ol style="list-style-type: none"> a. draw or create a scheme b. The students present the results obtained c. other student responses 7. The class discussion is led by the teacher 8. The teacher asks the students to reflect on the material they have just learned 9. Teachers slowly bring students to formal mathematics
closing activities	<ol style="list-style-type: none"> 1. Withdrawal of inferences from what has been learned in 2. learning according to the goals to be achieved. 3. Reflecting on every step taken or on learning outcomes. 4. Giving assignments or exercises.

Can be explained if the PMRI model is a solution that can be selected by the teacher in giving the concept of understanding to the students on the subject of mathematics because it utilizes the surrounding circumstances that exist in the student environment. So the PMRI model can be understood as well as understand the benefits he learned mathematics for the lives of learners. This is one of the advantages of the PMRI model, but there are some more advantages of the PMRI model. Behind the excess of the PMRI model also has some kekrurangan. The advantages and disadvantages of PMRI model will be explained starting from the excess first, among others:

1. PMRI is a learning that relates between mathematics with daily life and the usefulness of mathematics in general for students.
2. PMRI is a learning that teaches students that mathematics is a field of science studies that are constructed and developed by students themselves.
3. PMRI is a learning that emphasizes on how to solve a problem or a problem does not have to be single and not necessarily the same between one student with another student. Everyone can find or use their own way. Furthermore, by comparing the way of settlement to one another will be obtained the most appropriate way of completion seseuai with the purpose of the process of solving the problem or problem.
4. PMRI is a learning process that prioritizes. To learn mathematics students have to go through the process and try to find their own mathematical concepts with the help of teachers. Without the will to go through the process itself meaningful learning will not happen

While some weakness PMRI which is a challenge that must be faced by teacher in PMRI implementation among others (Izzati 2014:25):

1. Efforts to implement PMRI require a lot of paradigm shifts for teachers, students, social roles, the role of context, and the role of props.

2. Searching for problems or contextual problems that meet the requirements demanded in realistic mathematics learning is not easy for any mathematical topic that students need to learn, especially since they must be resolved in various ways.
3. The effort to encourage students to find ways to solve problems is not easy for teachers to do.
4. The process of developing students' thinking skills, through contextual problems, the process of horizontal mathematization and vertical mathematization is also not a simple thing, because the processes and mechanisms of students' thinking must be carefully followed, so that teachers can assist students in rediscovering concepts certain mathematics.

Indirectly people have known mathematics in their daily activities such as calculating, measuring and even producing products such as webbing. This habit is a culture that can be associated with a mathematical concept better known as ethnomatematics. Ethnomatematics is a new term in mathematics that links culture with mathematical concepts. D'Ambrosio (2001: 1) The Ethnomatematics is the mathematics practiced by cultural groups, such as urban and rural communities, groups of workers, professional classes, children in a given age group, indigenous societies, and so many other groups that are identified by the objectives and traditions common to these groups.

The importance of applying realistic mathematical approaches through ethnomatematics because realistic mathematics departs from the real world for learners, while culture is a thing that also exists in the real world of learners. So in everyday culture that exists in the society learners indirectly also provides a concept of teaching mathematics that is unknown to him.

From this point of view it can be explained that ethnomatematics is a mathematical practice practiced by cultural groups, such as urban and rural communities, working groups, professional classes, children in certain age groups, indigenous peoples and so many other groups identified by common goals and traditions with the cultural group.

The application of RME based on ethnomatematics can be applied to one culture, one of which is Betawi culture which is located in Jakarta Special Capital Region. Betawi culture has a traditional game, a traditional game in Betawi culture that has a mathematical element. By utilizing the habit or culture of betawi inherent in their daily activities such as games, learners are expected to relate it to mathematical concepts learned and feel the benefits of learning mathematics in accordance with the culture of their own community.

2. METHOD

The research was conducted at SDN Batu Ampar 09 Pagi East Jakarta, located in Batu Ampar Urban Village, Kramatjati Sub-district, East Jakarta Municipality, DKI Jakarta Province. The research was conducted in class III SDN Batu Ampar 09 Jakarta Timur with the number of students as much as 32 students. The research time is planned in the first semester of the academic year 2018/2019, precisely in July 2018 until August 2018. This research is action research done in the classroom.

Action research is a research conducted by teachers in their own class by planning, implementing, and reflecting collaborative and participatory action with the aim of improving their performance as teachers, so that learners' learning outcomes can increase.

Many models can be used as guidelines for designing and conducting classroom action research. Researchers in this study using the concept of action research from Kemmis Taggart. Model research model of Kemmis Taggart model

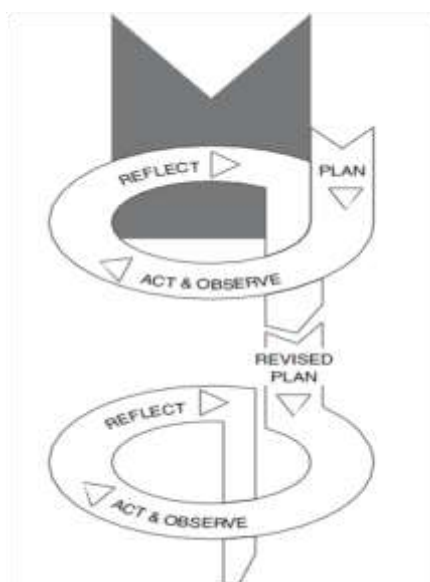


Figure 1. Action Research Kemmis Taggart Model

Instrument data collection to measure the ability of mathematical connections learners use the test. The assessment of mathematical connection capability was obtained from two assessments, namely the main assessment and the supporting assessment. The main assessment is obtained from daily observations written in daily journals. While the supporting assessment is obtained from the interview result to be used as a means of confirmation of the assessment results by educators. The data collection instrument to measure the knowledge aspect of the learner is assessed through a written test. Based on the Technical Guidance Guidance in Elementary School it is mentioned that written tests are test questions and the answers are written in the form of multiple choices, entries, and descriptions. The written test used in this study is a written test that measures the learner's knowledge of mathematics subjects.

3. RESULT AND DISCUSSION

3.1 Result

Tabel 12.: Recapitulation of Evaluation Data Analysis

Value	The number of students		Percentage		Percentage KKM	
	Siklus I	Siklus II	Siklus I	Siklus II	Siklus I	Siklus II
>= 65	18	26	59,14 %	87,29 %	57,14 % students reach KKM	89,29 % students reach KKM
< 65	13	5	40,86 %	12,71 %		

The diagram below shows the data of evaluation result of mathematical connection ability of multiplication material in cycle I and II

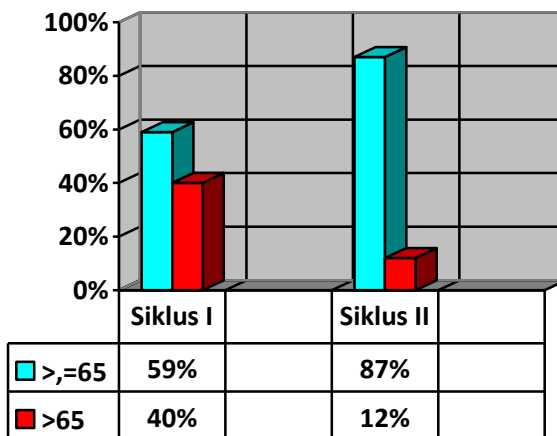


Figure 2. Test Results Diagram The ability of mathematical connections Materials Cycles I and II

While the tables and diagrams below show teacher and student action monitoring data using the model of Indonesian Realistic Mathematics Education (PMRI) of fractions in cycle I and II:

Tabel 13. Teacher and Student Action Monitor

Action Teachers and Students Use RME approach		
Aspect	Siklus I	Siklus II
Teacher	77 %	89 %
Student	56%	89%

Based on the above table, the mathematical connection ability of fractional material from cycle I to cycle II has increased by 12% for teacher action monitoring and 33% for student action monitor.

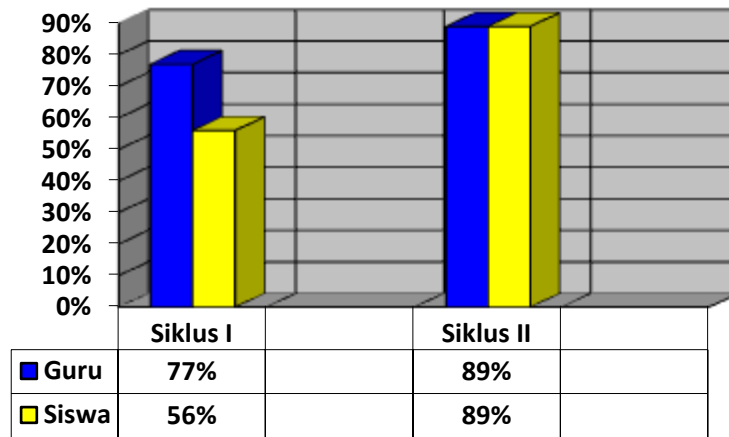


Figure 3. Master and Student Action Monitoring Diagram

3.2 DISCUSSION

Discussion of the results of this study is based on data that has been analyzed in the previous sub-chapter and findings obtained field. This research is also analyzed based on the factors of learning process using model of Indonesian Realistic Mathematics Education (PMRI) with improvement of mathematical connection of students.

After analyzing the data by applying Mathematics Education Realistic Indonesia (PMRI), the results of data analysis indicate that there is improvement of students' mathematical connection ability. Differences increase based on the results of the test cycle I and cycle II which indicates a change. After the data poses and tested the results obtained research, then conducted a discussion of the results of these studies.

In the implementation of learning using RME start with asperses to know the initial knowledge of students before studying material multiplication class 3 semester 1 during four times meeting and two meeting for evaluation. Then, communicate the learning objectives. In the core activities, carried out RME learning steps namely the submission of this individual problem, students provide a contextual problem. The use of this contextual problem refers to the RME characteristics. Examples of contextual problems in multiplication materials with group discussions, question and answer between students and teachers, exchanging opinions or ideas and working together. This is in accordance with RME characteristics according to Treffers and RME principles according to Gravemeijer, and according to Zulkardi the steps of learning mathematics using the RME approach as follows (zulkardi 2000: 13): 1) give students contextual issues related to the topic as a starting point; 2) during interaction activities provide instruction to students, for example by drawing a table on the board; 3) guide students individually or in small groups if they need help; and 4) stimulate students to compare their solutions in class discussions. The discussion proceeds on the interpretation of the situation described in the contextual problem and also focuses on the adequacy and efficiency of various solution procedures. Let the students find their own solutions. This means students are free to make discoveries at their own level, to build their own experiential knowledge and do shortcuts with their own density.

This is similar to the development of students according to Piaget of the third-grade students aged 8-10 years, in which the development of students entering a concrete operational phase, the end of thinking imaginary and start thinking concretely (related to the real world). So students at this time have thought something acceptable by reason or logic although still tied to objects that are concrete so it takes concrete objects in order to facilitate students in the learning process.

When the teacher's ongoing learning process is a facilitator as a guide and guide. That is, if there are students who have difficulty in completing the task, the teacher directs students by giving feed questions to students so that students find further instructions to complete group tasks.

Then, the group problem submission from the first meeting to the fourth, students are grouped 5-6 students in each group to work on the problems posed by the students listed on the Student Activity Sheet (LKS). In applying for this group problem, students discuss with a group of friends, exchanging ideas, ideas or solutions. According to Torrance creativity consists of four components namely: (1) eloquence that refers to the continuity of ideas; (2) the flexibility associated with changing ideas; (3) originality characterized by a unique way of thinking; (4) elaboration that refers to the ability to generalize ideas. Of the four components, novelty or originality is widely recognized and viewed as a process related to the generation of original / original ideas. Another opinion according to Kozulin that the interactions of someone with the environment can help learning. Therefore with the grouping, the interactivity aspect in the RME learning helps students to interact, exchange ideas and discuss with their friends so that students can find ways to solve the problem.

In modeling the student begins playing a traditional game related to mathematics, determines the value of multiplying a number by two numbers, multiplication of a number by three numbers, multiples that produce three numbers, exchanging opinions or ideas and cooperating on this answer in accordance with the characteristics of RME According to Treffers and the principle of

RME according to Gravemeijer, and according to Zulkardi the steps of learning mathematics where during interaction activities provide instruction to students, for example by drawing and let the students find their own solutions. This means that students are free to make discoveries at their own level to build their own experiential knowledge and shortcuts with their own density. This is in line with Krulik & Rudnik's opinion that creative thinking involves synthesizing ideas, building new ideas, and determining their effectiveness. Mathematical connections are characterized by the ability to link between mathematical topics, linking mathematical topics with other disciplines, relating mathematics to everyday life.

The same thing with the elementary school age (7-12 years) phase is characterized by lively motion or motor activity. Therefore, this age is an ideal time to learn these motor-related skills, such as writing, drawing and coloring according to RME learning when performing traditional multiplication games where students play followed by working on LKS through the media. In the process of modeling students have the skills to create something new to support motor development for the success of student learning.

Furthermore, at the conclusion the student representatives present their work and communicate the results of the discussion answers and the other students respond to the answers of their group's friends. Some students are not afraid to be criticized, appear brave and appreciate the opinions of other friends when the process of delivering the work in front of the class. Students equate the perceptions of the material learned so as to develop students' thinking skills.

Then, the development of students' language is seen when the student representatives come forward to present the results of the discussion group there are students who express their opinions smoothly there is also stammered in the opinion of Abidin Syamsuddin that students who have many vocabulary means having the skills to read and communicate with others so that children are able to link math subjects. The development of emotions seen every meeting students cheered feelings of excitement, passion, passion or curiosity (high curiosity) in completing the LKS, modeling until modeling this will affect the individual so that students actively discuss. In the social development seen students discussed determine a suitable friend and can be invited so that the interest of peer to peer activities and stronger desire to be accepted as a member of the group.

In the learning process of completing the LKS, modeling and presenting the results of teacher discussions move from one place to another to guide students who have difficulty and monitor the course of the discussion. The role of the teacher as a facilitator to guide students in solving individual problems as well as group problems given during the learning process. It is appropriate in Chapter II earlier, that the role of educator as facilitator, moderator or evaluator.

After that, students are given individual tasks and homework (homework) to find out every student is familiar with the material being studied. During four learning sessions and at the end of each cycle students are given evaluation questions to determine students' mathematical connection ability to RME approach based on ethnomatematics betawi. Mathematical connection capability data is obtained from the same postes score of the item instrument. Grain test problem of mathematical connection ability amounted to 10 problem. This is based on the purpose of this study is to know the description of the difference of acquisition and improvement of mathematical connection ability of students by applying Realistic Mathematics Education (RME) learning based on ethnomatematic betawi, the indicator that researchers use is the indicator of mathematical connection that is: (a) topic of mathematics learning (b) linking the topic of mathematics learning with other learning disciplines (c) linking mathematics learning with daily life.

Based on the results of descriptive analysis of the ability of mathematical connections in whole show there is an increase in learning to improve the ability of mathematical connections. This is derived from the analysis of postes data. Data analysis before applying the RME shows results below the KKM before being treated with RME learning. From the results of postes data, proving hypothesis in peneitian is the application of Realistic Mathematics Education (RME) approach to improve student connection ability.

From the postes score data obtained is used to see the ability of mathematical connections using the RME approach. It is also to answer the research hypothesis listed in Chapter II. The ability of mathematical connections on learning approach RME score of 57% and cycle II to 89%, then the increase can be said higher than the cycle I. Improved results score of creative thinking ability in cycle II is categorized high (results of data attached in appendix) with 28 students from 31 students who achieve greater value and equal to 70, while the value less than 70 there are 3 students means students have increased the value of the test tray of students' mathematical connections are high compared to cycle I with a value greater and equal to 70 there are 18 students and less than 70 there are 14 students.

Based on the results of the above exposure and the results of mathematical connection improvement analysis can be concluded that there is an increase in mathematical connection capabilities with ethnomatematics-based PMRI with high category compared to conventional learning.

4. CONCLUSION

Based on research conducted in grade 3 SDN Batu Ampar 09 Pagi seeks to improve mathematical connection ability of students multiplication material with PMRI application, and based on result of data analysis and discussion which have been done, hence can be concluded that: Realistic Mathematics Education (RME) able to improve the ability of mathematical connections in third grade students SDN Bau Ampar 09 Pagi Year Lesson 2018/2019, especially on multiplication subject.

By implementing RME learning steps that include individual problem-solving or group of students providing a contextual problem with through traditional betawi games on multiplication materials, the interactivity of student problem solving is grouped 5-6 students in each group to work on the problems posed by the students listed on Student Activity Sheets (LKS) as well as students discussing with a group of friends (exchanging ideas, ideas or solutions), solving problems in modeling that students start playing a traditional game of multiplication values on answers. Continuing, concludes the student representation to predominate or communicate the result of answers on the LKS and each student responds to the answers of his group's friends, affirmation and assignment equalize the perception of each student, so that students know the essence of the material learned and to develop students' thinking ability, given problems others and students work individually to find out whether each student already understood or already understood the material being studied. By applying PMRI learning with improvement of mathematical connection ability of students able to improve the quality of learning at SDN Batu Ampar 09 Pagi especially about multiplication concept in academic year 2018/2019.

Excess PMRI is able to improve the ability of mathematical connections, able to increase student activeness, skills to play traditional games pertaining to betawi betawi, communicating various answers, able to integrate daily problems in solving problems and students have freedom in mengkonstrusikan knowledge and understanding owned. The weakness of PMRI is that it takes a long time and the child is too free or playing alone.

Based on the conclusion of the research, the formulation of the implication of this research is the application of the model, the writer hopes the mathematics learning with the model of Indonesian Realistic Mathematics Education (PMRI), teachers who have difficulty in conveying the material as an alternative learning model. While the level of understanding that students have varied. The application of Indonesian Realistic Mathematics Education (PMRI), enables students to develop students' mathematical connection abilities. Learning is meaningful because students are exposed to real or contextual conditions in finding a concept. Thus the application of Indonesian Realistic Mathematics Education model (PMRI) multiplication material can improve students' mathematical connection ability.

The efforts to improve the application of Indonesian Realistic Mathematics Education (PMRI) so as to improve the mathematical connection ability of students include: (a) linking between mathematics learning topics (b) linking the topic of mathematics learning with other learning disciplines c) everyday life.

Through this activity, students will directly apply the model of Indonesian Realistic Mathematics Education (PMRI) in finding the concept of fractions.

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