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EFFORTS TO IMPROVE STUDENTS INTEREST AND LEARNING OUTCOMES IN MATHEMATICS: THE INDONESIAN REALISTIC MATHEMATICS EDUCATION APPROACH (PMRI)

Erwanto Guntoro [1*], Siti Ruqoyyah[2]
[1] Postgraduate Program, University of Riau Islands, Indonesia [2] Muhammadiyah University of Surakarta, Indonesia
*Corresponding Author: erwantoguntoro@yahoo.com

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ABSTRACT
This study aims to describe (1) the use of the Indonesian realistic mathematics approach (PMRI) method by mathematics teachers in learning in class IX B (2) student responses to the use of the PMRI method in mathematics learning in class IX B (3) teacher obstacles that come from students in the use of the PMRI method in mathematics learning in class IXB SMP Negeri 3 Numfor Barat. This study uses a qualitative and quantitative descriptive research design. The subjects of this study are teachers and students. The objects in this study are the use of the PMRI method, student responses, and teacher obstacles. The data collection methods used are the observation method and the interview method. The data in this study were analyzed descriptively quantitatively. The conclusions of this study are (1) the use of the PMRI method has been effective and in accordance with procedures. (2) student responses are mostly positive. (3) the obstacles found by teachers are in terms of students and very limited school facilities. The suggestion of this study is for mathematics teachers to maintain the effectiveness of learning and motivate students more, and for schools to improve learning facilities .

Keywords: *Interest, Learning Outcomes, Mathematics, PMRI*

ABSTRACT
Penelitian ini bertujuan untuk mendeskripsikan (1) penggunaan metode pendekatan matematika realistik indonesia (PMRI) oleh guru matematika dalam pembelajaran di kelas IX B (2) respons siswa terhadap penggunaan metode PMRI dalam pembelajaran matematika di kelas IX B (3) kendala guru yang datang dari siswa dalam penggunaan metode PMRI pada pembelajaran matematika di kelas IX B SMP Negeri 3 Numfor Barat. Penelitian ini menggunakan rancangan penelitian deskriptif kualitatif dan kuantitatif. Subjek penelitian ini adalah guru dan siswa. Objek dalam penelitian ini adalah penggunaan metode PMRI, respons siswa, dan kendala guru. Metode pengumpulan data yang digunakan adalah metode observasi dan metode wawancara. Data dalam penelitian ini dianalisis secara deskriptif kuantitatif. Simpulan penelitian ini adalah (1) penggunaan metode PMRI telah efektif dan sesuai prosedur. (2) respons siswa sebagian besar positif. (3) kendala yang ditemukan oleh guru adalah dari segi siswa dan fasilitas sekolah yang sangat terbatas. Saran penelitian ini ialah, guru matematika agar mempertahankan keefektifan pembelajaran dan lebih memotivasi siswa, serta untuk pihak sekolah lebih meningkatkan fasilitas pembelajaran.

Keywords: Minat, Hasil Belajar, Matematika, PMRI

INTRODUCTION

Education is very important and fundamental in improving the quality of human life. Soedjadi (1994:1) stated that "education is the only activity that can function to create high-quality human resources". Based on this, it means that education is required to produce graduates who are expected to be able to solve problems, think critically and creatively so that they can express themselves in the development of the times. Education aims to achieve a better individual personality. Education essentially includes the activities of educating, teaching, and training. Educating and education are two things that are interrelated. In terms of language, educating is a verb, while education is a noun. Achmad Munib (2006:42) stated that: every educational activity almost always involves related elements in it, namely students, educators, goals, educational content, methods and the environment. In education, an activity or action occurs which is called learning. Therefore, education can be observed as a learning process.

Learning contains three main elements, namely behavioral changes, experience, and the length of time of behavioral changes owned by the learner. The behavioral changes in question can be in the form of cognitive, affective, and psychomotor changes. According to Gagne (in Chatarina 2006:16) behavioral changes are related to what is learned by the learner in the form of intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes.

Learning mathematics is a mental activity to understand the meaning, relationships and symbols, then applied to real situations (Hamzah B. Uno 2009:130). While learning mathematics is an activity in understanding mathematics so that the ability to think critically, logically, systematically, and have an objective nature in a problem can be built.

The successful and quality mathematics learning process is influenced by several factors, namely internal factors, external factors and learning approach factors. Internal factors are factors from within students including physiological and psychological aspects. Physiological aspects include students' physical conditions while psychological aspects include student intelligence, student attitudes, student talents, student interests and student motivation. External factors are factors from outside students including social and non-social environments. Learning approach factors include strategies and methods used to carry out learning activities.

Interest is a form of interest or being fully involved in an activity because of realizing the importance or value of the activity. Another simple definition is given by Muhibbin Syah (2004:136) who defines that interest means a tendency or desire for something big. Likewise, Slameto (2010:180) states that interest is a greater liking and attachment to something or activity, without anyone telling you to.

Student learning interest is influenced by three aspects, namely: student attention during the teaching and learning process, student enjoyment and student curiosity. This factor is one of the internal factors included in the psychological aspect that influences the success of the student learning process. Teachers who succeed in fostering their students' learning interest means that they have done the most important thing that can be done for the sake of their students' learning. Because, interest is not something that just exists but something that can be learned. Students' learning interest will ultimately affect students' learning achievement.

The learning outcomes referred to are the results obtained by students as a result of the learning process carried out by students. The higher the learning process carried out by students, the higher the learning outcomes achieved (Catharina 2006:4).

Based on the results of observations in class VIIIB and interviews with mathematics teachers of SMP Negeri 3 Numfor Barat, it is known that student interest and learning outcomes are still low. This is indicated by the low attention and interest of students in studying textbooks, as well as in learning activities in class. Some students actually look busy and noisy outside the related material during learning. In addition, the sense of interest is also still low, indicated by the passivity of students when participating in learning. Students only tend to be quiet and listen to what the teacher says. Not actively asking questions, expressing opinions, or actively discussing. In addition to low interest, there are several students whose scores have not reached the set KKM. In the process of implementing KBM, learning is still dominated by teachers. In the teaching and learning process, teachers tend to apply conventional methods more often as the main method where students receive lesson materials

passively by taking notes and listening to what is written or said by the teacher. Mathematics learning is often a form of transferring mathematical facts and calculation procedures to students by emphasizing calculation rather than reasoning so that students tend to memorize. Mathematics learning seems to be oriented towards the habit of sequences starting from the presentation of theories/definitions/theorems followed by giving examples which are then given questions. Not associated with reality or everyday problems that students often encounter. This causes students' interest in learning to be low. Students have less opportunity to use their own way to solve a problem. Students are accustomed to working procedurally and are less given the opportunity to construct their understanding or reasoning in their own way first.

In relation to the description above, it is necessary to change the paradigm of mathematics learning from the paradigm of 'teacher explains - students listen' to the paradigm of 'students actively construct - teachers help' by teachers having to create an atmosphere that makes students enthusiastic about the existing problems, so that they are willing to try to solve the problems given. Teachers play a greater role as facilitators who help students' activeness in thinking and constructing their knowledge. This is done by letting them try to solve the problems given. This teaching and learning method is in accordance with the principles of constructivism.

One approach to learning mathematics that is imbued with constructivism values is Realistic Mathematics Education (RME). In Indonesian, RME means Realistic Mathematics Education, operationally called Realistic Mathematics Learning (PMR). Indonesian Realistic Mathematics Education (PMRI) is an adaptation of *Realistic Mathematics Education (RME)* , a learning theory developed in the Netherlands since the 1970s by Hans Freudenthal. Freudenthal stated that mathematics learning should start from human activities (IP-PMRI 2011, accessed April 21, 2013). This means that mathematics must be close to children and relevant to everyday real life.

According to Gravemeijer (Atmini Doruri 2010:3) in mathematics learning using the RME approach there are three main principles, namely: (a) Guided reinvention and progressive mathematization. According to the principle of reinvention, in mathematics learning, it is necessary to strive for students to have experience in discovering various concepts, principles or procedures themselves, with teacher guidance. Thus, when students carry out mathematics learning activities, a mathematization process occurs in them. There are two types of mathematization processes, namely horizontal mathematization and vertical mathematization. Horizontal mathematization is the process of reasoning from the real world into mathematical symbols. While vertical mathematization is the process of reasoning that occurs within the mathematical system itself, for example: finding ways to solve problems, linking mathematical concepts or applying mathematical formulas. (b) Didactic phenomenology. What is meant by didactic phenomenology is that students in learning concepts, principles or other materials related to mathematics start from contextual problems that have various possible solutions, or at least from problems that students can imagine as real problems. (c) Developing their own models (self-developed model). What is meant by developing a model is in learning concepts, principles or other materials related to mathematics, through contextual problems, students need to develop their own models or ways to solve the problem. These models or methods are intended as a vehicle to develop students' thinking processes, from the thinking processes that students are most familiar with, towards more formal thinking processes. So in learning, teachers do not provide information or explain how to solve problems, but students themselves find the solutions. Research gaps that can be highlighted in the Introduction section: a) limitations of the Iceberg Model in Specific Learning Contexts. Previous research, as explained by Moerland and Atmini Doruri (2010), has visualized mathematization in realistic mathematics learning with the iceberg model. However, this model has not been widely tested in various learning contexts, such as at certain levels of education (e.g. elementary, middle, or high school) or in specific materials such as geometry or statistics. b) lack of Empirical Studies on the Effectiveness of the Iceberg Model. Research that adopts the iceberg model in mathematization focuses more on theoretical concepts. There are still few empirical studies that measure the effectiveness of this model in improving student understanding or comparing it with other approaches. c) lack of Model Development in the Digital Learning Era, The iceberg model was developed in the context of conventional learning. With the development of technology and digital-based learning, there are still not many studies that adapt this model in the

context of technology-based learning, such as e-learning or the use of interactive applications. d) gaps in Adapting to Different Learning Styles. The mathematization process in the iceberg model may not be appropriate for all types of learners. Previous research has not specifically examined how the model can be adapted for students with different learning styles, such as visual, auditory, or kinesthetic. by highlighting this gap, new research could highlight novelties in the approach, whether by testing the effectiveness of the iceberg model in specific contexts, developing a model that is more relevant to the digital age, or adapting it to the needs of diverse students.

Frans Moerland (Atmini Doruri 2010:5) visualizes the mathematization process in realistic mathematics learning as the process of forming an iceberg. The process of forming an iceberg in the sea always starts from the base below sea level and then finally forms the peak of the iceberg that appears above sea level. The base of the iceberg is wider than the peak, thus the construction of the iceberg becomes sturdy and stable. This process is adopted in the mathematization process in realistic mathematics, namely in learning it always begins with horizontal mathematization then increases to vertical mathematization. Horizontal mathematization is emphasized more to form a solid mathematical construction so that vertical mathematization is more meaningful for students.

In the principles of realistic mathematics learning, horizontal mathematization consists of three levels, namely: (1) mathematical world orientation; (2) material model; (3) building stone number relation. While vertical mathematization is an activity that uses formal mathematical notation. This level is described by Frans Moerlands in the following diagram:

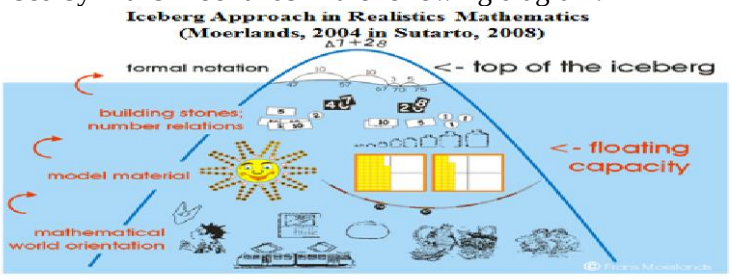

Figure 1 Iceberg Approach in Realistic Mathematics developed by Frans Moerland (2004 in Sutarto, 2008).

PMRI can increase students' interest in learning because in the learning process it uses real contexts to explore. This means that in mathematics learning activities it starts from real problems that are close to students or are often encountered by students every day. After that, a constructive process occurs in learning, where in learning students are the ones who actively construct their own knowledge, not teachers who explain to students about the meaning or concept of mathematics. From these real problems, students then state them in mathematical language, then students solve the problem with the tools available in mathematics, then students rephrase the answers obtained into everyday language. With these steps, it is hoped that students will be able to see the usefulness of mathematics as a tool to solve contextual problems, thereby increasing students' interest in learning mathematics.

By increasing students' interest in learning, it will also increase students' learning outcomes. Learning outcomes can increase because in learning students will find it easier to understand concepts if they know the benefits or uses. Because something meaningful will be easier for students to understand than something meaningless. In this case, what is meant by meaningful is that the information that has just been received is related to information that students have previously known (intertwining) so that they get a mathematical material structure. In this case, the subject matter in the subject matter does not stand alone but is integrated with others.

METHOD

This study uses classroom action research (CAR), qualitative and quantitative descriptive. The subjects of this study are teachers and students. The objects in this study are the use of the PMRI method, student responses, and teacher constraints. The data collection methods used are observation methods and interview methods. using the Kemmis and McTaggart model with a repeating cycle: Planning, Implementation, Observation, Reflection: For Quasi Experiments Using a pretest-posttest

control group design: a) The experimental group uses the PMRI approach. b) The control group uses conventional methods. c) Instruments: Learning interest test (questionnaire) and learning outcomes (pretest & posttest).

Data Collection Techniques: a) Observation by observing student activities in PMRI-based learning. b) Questionnaire: Measuring student learning interest before and after the implementation of PMRI. c) Learning outcome test: To determine the increase in students' mathematical understanding. d) Interview: To explore the experiences of students and teachers in the implementation of PMRI. Data Analysis Techniques: a) Descriptive Analysis: To see changes in student interest. b) Statistical Test (If Quasi Experiment): Using t-test to compare learning outcomes before and after the implementation of PMRI, N-gain Analysis to measure the improvement of learning outcomes. The data in this study were analyzed descriptively quantitatively. The conclusion of this study is (1) the use of the PMRI method has been effective and in accordance with procedures. (2) student responses were mostly positive. (3) the obstacles found by teachers were in terms of students and very limited school facilities.

Table 1 Indonesian Realistic Mathematics Education Approach (PMRI)

Aspect	Description
Definition	PMRI is a mathematics learning approach that emphasizes the use of real contexts as a starting point in learning to help students understand mathematical concepts meaningfully.
Main Principles	1. Horizontal & Vertical Mathematization (from real problems to abstract concepts). 2. Social Interaction (discussion and collaboration between students). 3. Conceptual Relation (connection between mathematical concepts and the real world). 4. Students as Discoverers (exploration and construction of concepts by students). 5. Contextualization (using real-world problems as a basis for learning).
PMRI Stages	1. Mathematical World Orientation: Students are introduced to relevant real-world problems. 2. Model Material: Students use models or visual aids to understand concepts. 3. Building Stones (Number Relations): Students begin to recognize patterns and relationships between numbers. 4. Formal Notation: Students understand and use mathematical symbols and notation formally.
Learning methods	Discussion and exploration of concepts in groups, Problem solving based on real contexts, Use of manipulative aids or concrete models.
Superiority	Improving understanding of concepts meaningfully, Helping students see the connection between mathematics and everyday life, improving critical thinking and problem solving skills.
Lack	It takes longer than conventional methods, requires teacher creativity in designing appropriate contexts, not all students are accustomed to exploratory methods.
Application Examples	Learning fractions using pizza slices as a concrete model, Using buying and selling games to understand the concept of social arithmetic, Arranging number patterns using real objects such as buttons or stones.

Theoretical Framework

Study

Learning is a mental/psychic activity that takes place in active interaction with the environment, which results in changes in knowledge-understanding, skills and attitude values (WS Winkel, 1983). Learning events can occur when humans are able to process stimuli and respond to them well and not piecemeal so that they really understand them.

In general, learning can be interpreted as a change in a person who learns because of experience (Suparno, 1997). This is similar to the opinion of Slameto (1991:2) who stated that learning is a process of effort made by a person to obtain a new change in behavior as a whole, as a result of his own experience in interacting with his environment. Furthermore, Gagne (Chatarina, 2006) stated that the change takes place over a certain period of time. A similar opinion was expressed by Syaiful (2002:13) that learning is a series of mental and physical activities to obtain a change in behavior as a result of an individual's experience in interacting with his environment which involves cognitive, affective, and psychomotor.

From several definitions of learning, it can be seen that the concept of learning contains three main elements, namely: a) Learning is related to changes in behavior, to measure whether someone is

learning, a comparison is needed between behavior before and after experiencing learning activities. b) Changes in behavior are due to the process of experience, the process of experience in this case includes the process of seeing, observing, and understanding something. c) Changes in behavior due to learning take place over a certain period of time.

If someone is able to understand the learning process and apply the knowledge gained in everyday life, then he will be able to explain what is in his environment. Likewise, if someone understands the principles of learning, then he will be able to change behavior as desired. Skinner put forward the principles of learning as follows: a) Preparation for learning, at least before learning, we know the learning objectives or requirements so that later the maximum goals will be achieved. b) Motivation. c) Interest. d) Individual differences, In making learning designs according to student experiences concerning learning speed, determining levels, determining abilities, and teaching materials. e) Learning conditions, These learning conditions include internal and external conditions. Internal conditions include physical, psychological, and social conditions. The external conditions include variations and levels of difficulty of the material, place of learning, and community culture will also affect readiness, process, and learning outcomes. Learning will be successful if the learning objectives are clear and will be easier if the arrangement of materials starts from easy to learn to complex things including a) Active student participation. b) Delivery of student learning outcomes. c) Results that have been obtained. d) Practice. e) Content of ingredients provided. f) Teaching attitude.

From the various opinions above, it can be concluded that learning is a process of changing a person's behavior towards something better as a result of the experience of interacting with humans and the environment which involves cognitive, affective, and psychomotor aspects and lasts for a certain period.

Learning

Learning implies the existence of teaching and learning activities, where the one who teaches is the teacher and the one who learns is the student. Learning is oriented towards activities that teach the material for developing students' knowledge, attitudes, and skills as learning targets. Darsono (2002: 24-25) generally explains the meaning of learning as "an activity carried out by the teacher in such a way that the student's behavior changes for the better". Learning can be interpreted as the result of several processes. This is in line with the opinion of Mark K. Smith (2009) who states "learning is approached as an outcome the end product of some process".

In the learning process will include various other components, such as media, curriculum, and learning facilities. According to Piaget (in Dimyati and Mudjono, 2002:14-15), learning consists of four steps: a) Determining topics that can be learned by children themselves, in determining the topic while also paying attention to what topics are suitable for constructivism activities. b) Choosing or developing class activities with the topic, after the topic is determined, activities are selected or developed based on the topic. c) Knowing that there is an opportunity for teachers to raise questions that support the process of constructivism of student knowledge. d) Assessing the implementation of each activity, paying attention to success, and making revisions.

Based on the description above, it can be concluded that learning is a series of events that are designed and arranged in such a way as to encourage the learning process so that students learn by involving many components and factors that are considered so as to change student behavior for the better.

Mathematics Learning

Mathematics is logical knowledge, related to numbers and organized systematically. The characteristics of mathematics according to Soedjadi and Masriyah (Amin Suyitno, 2004:52) include mathematics having abstract objects of study, based on agreements, using deductive thought patterns and imbued with the truth of consistency.

The direct objects of mathematics (Amin Suyitno, 2004:52) are as follows. a) Facts, namely arbitrary conventions in mathematics. b) Concepts, are abstract ideas that can be used to classify groups. c) Principles, are functional relationship patterns between concepts. d) Skills, are mental skills to carry out procedures/algorithms to solve a mathematical problem.

Meanwhile, according to Frederick (Amin Suyitno, 2004:52), there are 7 types of indirect

objects of mathematics, namely: a) Theorem proving; b) Problem solving; c) Transfer of learning; d) Intellectual development; e) Working individually; f) Working in groups; g) Positive attitudes.

According to Amin Suyitno (2004: 2) mathematics learning is a process or activity of mathematics subject teachers by teaching mathematics to students which includes the teacher's efforts to create a climate and service for the abilities, potentials, interests, talents and needs of diverse students so that there is optimal interaction between teachers and students, as well as between students and students in learning mathematics. For that reason, mathematics in schools functions as a vehicle to develop intelligence, abilities, and shape the personality of students.

In mathematics learning, students are accustomed to gaining understanding through experience about the properties that are and are not possessed by a set of objects (abstraction). By observing examples and non-examples, students are expected to be able to grasp the meaning of a concept. Furthermore, with this abstraction, students are trained to make estimates, guesses or tendencies based on experience or knowledge developed through specific examples (generalization). In the reasoning process, inductive and deductive thought patterns are developed. However, this process must be adjusted to the development of students' abilities, so that in the end it will greatly help the smooth running of the mathematics learning process in schools. (Suherman, 2003:57)

Based on the National Curriculum, school mathematics learning for junior high school and MTs levels aims to develop the expected mathematical skills or abilities as follows. a) demonstrate an understanding of the mathematical concepts studied, explain the relationship between concepts and apply concepts or logarithms flexibly, accurately, efficiently and precisely in problem solving. b) have the ability to communicate ideas with symbols, tables, graphs/diagrams to clarify situations or problems. c) use reasoning on patterns, properties or perform mathematical manipulations in making generalizations, compiling evidence, or explaining ideas from mathematical statements. d) demonstrate strategic abilities in creating (formulating), interpreting and solving mathematical models in problem solving. e) have an attitude of appreciating the usefulness of mathematics in life, namely having: Curiosity, attention, and interest in studying mathematics; Persistence and confidence in problem solving.

Interest in learning

Interest in learning consists of two words, namely interest and learning. Interest according to the big Indonesian dictionary is a high tendency of the heart towards a passion of desire. Bimo Walgito (2004:38) defines interest as a condition when someone has great attention to an object accompanied by a desire to know and learn until finally proving further about the object.

Slameto (2010:58) provides the following formulation of learning interest: learning interest is a constant tendency to pay attention to and remember some activities. Activities that someone is interested in and is continuously interested in which are accompanied by a sense of pleasure and ultimately satisfaction. Interest has a great influence on learning, because if the learning material is not in accordance with the student's interests, then the student will not learn as well as possible, because there is no attraction for him and as a result the student will be lazy to learn.

Factors that influence interest in learning.

According to Sugihartono, et al (2007:76) two factors that influence students' interest in learning are: a) Internal factors, namely a person's innate nature. b) External factors include family, school, society or environment.

Based on the opinions above, it can be concluded that the state of interest can be indicated by the following symptoms: a) The condition of people who are interested in the aspects of their appearance: A sense of pleasure and interest includes being interested in completing lesson questions, enjoying learning activities. b) Attention includes paying attention to the teacher's explanation, completing assignments on time. c) The desire or drive to learn includes asking the teacher if there are difficulties, asking questions/responding to questions.

Factors that influence the emergence of student learning interest with the following aspects: a) Internal factors are factors that come from within a person. Internal factors include: motivation, feelings, ideals and past experiences. Factors or motivations from within are related to feelings of pleasure and displeasure, sympathy or dissympathy, and other feelings that grow from within towards an object. Feelings or emotions are factors that guide the sustainability of interest. Individuals who

have felt successful in an activity will automatically feel happy, satisfied and proud. Students who have ideals related to a particular subject will grow interest in themselves. Past experiences that can grow interest are past failures, so to get better results, students must try to increase their interest in learning. b) External factors are external factors that can generate interest are social motivation factors, parents and teachers. The existence of a situation that develops in society encourages someone to be interested in doing activities. The purpose of the activity is so that he is recognized as a member of a group in society.

Parents and teachers are the main educators in fostering students' interest in learning. Parents need to be kind and positive so that they can foster interest in learning in children. Another factor of teachers is their role in fostering interest in learning, including by providing a need, providing motivation, and variations in learning methods that can attract students.

Function of Interest in Learning

Interest is one of the factors that can influence a person's efforts. Strong interest will create persistent, serious efforts, and not easily give up in facing challenges. If a student has a desire to learn, he will quickly understand and remember what he has learned. Elisabeth B. Harlock (1990) wrote about the function of interest in a child's life as follows: a) Interest influences the form of intensity of ideals, for example a child who is interested in sports, then his ideal is to become an accomplished athlete. b) Interest as a strong driving force. A child's interest in mastering lessons can encourage him to study in a group at his friend's place even though it is raining, for example. c) Achievement is always influenced by the type and intensity. A person's interest even though taught by the same teacher and given the same lesson, but between one child and another get a different amount of knowledge. This happens because their absorption power is different and this absorption power is influenced by the intensity of their interest. d) Interests that are formed since childhood / childhood are often carried throughout life because interest brings satisfaction.

in relation to concentration, interest plays a role in generating attention which immediately facilitates the creation of concentration, and prevents external distractions. Therefore, interest has a great influence in learning. Because, if the learning material being studied does not match the student's interests, then the student will not learn optimally, because there is no attraction for him. On the other hand, if the learning material interests the student, then it will be easy to learn and stored in his memory because of the high interest in learning. So, the function of interest in learning is greater as a motivating force, namely as a force that encourages students to learn.

Efforts to Develop Students' Interest in Learning

According to educational scientists, the most effective way to arouse students' interest in learning is by using students' existing interests and forming new interests in students. This can be achieved by providing students with information about the relationship between a teaching material that will be given with previous teaching materials, outlining its usefulness for students in the future. Interest can be aroused by connecting the subject matter with sensational news that most students already know.

According to Mel Silberman (2007:52) building student interest can be done by: a) Presenting an interesting story or visual: presenting anecdotes, physical stories, relevant cartoons or graphs that can fulfill students' attention to what you are doing. b) Create a problem case: present a problem around the lecture that will be arranged. c) Question test: give students a question (whether they have a little prior knowledge) so that they will be motivated to listen to your lecture to answer it. d) Characteristics of students who are interested in learning

According to Slameto (2010:58) students who are interested in learning have the following characteristics: a) Have a constant tendency to pay attention and remember something that is learned continuously. b) There is a sense of liking and enjoyment in something that is of interest. c) Obtain a sense of pride and satisfaction in something that is of interest. There is a sense of attachment to something that is of interest. d) Prefer something that is of interest to others. e) Manifested through participation in activities and events.

Interest is the main motivational tool that can raise students' spirits in a certain period of time. Therefore, teachers need to raise students' interest in learning so that the lessons given will be easier for students to understand.

To measure students' interest in learning mathematics, a questionnaire on interest in learning mathematics is used. According to Nana Sudjana (2002:77) a questionnaire is a tool for measuring values, attitudes, interests and attention and others which are arranged in the form of statements to be assessed by respondents.

Learning outcomes

Learning outcomes are essentially changes in behavior obtained by learners after experiencing learning activities. Changes as a result of the process can be shown in various forms such as changes in knowledge, understanding, skills, abilities, and changes in other aspects that exist in the individual who is learning (Chatarina Tri Anni, 2006:4-5). This is in line with Woordworth's opinion (in Ismihyani, 2000) which states that learning outcomes are changes in behavior as a result of the learning process. Woordworth also said that learning outcomes are actual abilities that are measured directly. The results of this learning measurement will ultimately determine how far the goals of education and teaching have been achieved.

Learning outcomes or learning as an influence that provides a measure of the value of alternative methods in different conditions, there are also real desired results. Real results are the results of real life from using specific methods in specific conditions, while desired results are goals that generally influence the selection of a method. This means that learning outcomes are closely related to the method used in a particular condition (learning). The more appropriate the selection of methods or strategies (learning) in a condition, the better the learning outcomes. Specifically, learning outcomes are a performance indicated as an ability that has been acquired.

Learning outcomes are influenced by two factors (Sri Rusmini et al., 1995:60), namely: a) Factors originating from the individual who is learning. The factors found in individuals who are learning are grouped into: Psychological factors, including cognitive, affective, psychomotor, mixed, and personality; Physical factors, including senses, limbs, body, glands, nerves, and internal organs. b) Factors originating from outside the individual, Teachers must pay attention to individual differences in teaching them, so that they can handle them according to the conditions of their students to support learning success, because the factors that influence student learning are very different from one another. The indication that a teaching and learning process is considered successful (Syaiful Bahri and Aswan Zain, 2002:120) is a) The absorption of the teaching materials taught reaches high achievement, both individually and in groups. b) The behavior outlined in the specific instructional teaching objectives has been achieved by students, both individually or in groups.

The learning outcomes achieved by students through an optimal teaching and learning process show the following characteristics: Satisfaction and pride that can foster intrinsic learning motivation in students, Increase confidence in their abilities, The results achieved are meaningful for students, The learning outcomes obtained by students are comprehensive (all-encompassing) which include the cognitive, knowledge, affective, psychomotor, and skills or behavior domains.

The cognitive domain is concerned with intellectual learning outcomes consisting of six aspects, namely knowledge, memory, understanding, application, analysis, synthesis and evaluation. The affective domain is concerned with attitudes consisting of five aspects, namely acceptance, response or reaction, assessment, organization and internalization . The psychomotor domain is concerned with learning outcomes, skills and ability to act. There are six aspects of the psychomotor domain, namely reflex movements, basic movement skills, personal abilities, harmony or consistency, complex skill movements, and expressive and interpretive movements. (Benyamin Bloom quoted by Nana Sudjana, 2002: 22) The ability of students to control or assess and control themselves in assessing the results achieved as well as the process and efforts of their learning.

From the explanation above, it can be concluded that learning outcomes are essentially a process of changing student behavior in talent, experience and training. This means that the achievement of the objectives of teaching and learning activities is a change in behavior, both concerning knowledge, skills, attitudes, and even covering all aspects of the person. Teaching and learning activities such as organizing learning experiences, assessing the process and learning outcomes, are included in the scope of teacher responsibility in achieving student learning outcomes.

The Influence of Student Interest on Student Learning Outcomes

Developing an interest in something is basically helping students see how the relationship

between the expected material, to be learned by themselves as individuals. Learning outcomes can increase because in learning students will find it easier to understand concepts if they know the benefits or uses. Because something meaningful will be easier for students to understand than something meaningless. In this case, what is meant by meaningful is that the information that has just been received is related to information that students have previously known (intertwining) so that they get a mathematical material structure. In this case, the subject matter in the lesson material does not stand alone but is integrated with others. If students realize that learning is a tool to achieve several goals that they consider important, and students see that the results of their learning experiences will bring progress to themselves, they will most likely be interested and motivated to learn it.

Interest has a great influence on learning outcomes, because if the learning material taught does not match the student's interests, the student will not be interested in learning as well as possible because there is no attraction for him. He is reluctant to learn and does not get satisfaction from the lesson. Learning materials that are interesting to students are easier to learn and conclude, because interest adds to learning activities.

Through the explanation above, it can be concluded that a person's interest in learning has an influence on learning outcomes because with interest, a person will be serious about learning, and vice versa.

Indonesian Realistic Mathematics Education Approach (PMRI)

Indonesian Realistic Mathematics Education (PMRI) is an adaptation of *Realistic Mathematics Education (RME)* , a learning theory developed in the Netherlands since the 1970s by Hans Freudenthal. Freudenthal stated that mathematics learning should start from human activities (IP-PMRI 2011, accessed march 17, 2025). This means that mathematics must be close to children and relevant to everyday real life. His view emphasizes that mathematical materials must be able to be transmitted as human activities. Education should provide students with the opportunity to "re-invent" mathematics through practice (doing it).

Realistic Mathematics Education (PMRI) has a basic philosophy that mathematics is a human activity that results in very fundamental changes in the process of learning mathematics in the classroom. Teachers in teaching and learning activities no longer directly provide information, but must create activities for students that can be used to gain mathematical knowledge.

According to Gravemeijer as quoted by Tatang Eko, there are three main principles in PMR, namely Guided Reinvention and Progressive Mathematization, Didactical Phenomenology, and Self-developed Models. The first principle, namely guided discovery, means that students are given the opportunity to experience the learning process as when they discover a concept through the topic presented. Students in learning mathematics need to be encouraged to have experience and discover various concepts, mathematical principles, and so on through horizontal and vertical mathematization processes. Horizontal mathematics, students are expected to be able to identify contextual problems so that they can be transferred into mathematical problems in the form of models, diagrams, tables (informal models) for better understanding. While vertical mathematics, students solve formal or non-formal mathematical forms of contextual problems using applicable mathematical concepts, operations and procedures. According to references in IGP Suharta (2006), examples of horizontal mathematization are identifying, formulating, and visualizing problems in different ways and transforming real-world problems into mathematical problems. While examples of vertical mathematization are representing relationships in formulas, improving and adjusting mathematical models, using different models and generalizing.

The second principle in PMR is the didactic or learning phenomenon that emphasizes the importance of contextual problems to introduce mathematical topics to students. The situations given in a mathematical topic are given based on two considerations, namely seeing the possibility of application in teaching and as a starting point in the mathematization process. The purpose of investigating these phenomena is to find specific problem situations that can be generalized and can be used as a basis for vertical mathematization. This principle provides an opportunity for students to use their reasoning and academic abilities to achieve generalization of mathematical concepts.

The third principle in PMR is a self-developed model, namely when solving real problems (contextual), students develop their own models. The expected learning sequence in PMRI is the

presentation of real problems (contextual), creating problem models, formal models of problems and formal knowledge. Thus, in learning mathematics, through contextual problems, it is expected that students can develop their own models or ways of solving the problem. The model is intended as a vehicle for developing students' thinking processes, from the thinking processes most familiar to students towards more formal thinking processes.

The PMRI approach has 5 main characteristics, namely: a) Real context, Mathematics learning with the PMRI approach begins with something real or something that can be imagined by students. This means that learning does not start with a formal system. Through abstraction and formalization, students will develop more complete concepts. Then students can apply mathematical concepts to the real world. Thus, students' understanding of the concept becomes better. The use of contextual questions has several functions as stated by Dian Armanto (2003), namely helping students in supporting mathematical thinking patterns, used in mathematical applications, and to train students' special abilities in real situations. According to De Lange in IGP Suharta (2006) two mathematization processes in the form of cycles where the "real world" is not only a source of mathematization but also a place to re-apply mathematics, can be described as follows:

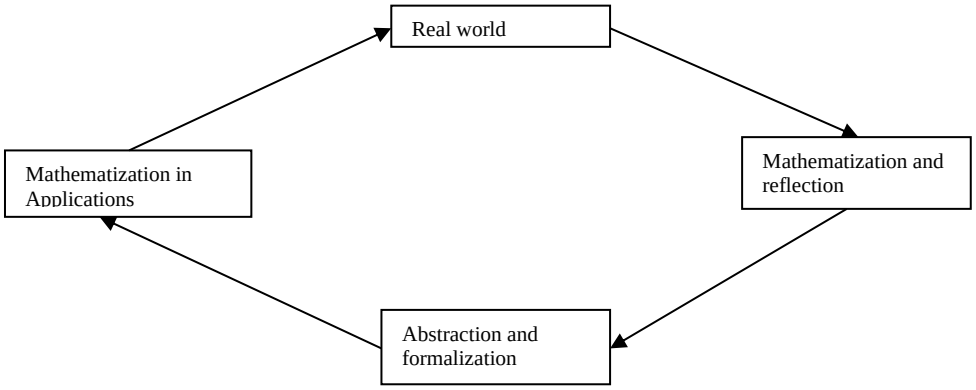

figure 2: everyday life (real world) is made up of problems related to everyday life

From the picture above, examples can be made, among others, from everyday life (real world) problems related to everyday life are made, then with the students' ability to abstract (change the problem into a mathematical form) and construct the solution mathematically. From the problems given by the teacher, students can apply mathematical concepts to the real world (everyday life).

Models, The term model relates to situational models and mathematical models developed by students themselves. The role of developing models by students themselves is to bridge students from real situations to abstract situations. There are several stages of modeling, namely situational, model-of, model-for and formal knowledge. At first, the situation is connected to real activities. Students can imagine the experience they have had, strategies and their application to the situation. Then the model is generalized and formalized into a model-of, expressed in writing. Furthermore, students work with numbers with mathematical reasoning without thinking about the situation again, the model-of becomes a model-for which eventually becomes formal knowledge (Gravemeijer, 1994: 100-101). These models can be described as follows:

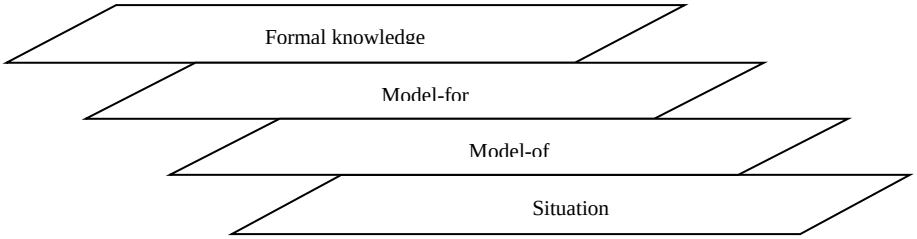

Figure 3 Student Production and Construction Model

Student production and construction. In the learning process, students are active in constructing their knowledge, not teachers who transfer knowledge to students. The role of the teacher is as a facilitator, so that students can construct their knowledge. By using "free production" students are encouraged to reflect on parts that are considered important in the learning process. Students' informal strategies in the form of contextual problem-solving procedures are a source of inspiration in further

learning development, namely to construct formal mathematical knowledge.

Interaction is a characteristic of the learning process, where interaction between students and each other, between students and teachers is fundamental in PMRI. Explicit forms of interaction in the form of negotiation, explanation, justification, agreement, disagreement, questions or reflection are used to achieve formal forms from informal forms of students. According to Van Heuvel-Panhuzen (2000), learning mathematics with the RME approach is a social activity, where learning must provide opportunities for students to share their strategies and discoveries. By listening to their friends' discoveries and discussing them, students get ideas to improve their strategies.

Relatedness. Units in mathematics are related to each other. If in learning mathematics we ignore the relationship with other fields, it will affect problem solving. In applying mathematics, more complex knowledge is needed, not only the elements in mathematics but also other fields. In learning with the PMRI approach, students are expected to construct their knowledge not only to view one branch from another as separate, but as a unit that supports each other.

One of the philosophies underlying the realistic approach is that mathematics is not a collection of rules or complete properties that students must learn. According to Freudenthal (Eman Suherman, 2003:144) mathematics is not a ready-made subject for students, but rather a lesson that can be learned by doing it. So that with the learning experience that students have had, students have the potential to develop their knowledge or learning experience.

The development of mathematics learning with a realistic approach is one of the efforts to improve students' ability to understand mathematics. These efforts are carried out in connection with the differences between the material aspired to by the written curriculum (intended curriculum) and the material taught (implemented curriculum), as well as the differences between the material taught and the material learned by students (realized curriculum) (Eman Suherman, 2003:145).

RESULTS AND DISCUSSION

An innovation in the world of education is expected to have a positive impact on the development of education. PMRI is an approach to teaching mathematics that seeks to change the teaching paradigm to the learning paradigm. The meaning of learning here is that the knowledge that students gain is created by students from what they see, hear, and feel naturally. This is in line with the principle of constructivism, which argues that teaching is not an activity of transferring knowledge from teacher to student, but rather an activity that allows students to build their own knowledge. Furthermore, Bettecourt (Paul Suparno, 1997) defines the meaning of teaching, where teaching means participation with students in forming knowledge, making intentions, seeking clarity, being critical, and making justifications. So teaching is a form of self-learning. The creation of a meaningful learning atmosphere can only be created if students are truly active in learning (student center), and the teacher as a facilitator in creating how students learn and can interpret what is learned in life.

In relation to the application of the PMRI approach in mathematics learning and seeing the existing principles or characteristics, as well as the paradigms used, PMRI certainly has an impact on students' interest in mathematics and their learning outcomes. Therefore, in this study, the researcher reveals how students' interest in mathematics and how students' mathematics learning outcomes are using the PMRI approach. To obtain this information, the researcher conducted interviews with teachers who apply the PMRI approach in teaching mathematics and students in the class. In addition, the researcher conducted direct observations in the classroom where learning with the PMRI approach was being implemented. To support this information, the researcher provided documents in the form of photos of student activities during mathematics learning. Meanwhile, to see the development of students' mathematics learning outcomes, the researcher used a learning outcome test. After the data was collected, data processing was carried out with the stages of data reduction, data display, and drawing conclusions.

RESULTS

in this study is the Kemmis and Mc Taggart model. The Kemmis and Mc Taggart model is a development of the basic concept introduced by Kurt Lewin. It's just that, the acting (action) component with observing (observation) is made into one unit. The unification of the two components

is due to the fact that the implementation of acting and observing are two inseparable activities. This means that both activities must be carried out in one unit of time, so that an action takes place so must observation. In the Kemmis and Mc Taggart model, the research stages are divided into four stages, namely the planning stage, action implementation, observation and reflection which may be followed by a re-refinement designed in the image below:

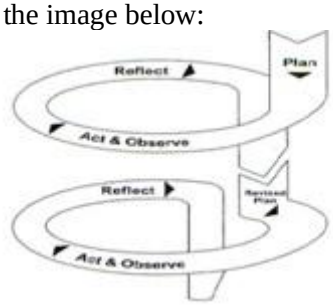

Figure 4 Kemmis and Mc Taggart's action research design model

The data collected in the form of interview results, observation results, questionnaires and tests were analyzed to determine the implementation and obstacles that occurred during learning.

Qualitative data in this study were obtained from the results of observations, teacher interviews, student interviews and field notes. The data analysis technique used is the analysis technique developed by Miles and Huberman (1992). Interactive analysis techniques consist of three components, namely: Data Reduction, Data Display, Conclusion Drawing.

Table 2. Percentage Qualification of Observation Score

Percentage of Observation Score	Category
66.68% ≤ x ≤ 100%	Tall
33.34% ≤ x ≤ 66.67%	Currently
0 ≤ x ≤ 33.33 %	Low

Table 3. Interest Questionnaire Scoring Guidelines

Characteristic Question	Level of Compliance			
	Strongly agree	Agree	Don't agree	Strongly Disagree
Positive	4	3	2	1
Negative	1	2	3	4

Table 4. Qualification of Percentage Results of Student Questionnaire Scores on Mathematics Learning with the PMRI Approach

Percentage	Information
80% ≤ x ≤ 100%	Very high
60% ≤ x ≤ 80%	Tall
40% ≤ x ≤ 60%	Currently
20% ≤ x ≤ 40%	Low
0% ≤ x ≤ 20%	Very Low

Table 5. The percentage of learning outcome tests in the low, medium and high categories is used as a guideline.

Percentage of average test score	Category
66.68% ≤ x ≤ 100%	Tall
33.34% ≤ x ≤ 66.67%	Currently
0 ≤ x ≤ 33.33 %	Low

DISCUSSION

The success rate of this study is marked by changes towards increasing students' interest in learning mathematics and improving students' learning outcomes in the learning process. As an indicator of success achieved by students in this study is the increase in students' interest in learning mathematics and students' learning outcomes in the subject matter .. through the Indonesian Realistic Mathematics Education (PMRI) learning approach.

CONCLUSION

Based on research on efforts to improve students' interest and learning outcomes in mathematics through the Indonesian Realistic Mathematics Education Approach (PMRI), it can be concluded that:

1. PMRI is effective in improving students' interest in learning because this approach connects mathematical concepts with real experiences, so that students feel more interested and motivated

in learning.
2. Student learning outcomes increase significantly after the implementation of PMRI, because students not only memorize formulas but understand concepts through horizontal and vertical mathematization processes.
3. Interaction and exploration in PMRI help students develop critical thinking and problem-solving skills, which are very important in learning mathematics.
4. Although it requires teacher creativity in compiling context-based learning, PMRI has a positive impact on learning that is more meaningful and enjoyable for students.
5. With consistent implementation of PMRI, students are more confident in understanding mathematical concepts and are able to relate them to everyday life.

Overall, PMRI has been proven to be an approach that can improve students' interest and learning outcomes in mathematics, so it is worthy of being implemented in learning in schools.

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