

## **BUILDING LEARNING WITH A REALISTIC MATHEMATICS EDUCATION APPROACH**

**Nursupiamin \*<sup>1</sup>**

UIN Datokarama Palu, Indonesia  
Email : nursupiamin@uindatokarama.ac.id

**Dwi Risky Arifanti**

IAIN Palopo, Indonesia  
Email : dwi\_risky\_arifanti@iainpalopo.ac.id

### **Abstract**

The realistic mathematics approach is one of the approaches to learning mathematics that was developed to bring mathematics closer to students. Real problems from everyday life are used as a starting point for learning mathematics to show that mathematics is actually close to everyday life. A main principle of Realistic Mathematics Education is that students must participate actively in the learning process. Learners must be given the opportunity to build their own knowledge and understanding. Abstract mathematical concepts need to be transformed into things that are real for students. Realistic problems given to students do not always have to use problems that exist in the students' real world or can be found in students' daily lives. A problem is called realistic if the problem given can be imagined or real in the students' minds. Applying a realistic mathematical approach will change learning to be easy for students to understand. This approach develops children's thinking patterns by finding their own concepts in mathematics through establishing relationships between the material and children's daily lives. So that the mathematical concepts learned can be applied in life. From this, children's mathematical understanding will increase.

**Keywords:** Learning, Realistic Mathematics Education

### **INTRODUCTION**

Mathematics is one of the subjects taught from elementary to tertiary level. Objects in mathematics are abstract. Because of its abstract nature, it is not uncommon for teachers and students to experience several obstacles in the learning process. In essence, mathematics lessons cover three aspects, namely product, process and attitude aspects. The product aspect includes concepts and principles in mathematics lessons. The process aspect includes the methods or methods used to obtain knowledge. Meanwhile, the attitude

---

<sup>1</sup> Correspondence author.

aspect is a scientific attitude which is a variety of beliefs, opinions and values that must be maintained by people who study it (Zakaria, E., & Syamaun, M, 2017).

Mathematics is a very important science and must be taught from elementary school, because elementary school is the pillar of success in learning mathematics at the next level. This is in accordance with what Meirisa, A., et al (2018) stated that the need for mathematics to be given to all students is to act as a basis for development to equip students with various knowledge and technology, so that by learning mathematics students will know various knowledge that is important for future life.

Mathematics is closely related to daily human activities, from simple things to things that require more thinking. Mathematics is not a science that is tolerant of human life, but mathematics arises from and is useful for our daily lives. Knowledge is not a separate object but rather a form of application in life. It will be difficult for us to apply knowledge if the knowledge is not meaningful to us. The meaningfulness of knowledge is also a main aspect in the learning process which will have an impact on student learning outcomes. Mathematics is closely related to daily activities, therefore, in teaching mathematics, teachers should be able to relate learning to students' daily lives or what is real for students (Makonye, J. P, 2014).

One approach to mathematics learning that is oriented towards mathematizing everyday experiences and applying mathematics in everyday life is the realistic mathematics education approach (Lestari, L., & Surya, E, 2017). The realistic mathematics approach is one of the approaches to learning mathematics that was developed to bring mathematics closer to students. Real problems from everyday life are used as a starting point for learning mathematics to show that mathematics is actually close to everyday life. Real objects that are familiar with students' daily lives are used as teaching aids in mathematics learning. Research in this field has produced quite encouraging reports. Students become more interested and enjoy learning mathematics and show quite satisfactory increases in learning outcomes (Hadi, S, 2005).

The realistic mathematics education approach reflects a view of mathematics as a subject matter, how children learn mathematics and how mathematics should be taught. This Realistic Mathematics Education Approach emphasizes that mathematics is essentially a human activity so that in learning students do not just receive the material presented, but students need to be given the opportunity to discover mathematics through the practice they experience themselves (Susanto, A, 2013). Likewise, according to

Ahmad, M., & Nasution, D. P (2018), the Realistic Mathematics Education Approach provides students with the opportunity to rediscover mathematical concepts as they were discovered with the help and guidance of teachers.

A main principle of Realistic Mathematics Education is that students must participate actively in the learning process. Learners must be given the opportunity to build their own knowledge and understanding. Abstract mathematical concepts need to be transformed into things that are real for students. This is the reason why it is called realistic mathematics learning (Ulandari, L., et al, 2019). Of course, this does not mean that the Realistic Mathematics Education approach must always use problems that exist in students' real lives. The problems used in learning can be abstract mathematical problems that can be transformed into real ones in students' minds or understood by students by imagining them in their minds.

## **RESEARCH METHOD**

The study in this research is qualitative with literature. The literature study research method is a research approach that involves the analysis and synthesis of information from various literature sources that are relevant to a particular research topic. Documents taken from literature research are journals, books and references related to the discussion you want to research (Earley, M.A. 2014; Snyder, H. 2019).

## **RESULT AND DISCUSSION**

### **Basic Concepts of a Realistic Mathematical Approach**

#### **A. Understanding**

Realistic mathematics education, which is translated as realistic mathematics education (PMR), is an approach to learning mathematics developed in 1971 by a group of mathematicians from the Freudenthal Institute, Utrecht University in the Netherlands. This approach is based on Hans Freudenthal's assumption (Lestari, L., & Surya, E, 2017) that mathematics is a human activity. According to this approach, the mathematics class is not a place to transfer mathematics from the teacher to students, but rather a place where students rediscover mathematical ideas and concepts through exploration of real problems.

Here mathematics is seen as a human activity that begins with problem solving (Muhsetyo, G., et al, 2014). Therefore, students are not viewed as passive recipients, but must be given the opportunity to rediscover mathematical ideas and concepts under the guidance of

teachers. This rediscovery process was developed through exploring various real world problems (Hadi, S, 2005). Here the real world is defined as everything outside mathematics, such as everyday life, the surrounding environment, and even other subjects can be considered the real world. The real world is used as a starting point for learning mathematics. To emphasize that the process is more important than the results, in the realistic mathematical approach the term mathematization is used, namely the process of mathematizing the real world. This process is described by de Lange (in Hadi, S, 2005) as an endless circle. Furthermore, by Treffers (in Vembriarto, S, 1981) mathematization is divided into two, namely horizontal mathematization and vertical mathematization. These two processes are described by Gravenmeijer (in Hadi, S, 2005) as a process of rediscovery.

#### B. Conceptions about Students

In the realistic mathematics approach, students are seen as individuals (subjects) who have knowledge and experience as a result of their interactions with the environment. Furthermore, in this approach it is also believed that students have the potential to develop their own knowledge, and if given the opportunity they can develop their knowledge and understanding of mathematics. Through exploring various problems, both daily life problems and mathematical problems, students can reconstruct findings in the field of mathematics. So, based on this thinking, the conception in this approach is as follows (Hadi, S, 2005):

1. Students have a set of alternative concepts about mathematical ideas that influence subsequent learning;
2. Students gain new knowledge by forming that knowledge for themselves;
3. Students form knowledge through a process of change which includes addition, creation, modification, refinement, rearrangement and rejection;
4. Students build new knowledge for themselves from the various experiences they have;
5. Students have the ability to understand and do mathematics regardless of race, culture and gender.

#### C. Teacher's Role

The thinking and conception above shifts the role of the teacher in the classroom. If in the traditional approach teachers are seen as authorities who try to transfer their knowledge to students, then in this realistic mathematics approach teachers are seen as facilitators,

moderators and evaluators who create situations and provide opportunities for students to rediscover mathematical ideas and concepts in their own way. . Therefore, teachers must be able to create and develop learning experiences that encourage students to have activities both for themselves and with other students (interactivity). As a result, teachers must not only focus on the material in the curriculum and textbooks, but must continuously update the material with new and challenging problems. So, the role of teachers in a realistic mathematics approach can be formulated as follows: (Erbas, A. K., et al, 2014)

1. Teachers must act as learning facilitators;
2. Teachers must be able to build interactive teaching;
3. Teachers must provide opportunities for students to actively contribute to the learning process;
4. Teachers must actively help students interpret problems from the real world; And
5. Teachers must actively link the mathematics curriculum to the real world, both physical and social.

### **Implementation of a Realistic Mathematical Approach**

#### **A. History of the Realistic Mathematics Education Approach**

Realistic Mathematics Education is a promising approach to learning mathematics. Several literatures state that PMR has the potential to improve students' mathematical understanding. The implementation of PMR in Indonesia has been going on for quite a long time, namely approximately ten years. PMR became known in Indonesia after RK Sembiring and Pontas Hutagalung brought the idea when they returned from attending the ICMI (International Conference on Mathematical Instruction) Conference in Sanghai, China, in 1994. At that conference, one of the guest speakers was Prof. Jan de Lange, who at that time as Director of the Freudenthal Institute (IF), Netherlands. The Freudenthal Institute is an institute that carries out research and development of PMR theory. It could be said that IF is where the PMR theory originates (Paroqi, L. L., et al, 2020).

There are two types of mathematical processes, namely horizontal mathematics and vertical mathematics. Horizontal mathematics means that students with the knowledge they have can organize and solve real problems in everyday life. Meanwhile, vertical mathematics is a process of reorganization within the mathematical system itself, for example finding

short ways of finding relationships between concepts and strategies, and then implementing those strategies. In short, horizontal mathematics is related to changing the real world into mathematical symbols, while vertical mathematics is the conversion of symbols to other mathematical symbols. Although the differences between the two types are striking, this does not mean that the two types are completely separate. Both types are equally valuable (Herawaty, D., et al, 2019).

#### B. Principles of a Realistic Mathematics Education Approach

Realistic Mathematics Education has three characteristics, namely:

1. Guided Reinvention (rediscovery)/ Progressive Mathematizing (progressive mathematics), students must be given the opportunity to experience the same process as mathematical concepts being discovered. Learning begins with a contextual or realistic problem and then through activities students are expected to "rediscover" properties, definitions, theorems or procedures. Contextual problems are selected that have various possible solutions. Differences in students' solutions or procedures in solving problems can be used as steps in the mathematics process, both horizontally and vertically.
2. Didactical Phenomenology (didactic phenomena), the situations given in a mathematical topic are presented based on two considerations, namely looking at possible applications in teaching and as a starting point in the mathematical process. The aim of investigating these phenomena is to find specific problem situations that can be generalized and can be used as a basis for vertical mathematics.
3. Self-developed Models (development of one's own model), this activity acts as a bridge between informal knowledge and formal mathematics. Models created by students themselves in solving problems. The model is initially a model of a situation that is known to be familiar to students. With a process of generalization and formalization, the model finally becomes a model in accordance with mathematical reasoning (Trisnawati, T., et al, 2018).

#### C. Characteristics of the Realistic Mathematics Education Approach

1. Using Context  
Context is the daily circle of real students. In mathematics it does not always mean "concrete", it can also be something that students understand or imagine.
2. Using Models

Models are directed at concrete models increasing to abstract or models of real situations or models for abstract directions.

3. Using Student Contributions

A major contribution to the teaching and learning process is expected from students' own construction which directs them from their informal methods towards more formal or standardized ones.

4. Interactivity

In constructive learning attention is paid to interaction, explicit negotiation, intervention, cooperation and evaluation of fellow students, student-teachers, and teachers and their environment.

5. Integrated with other learning topics.

In learning, a holistic approach is used, meaning that learning topics can be linked and integrated to give rise to an integrated understanding of a concept or operation. This allows efficiency in teaching several lesson topics (Zakaria, E., & Syamaun, M, 2017).

### **The Urgency of a Realistic Mathematical Approach in Mathematics Learning**

A learning approach that is close to students will make it easier to achieve learning goals. The experiences that students have in their daily lives will have a positive influence, namely being able to develop knowledge. However, the role of a teacher must be to link learning material with children's daily lives. An approach that is oriented towards the relationship between these two in mathematics using a realistic mathematical approach. This realistic mathematical approach was first introduced by a mathematician from Utrecht University, Netherlands, namely Prof. Hans Freudenthal. This approach is known as Realistic Mathematics Education (RME). This learning approach is student-oriented. By connecting real situations in the context of students' daily lives with mathematical material (Supriadi, N., et al, 2022). So it can make it easier to understand the material. As explained by Dwi Kurino, Y (2015) that "Realistic Mathematic Education pays great attention to informal aspects and then looks for bridges to lead students' understanding of formal mathematics." In this case, the aim is to transfer problems that exist in everyday life into problems that exist in mathematics.

In this approach, students are not just recipients of the material. However, they are given the opportunity to discover mathematical material in their daily lives. Because the starting point of this realistic mathematical approach is the student's own experience. So they can experience for themselves that mathematics is related to their daily activities. Just like the

opinion of Widyanti et al in Suherman, E., et al (2021), this realistic mathematics approach is 'mathematics learning that is oriented towards providing information and using ready-to-use mathematics to solve problems'. Students will be given the opportunity to discover mathematical ideas and concepts in their environment. With this interaction, children's insight will be broader and it will be easier to understand mathematics material.

This realistic mathematics learning has guidelines for its implementation. This was discussed by Widiyanti, P., & Yani, A (2015) who stated that three key principles of realistic mathematics learning are as follows:

1. Reinvent

Students are given the opportunity to discover concepts, definitions and ways of solving through contextual provision in various ways.

2. Didactic phenomena

In introducing mathematical topics to children, educators must emphasize contextual problems, namely problems that originate from the child's real world.

3. Develop your own model

When working on contextual problems children develop models in their own way.

The first principle explains that students discover mathematical concepts in their own way. This is supported by the role of a teacher. Teachers provide opportunities for students so that they think about solving and understanding mathematical concepts on their own. Not only that, the teacher also gives students something real related to the concept that will be discussed. This makes it easier to discover this concept.

The second principle explains that there is emphasis from teachers on students in explaining material in learning. Explanations related to children's daily life. Real situations and close to the child's life are what a teacher must direct. So that students can clearly understand this concept because it is directly related to their lives.

This third principle explains that after there is a real thing or concept that is close to the child's life. The teacher's role is to direct students to solve existing problems. This problem is related to mathematical concepts that have been demonstrated in accordance with children's daily lives. So from this problem it can be concluded that it is a mathematical concept.

These three principles explain that realistic learning in mathematics is based on children's direct discoveries about real life. Educators need to

emphasize contextual problems for their students. And educators become facilitators by directing children to develop their own models in an effort to understand the material (Syafriaedi, N., et al, 2019).

From the conclusions that have been made, it can be proven that the realistic mathematical approach is suitable for use in mathematics subject matter. The success of each research results in improvements in mathematical understanding and learning outcomes. From geometric shapes and simplifying fractions. Both are suitable if this approach is applied. However, the thing that must be considered is that there must be good cooperation or communication between students and teachers. Because this two-way communication can lead to the success of implementing this approach. Teachers understand children's experiences in their daily lives and also understand the material that will be discussed. So that material and children's daily lives are interrelated.

This realistic mathematical approach is oriented to children's daily lives. And this is related to the child's cognitive stages. For elementary school children aged 7-12 years, children will understand everything through the presence of abstract objects. Abstract or real objects exist in children's daily lives. Providing concrete objects in learning and applying realistic mathematical approach steps will make it easier for students to understand the material. This relationship has been proven by the success of the research discussed above (Hasbi, M., et al, 2019).

## **CONCLUSION**

This realistic mathematics education approach is learning that uses problems and topics from students' daily lives that they usually experience. Mathematics learning using a realistic mathematics education approach begins by providing contextual problems. This problem can be related to the material that has been studied and to everyday life, because the concept of realistic mathematics education is the meaningfulness of concepts. The learning given to students will be easier to understand if what is learned is meaningful for the students. Realistic problems given to students do not always have to use problems that exist in the students' real world or can be found in students' daily lives. A problem is called realistic if the problem given can be imagined or real in the students' minds.

Therefore, implementing a realistic mathematical approach will change learning to be easy for students to understand. This approach develops children's thinking patterns by finding their own concepts in mathematics through establishing relationships between the material and children's daily

lives. So that the mathematical concepts learned can be applied in life. From this, children's mathematical understanding will increase.

## REFERENCES

- Ahmad, M., & Nasution, D. P. (2018). Analisis kualitatif kemampuan komunikasi matematis siswa yang diberi pembelajaran matematika realistik. *Jurnal Gantang*, 3(2), 83-95.
- Dwi Kurino, Y. (2015). Pengaruh Contextual Teaching & Learning dan Direct Intruction terhadap Peningkatan Kemampuan Pemahaman Matematis Siswa SD. *Jurnal Cakrawala Pendas*, 1(1).
- Earley, M. A. (2014). A synthesis of the literature on research methods education. *Teaching in Higher Education*, 19(3), 242-253.
- Erbas, A. K., Kertil, M., Çetinkaya, B., Cakiroglu, E., Alacaci, C., & Bas, S. (2014). Mathematical modeling in mathematics education: basic concepts and approaches. *Educational Sciences: Theory and Practice*, 14(4), 1621-1627.
- Hadi, S. (2005). Pendidikan matematika realistik. PT RajaGrafindo Persada.
- Hasbi, M., Lukito, A., Sulaiman, R., & Muzaini, M. (2019). Improving the mathematical connection ability of middle-school students through realistic mathematics approach. *Journal of Mathematical Pedagogy (JoMP)*, 1(1), 37-46.
- Herawaty, D., Widada, W., Nugroho, K. U. Z., & Anggoro, A. F. D. (2019). The improvement of the understanding of mathematical concepts through the implementation of realistic mathematics learning and ethnomathematics. In *International Conference on Educational Sciences and Teacher Profession (ICETeP 2018)* (pp. 21-25). Atlantis Press.
- Lestari, L., & Surya, E. (2017). The effectiveness of realistic mathematics education approach on ability of students' mathematical concept understanding. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 34(1), 91-100.
- Makonye, J. P. (2014). Teaching functions using a realistic mathematics education approach: A theoretical perspective. *International Journal of Educational Sciences*, 7(3), 653-662.
- Meirisa, A., Rifandi, R., & Masniladevi, M. (2018). Pengaruh pendekatan pendidikan matematika realistik indonesia (PMRI) terhadap keterampilan berpikir kritis siswa SD. *Jurnal Gantang*, 3(2), 127-134.

- Muhsetyo, G., Krisnadi, E., & Wahyuningrum, E. (2014). Pembelajaran matematika SD.
- Paroqi, L. L., Mursalin, M., & Marhami, M. (2020). The Implementation of Realistic Mathematics Education Approach to Improve Students' Mathematical Communication Ability in Statistics Course. *International Journal for Educational and Vocational Studies*, 2(10).
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, 104, 333-339.
- Suherman, E., Irvan, I., & Amri, Z. (2021). Implementation Of Indonesian Realistic Mathematics Approach To Improve Students Mathematic Skills. *IJEMS: Indonesian Journal of Education and Mathematical Science*, 2(3), 103-108.
- Supriadi, N., Putra, R. W. Y., & Fitriani, F. (2022). Implementation of a realistic mathematics learning approach (PMR) and analytical thinking: The impact on students' understanding of mathematical concepts in Indonesia. *Al-Jabar: Jurnal Pendidikan Matematika*, 13(2), 465-476.
- Susanto, A. (2013). *Teori belajar & pembelajaran*. Jakarta: kencana.
- Syafriafdi, N., Fauzan, A., Arnawa, I. M., Anwar, S., & Widada, W. (2019). The tools of mathematics learning based on realistic mathematics education approach in elementary school to improve math abilities. *Universal Journal of Educational Research*, 7(7), 1532-1536.
- Trisnawati, T., Pratiwi, R., & Waziana, W. (2018). The effect of realistic mathematics education on student's mathematical communication ability. *Malikussaleh Journal of Mathematics Learning (MJML)*, 1(1), 31-35.
- Ulandari, L., Amry, Z., & Saragih, S. (2019). Development of Learning Materials Based on Realistic Mathematics Education Approach to Improve Students' Mathematical Problem Solving Ability and Self-Efficacy. *International Electronic Journal of Mathematics Education*, 14(2), 375-383.
- Vembriarto, S. (1981). *Pengantar pengajaran modul*. Yayasan Pendidikan" Paramita".
- Widiyanti, P., & Yani, A. (2015). Analisis kesulitan siswa dalam menyelesaikan soal materi pecahan bentuk aljabar di kelas VIII SMP. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK)*, 4(9).

Zakaria, E., & Syamaun, M. (2017). The effect of realistic mathematics education approach on students' achievement and attitudes towards mathematics. *Mathematics Education Trends and Research*, 1(1), 32-40.