PAKAR Pendidikan

p-ISSN: 1693-2226 ; e-ISSN: 2303-2219
Vol. 22, No. 1, January 2024
Hlm. 106-119
http://pakar.pkm.unp.ac.id/

Implementation of PMRI Approach in Learning Probability to Improve Numeracy Skills

Implementasi Pendekatan PMRI pada Materi Peluang di SMP untuk Meningkatkan Kemampuan Numerasi Siswa

https://doi.org/10.24111/pakar.v22i1.520

Chairunnisa Inayatusufi[1*], Makmuri[1], Meiliasari[1]
[1]Universitas Negeri Jakarta, Jakarta, Indonesia
[*]E-mail: chairunnisainayatusu1309820008@mhs.unj.ac.id

Abstract

Students with good numeracy skills will help them in solving problems. However, based on the PISA results, educational results in this domain are still below standard, one of which is in the concept of opportunity, one of the numeracy content domains. Based on this, this research aims to determine the application of Indonesian Realistic Mathematics Education learning in improving students' numerical abilities in class VIII opportunity concepts. This PTK research was carried out in three cycles: planning, implementation, observation, analysis, and reflection. The research subjects (SP) were 6 class VIII students at Al-Chalidyah Middle School. This research applies the PMRI stages. The stages of PMRI were applied in this study. At each meeting, a worksheet, distributed to students as a learning tool, displays numeracy problem-solving, such as context, models, student participation, interactivity, and linkage. The research results stated that students' understanding of mathematical concepts had increased. This can be seen from the student's participation in learning activities and the increase in the average score on the SP cycle tests. The results for cycle I were 65.97, cycle II 75.00, and cycle III 82.10. So, it can be concluded that PMRI learning can occasionally improve numeracy skills.

Keywords: PMRI approach, probability, numeracy ability

Abstrak

Siswa yang memiliki kemampuan numerasi yang baik akan membantu mereka dalam memecahkan masalah. Namun, berdasarkan hasil PISA, hasil pendidikan pada konten ini masih di bawah standar, salah satunya pada konsep peluang yang merupakan salah satu muatan konten numerasi. Berdasarkan hal tersebut, penelitian ini bertujuan untuk mengetahui penerapan pembelajaran Pendidikan Matematika Realistik Indonesia dalam meningkatkan kemampuan numerik siswa pada konsep peluang kelas VIII. Penelitian PTK ini dilaksanakan dalam tiga siklus: perencanaan, pelaksanaan, observasi, analisis, dan refleksi. Subjek penelitian (SP) adalah 6 siswa kelas VIII di SMP Al-Chalidyah. Penelitian ini menerapkan tahapan PMRI. Tahapan-tahapan PMRI diterapkan dalam penelitian ini. Pada setiap pertemuan, lembar kerja yang dibagikan kepada siswa sebagai alat bantu pembelajaran menampilkan pemecahan masalah matematika, seperti konteks, model, partisipasi siswa, interaktivitas, dan keterkaitan. Hasil penelitian menyatakan bahwa pemahaman siswa terhadap konsep matematika mengalami peningkatan. Hal ini dapat dilihat dari partisipasi siswa dalam kegiatan pembelajaran dan peningkatan nilai rata-rata pada tes siklus SP. Hasil untuk siklus I adalah 65,97, siklus II 75,00, dan siklus III 82,10. Jadi, dapat disimpulkan bahwa pembelajaran PMRI dapat meningkatkan kemampuan berhitung.

Kata Kunci: pendekatan PMRI, peluang, kemampuan numerasi

1. Introduction

Currently, numeracy skills are being implemented at all levels of education. For Indonesia, achieving numeracy literacy is a top priority in the 21st century (Putri, Inayah & Hadiany, 2021). Four innovations were introduced by the Ministry of Education and Culture's program to obtain the desired educational outcomes, one of which is that as a substitute for the UN in 2021, a Minimum Competency Assessment (MCA) program focusing on numeracy skills was implemented (Kemdikbud, 2017; Tohir, 2019; Handayu, 2020). This is explained in Permendikbudristek Regulation Number 17 of 2021 concerning the National Assessment, which states that cognitive learning objectives include numeracy and reading literacy, determined by the Minimum Competency Assessment (AKM).

Students with strong numeracy skills will help them solve problems. However, in reality, the educational results in this domain are still below standard. This is evidenced by data from the 2018 Program for International Student Assessment (PISA) assessment, which places Indonesia's mathematics skills at 74 out of 79 countries and is classified as low with an average score of 379 (OECD, 2019) Doorman, Panhuizen, and Robitzsch, (2014) imply that in the PISA test most students still face difficulties in the early stages of solving context-based math problems, such as understanding real-world situations and turning them into arithmetic problems. Meanwhile, the results of research conducted by Cahyanovianty and Wahidin (2021) say that students have difficulty solving numerical problems in AKM problems.

One of the numeracy content domains is the topic of chance. Games first introduced The concept of chance in mathematics (Gregersen, 2011). Since its emergence in games, the idea of chance has spread to various fields, including actuarial science, business, politics, sports, and academia (Walpole, 2012). Learning the concept of chance is essential because it has many applications. However, students still face some difficulties in learning the material.

This happens to Al-Chalidyah Junior High School students, whose numeracy skills are still experiencing obstacles. The results of the initial test of numeracy skills of class VIII students showed that students with scores below 61 were around 75% of the 28 students in the class. This shows that more than half of the students in the class have numeracy skills in the sufficient, deficient, and very deficient categories. The students' ability with these criteria shows that they are still weak in using numbers, symbols, or representations to solve problems, make predictions, and make decisions in mathematics.

The following is a review of the answers of class VIII students in the preliminary numeracy skills test. In the following problem, students must find practical solutions in everyday life, namely determining the number of game rides a child can play if the entrance fee and price for each game ride are known.

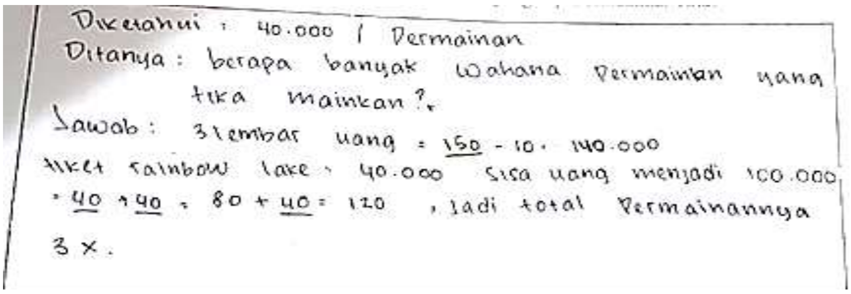


Figure. 1. Initial Test Question Answers of Student A's Numeracy Ability

P-ISSN: 1693-2226
E-ISSN: 2303-2219

Student A's answer in Figure 1 above summarizes the known and questionable things described in the solving steps. However, the information written is incomplete and wrong. Often, students have difficulty understanding the context of the problem, leading to errors in performing basic math operations. For example, student A gave an incorrect answer because he did not correctly use numbers and mathematical symbols. These results align with research from Sidik & Wakih, (2019), which found that students have difficulty interpreting the meaning of questions in existing mathematical models.

Based on these problems, an opportunity learning process that contains contextual activities is needed to build students constructively, develop models, and utilize existing understanding for ease of understanding abstract material so that it can become real (Martadinata et al., 2020). The PMRI approach is one of the approaches to teaching mathematics that is applied realistically and contextually (Martadinata et al., 2020).PMRI is a method that uses reality as a starting point for teaching to help students develop and rediscover their knowledge (Gravemeijer, 2010).

Considering the problems that occur at Al-Chalidiyah Junior High School, this research has never been done. The novelty of this study is implementing PMRI in junior high school learning opportunities to improve students' numeracy skills and focusing on knowing how the implementation and results of the PMRI approach to opportunity material at the junior high school level.

2. Literatur Review

2.1 Indonesian Realistic Mathematics Education (PMRI)

Freudenthal's idea of mathematics as a human activity is the basis of realistic mathematics education (Gravemeijer, 1994). This shows that Freudenthal viewed mathematics as an activity or process, not a final product or closed system (Wijaya, 2012; Sitorus & Masrayati, 2016). Mathematics must be connected to reality and experience and relevant to the context of everyday life (real)) (Sumirattana, Makanong, & Thipkong, 2017). The context mentioned is a realistic concept that becomes a component of the thinking scheme. These components connect various contexts and mathematical concepts (Sitorus & Masrayati, 2016).

Although realistic in the sense of the "real world" is very important, realistic in PMRI has a broader meaning. The term "realistic" does not necessarily imply a connection to the real world. Describe the emphasis of realistic mathematics education in using scenarios that students imagine. Correspondingly, according to Astuti, et al., (2020), a problem is considered realistic if the problem is something that can be imagined (imaginable) by students or perceived as something actual (real). Thus, it can be concluded that PMRI can also be realized imaginatively without occurring in reality. PMRI is a learning approach that stems from things that are real to students, emphasizing mathematical process skills, discussing and collaborating, and arguing with classmates (Ijariah, 2016).

2.2 Characteristics of PMRI

According to Laurens et al., (2018), two critical features of PMRI are using relevant contexts and creating models that enable contextual conversion to formal mathematics. PMRI embodies the idea of mathematics as a subject matter, i.e., how students learn mathematics and how mathematics should be taught (Heuvel-panhuizen et al., 2014); this perspective is characterized as a characteristic of PMRI. The five characteristics of PMRI (Treffers, 1987; Gravemeijer, 1994) are (a) the use of context, (b) the use of models, (c) student contribution, (d) interactivity, and (e) linkage. The following is a description of the characteristics of PMRI:

a. The use of context

Realistic contexts or problems are used as a starting point for learning. They do not have to be real-world problems but can be in various circumstances as long as they are meaningful to students (Inayatusufi & Aziz, 2021).

b. The use of models

Models are used to make connections between real and abstract levels. The diversity of models, symbols, and activity designs guides students' thought processes toward acquiring information (Afriansyah, 2016). First, the model may still be simple or informal mathematics (model of); then, students can create a more comprehensive model that leads to formal mathematics through generalization or formalization. (model for) (Sumirattana, Makanong & Thipkong, 2017).

c. Student contribution

The first and second features of PMRI are phenomenological inquiry, and the use of PMRI approaches as seen in students (Julie, Suwarsono & Juniati, 2014). Instructors provide opportunities for students to explore mathematical ideas through learning activities.

d. The use of context

Realistic contexts or problems are used as a starting point for learning. They do not have to be real-world problems but can be in various circumstances as long as they are meaningful to students (Inayatusufi & Aziz, 2021).

e. The use of models

Models are used to make connections between real and abstract levels. The diversity of models, symbols, and activity designs guides students' thought processes toward acquiring information (Afriansyah, 2016). First, the model may still be simple or informal mathematics (model of). Then, through generalization or formalization, students can create a more comprehensive model leading to formal mathematics (model for) (Sumirattana, Makanong & Thipkong, 2017).

f. Student contribution

The first and second characteristics of PMRI are phenomenological inquiry, and the use of PMRI approaches as seen by students (Julie, Suwarsono & Juniati, 2014). Instructors provide opportunities for students to explore mathematical ideas through learning activities.

g. Interactivity

When students and teachers collaborate, share ideas, and convey the results of their work, the learning process for students will be more meaningful (Fauziah et al., 2018). Students' cognitive and emotional skills can be developed simultaneously when interaction is used in teaching mathematics.

h. Linkage

The interrelationship between mathematical ideas is seen as something that must be considered in the learning process in PMRI. In preparing for formal mathematics, students must draw connections between the information they already have to gain new knowledge (Julie, Suwarsono & Juniati, 2014).

2.3 Numeracy Skills

The National Literacy Movement (GLN), referring to WEF and Boston Consulting Group (BCG), states that the basic literacy that must be possessed in the era of disruption is numeracy literacy (Nugraha & Octavianah, 2020). Numeracy is a literacy that plays a role in decision-making because these skills can be used to overcome difficulties that arise in everyday life. The ability to

P-ISSN: 1693-2226
E-ISSN: 2303-2219

apply mathematical symbols, data, and numbers related to numeracy literacy contributes to the welfare of individuals and society (Pangesti, 2018; Nafiah & Hartatik, 2020).

Numeracy refers to a person's capacity to formulate, apply, and understand mathematics in various situations (Wulandari & Azka, 2018). This is in line with the opinion (Parnis & Petocz, 2016) that numeracy is a fundamental component of learning that involves use in context and relates to (1) basic concepts and mathematical abilities, (2) mathematical thinking and strategies, (3) general thinking skills; and (4) understanding of context, furthermore, according to Aningsih, (2018).

Table. 1. Relationship between PMRI and Numeracy Skills

RME steps	Description PMRI Characteristics	Numeracy Indicator
Step 1: problem generation	Phenomenological exploration (use of context) Real problems formulated in mathematical problems are used to find solutions to these mathematical problems.	Use a variety of numbers and symbols related to operations on algebraic forms to solve problems in the context of everyday life. Analyze information (graphs, tables, charts, diagrams, etc.). Interpret analysis results to predict and make decisions.
Step 2: giving instructions	*Use models* Based on the problems that have been read and understood, students are given the freedom to express the problem in the form of other representations, and this process is called the model. The representation that students have made is then changed in mathematical form, and this process is called the model.	
Step 3: of problem-solving	Student contribution Interactivity After getting the mathematical form, students must discuss how to solve it with their previous skills.	
Step 4: group discussion	Linkage They are using existing knowledge to solve the mathematical model created. The results obtained from the discussion as student contributions in the form of solutions to mathematical problems are then interpreted in the real problems given at the beginning.	

3. Research Methods

The 28 students of class VIII even semester were used as the subject of this class action activity. Two upper, middle, and lower students were selected as research subjects (SP). This research will look at two things: (1) the use of PMRI techniques in the implementation of learning and (2) the increase in numeracy test scores at the end of each cycle. This activity consists of several research cycles, a type of class action research. Planning, implementation, observation, and reflection are included in the activities of each cycle. Figure 2 illustrates the steps taken in this study.

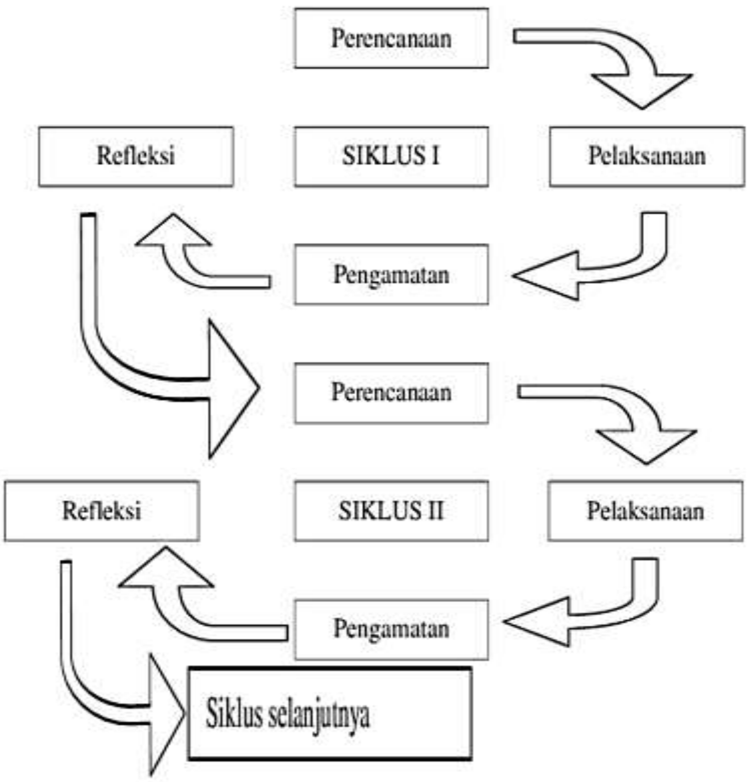


Figure. 1. PTK Flow Chart

Teachers and students who participated in the learning process, as well as the numeracy test results of each cycle, as a source of research data. End-of-cycle tests were conducted to measure students' skills after completing the learning process using PMRI. The triangulation method was used to validate the data. Data from interviews and observations that had been triangulated and verified were used in the research. This research uses qualitative and quantitative data as the type of data. Using the Milles and Huberman Model, the qualitative data analysis approach included data reduction, data presentation, and conclusion drawing. At the end of each cycle, test results were used to conduct quantitative data analysis.

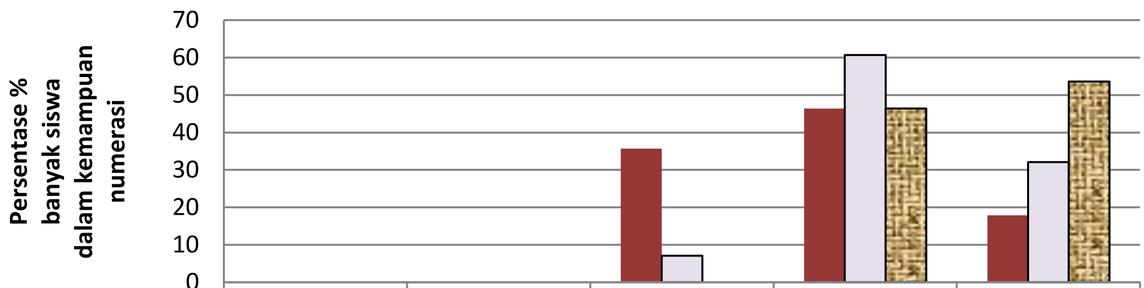
Data validation was carried out using triangulation techniques. Research data validated by triangulation techniques are observation and interview data. The types of data used in this research are qualitative and quantitative data. Qualitative data analysis techniques using the Milles and Huberman Model include data reduction, data presentation, and conclusion drawing. Quantitative data analysis was carried out from the test results at the end of each cycle. The indicators of success in this study are as follows: (1) at least 75% of students in class VIII have achieved the predetermined mathematical numeracy score of 72 or in the good category; (2) the final test results of mathematical numeracy skills of the six research participants have increased.

P-ISSN: 1693-2226
E-ISSN: 2303-2219

4. Results and Discussion

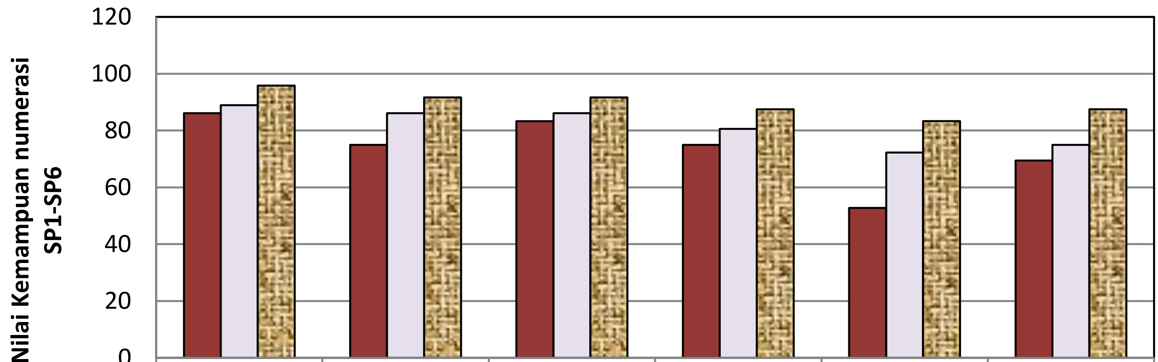
4.1 Research Results

Figure 3 and Figure 4 show the numeracy test results from cycle I to cycle III for each SP and all students in brief. A detailed discussion of the results of this study follows.



	sangat kurang (0,00-20,99)	kurang (21,00-40,99)	cukup (41,00-60,99)	baik (61,00-80,99)	sangat baik (81,00-100)
Siklus I	0	0	35,7	46,4	17,9
Siklus II	0	0	7,1	60,7	32,1
Siklus III	0	0	0	46,4	53,6

Figure. 2. Diagram of Percentage of Students in the Numeracy Ability Category Cycle I-III



	SP1A	SP2A	SP3T	SP4T	SP5B	SP6B
Siklus I	86,11	75	83,33	75	52,78	69,44
Siklus II	88,89	86,11	86,11	80,56	72,22	75
Siklus III	95,83	91,67	91,67	87,5	83,33	87,5

Figure. 3. Percentage Chart of Numeracy Skill Scores of the Six SPs in Each Cycle

In cycle I, students have begun to get used to using model stages and intertwinement to obtain solutions to numerical problems in the LKS. This activity is based on PMRI characteristics, which apply realistic contexts and use models to bridge student understanding from concrete to abstract. Besides that, through this activity, students are also led to being more active and creative during the learning process. The table that students fill in is the model. Then, students are asked to analyze the results table from student guesses and tables of student answers. The model is used to bridge students' knowledge to the model. Students explain why some of their guesses are correct, and some of their answers are wrong. The table and the reasons given will help students find the concept corresponding to the event as a model, as in Figure 5 below.

Based on the table and students' analysis, students can find the definition of chance. Students have found the concept of chance well through the worksheet. They understand that the meaning of chance is a possibility.

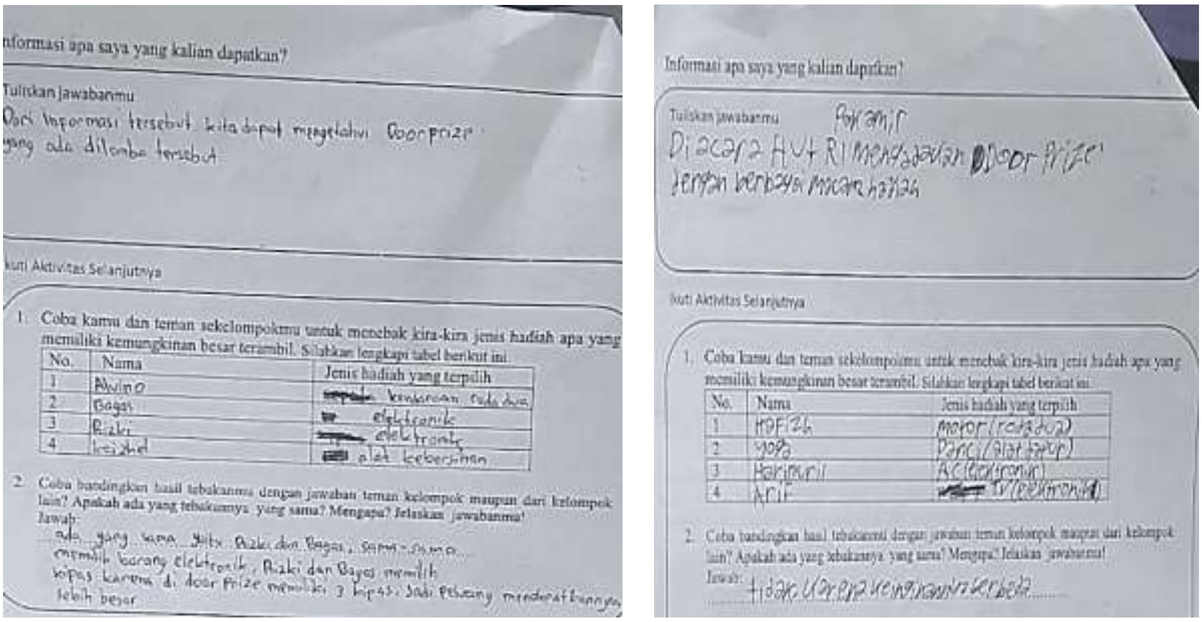


Figure. 4. Differences in Student Analysis of the Door Prize Guessing Table

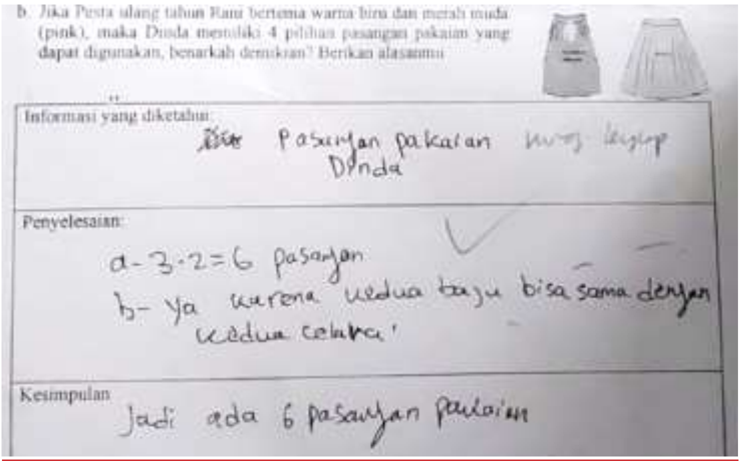


Figure. 5. SP1A Answer Number 3 Cycle 1 Test

In Figure 6, it can be seen that the first research subject of the upper group (SP1A) in the first cycle test is still not careful in analyzing information. Hence, the answers given are still not optimal. It can be seen from the picture above that SPA1 has not made the appropriate decision for the sample point problem of question number 3. The colour that must be used in Rani's birthday event is a combination of blue and pink, so there are only two pairs. So, the clothes that can be chosen are only blue clothes, pink skirts, and blue skirts, but SP1A answered six pairs because both clothes can be paired with the skirt. Based on the answers from SP1A, it can be analyzed that SPA1 has been able to understand numeracy problems. It is just that there are still mistakes in making the right decisions. Besides that, SP1A has also improved in working on problems with numeracy indicators.

P-ISSN: 1693-2226
E-ISSN: 2303-2219

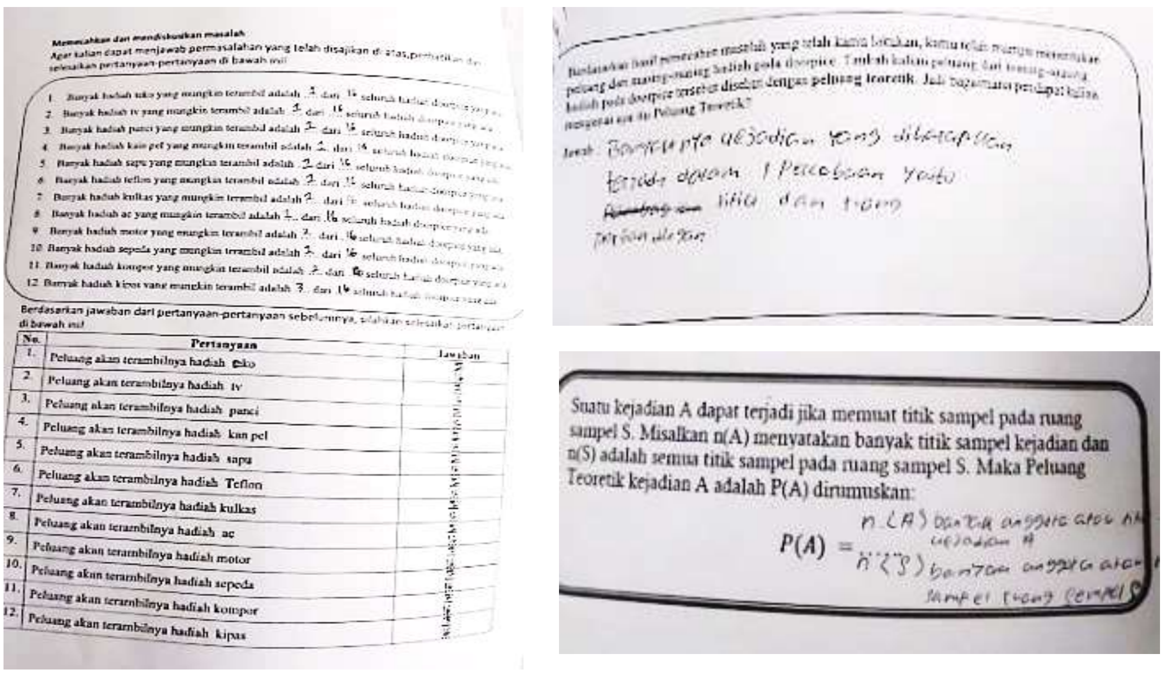


Figure. 6. Model of the Stage Becomes A Model For

Furthermore, based on observations made during cycle II, giving instructions and problems using models and linkage processes went well. Students can solve numerical problems regarding the theoretical odds using the context of door prizes. They can deduce the formula to find the odds. In addition, they can also perform the mathematical process of converting the model into a model to determine the limit value of the odds. In this case, students identify and select relevant information from the information on the LKS (the first indicator of numeracy skills). Students can use number symbols related to basic mathematics to solve daily life problems (the second indicator of numeracy skills).

The last stage, namely class discussion and conclusion, went quite well. Students exchanged opinions about the results of their group discussions to get the right solution. However, some students still seemed shy about presenting in front of the class. Through this final process, students can communicate the interpretation of the analysis results and provide mathematical arguments to make decisions (the third indicator of numeracy skills). However, some students' answers need to be corrected. Thus, the learning process with PMRI can improve numeracy skills despite shortcomings. Based on the results of the final test of cycle II, the test scores of mathematical numeracy skills, 21 students or 75% of students have completed. Based on the above explanation, it can be said that students' mathematical numeracy skills in cycle II increased and achieved the success indicators agreed upon by the teacher and participant observer, namely with a minimum score of 72 in the good category. However, there are still improvements.

The results of observations made during cycle III showed that students are accustomed to the application of PMRI so that when organizing students into groups are not rowdy and noisy as happened in the pre-cycle, students are also accustomed to using LKS containing problems with the context of everyday life which they think is very helpful in learning. Students work together with their respective groups to find new understanding. In the problem-solving process of PMRI learning, there is a stage of giving instructions by the teacher (interactivity). At this stage, the teacher was a facilitator when students were discussing.

Figure. 7. Group Discussion Atmosphere

4.2 Discussion

Students were first divided into groups and asked to read the LKS on numerical problems on chance. For the problems to be easily understood and familiar to students, they have been adapted to the situation and culture of Indonesia. This is in line with (2019), who state that learning becomes more meaningful because the characteristics and environment of students develop the materials and problems in the LKS. Students can freely express problems using different representations based on the problems they have learned and understood; this process is called modelling. After that, students' representations are transformed into mathematical form through a procedure called model for. This helps in analyzing information, which is an early indicator of numeracy. This is in line with research conducted by Amelia, Syamsuri and Novaliyosi (2020), that in solving mathematical literacy problems on chance and data content, students start by formulating the problem, namely identifying the information given by the problem.

After acquiring the mathematical form, students are asked to discuss how to solve the problem using their prior knowledge. In line with this, according to Suriyani and Wahyuni (2021), to lead to numeracy, students need to be invited to go deeper into mathematical meaning and understanding by being allowed to work on problem-solving and looking for connections and meaning. These linkage characteristics are consistent with the mathematization process by using a model, which includes completing the mathematical model developed with the previously obtained information. The numeracy indicator improved through this exercise is the student's capacity to use basic mathematics to solve contextual problems. After the discussion, students' contributions to mathematical problem-solving about the problems presented at the beginning were analyzed. This action is in line with the third numeracy indicator, namely interpretation.

Based on the description above, it can be concluded that each activity and stage of PMRI can help students realize the use of mathematics in everyday life and share their knowledge with peers to encourage the development of numeracy skills. This is also supported by the increase in the final test results of numeracy skills from each cycle for all students. The increase can be seen from each cycle's average value, which always increases. The average value of mathematical numeracy skills has reached the minimum completeness value determined in the cycle success

P-ISSN: 1693-2226
E-ISSN: 2303-2219

indicator of 72 or is in a suitable category. Students who achieved this value also increased in each cycle. In cycle III, they met the cycle success indicator of 85.71% of students were complete. Thus, PMRI learning can help Al-Chalidyah Junior High School class VIII students become more proficient in mathematical numeracy. Every learning activity carried out with the application of PMRI is a factor that supports the improvement of students' mathematical abilities.

So, it can be said that mathematics learning with PMRI to improve students' numeracy skills has been successfully applied in this study. Relevance with previous research shows that PMRI can improve the ability to understand, communicate, and cognitive learning outcomes of junior high school students, as well as problem-solving on chance material, through the application of RME combined with the use of media, traditional contexts, and the preparation of teaching materials (Zuhri et al., 2023; Armiati et al., 2022; Bilad & Ekawati, 2022). This adds to the novelty of the application of PMRI, which can improve numeracy skills on the topic of chance using the context of door prize draws.

5. Conclusion

Based on the findings and discussion in this study, it can be said that using PMRI can help VIII-grade students improve numeracy, especially on the topic of opportunities. This can be seen from (1) The test results on numeracy skills obtained by SP in each cycle have increased. The percentage of students who achieved mastery with a minimum score of 72 continued to increase each cycle, and this showed an increase in the mathematical numeracy of all students in class VIII. The increase increased to 64.3% in cycle I, 75% in cycle II, and 85.7% in cycle III; (2) The learning process took place during the stages of PMRI, namely giving problems, providing instructions, and solving problems, discussing results and drawing conclusions, and in learning also applied PMRI characteristics, namely the use of context, the use of models, interactivity, student contribution, and linkage. The worksheets are adapted to PMRI principles and are arranged based on numeracy indicators. The worksheet is given to students in each learning session as an application to solve numeracy problems. Students hone their abilities to get used to evaluating information through practice problems on the worksheet. Based on observations, interviews, and tests for each cycle, it can be concluded that students can improve their numeracy skills through each step of the learning process. So, it can be concluded that each PMRI activity encourages the achievement of students' mathematical numeracy skills.

5.1 Implikasi

Based on the findings and discussion of the research results that have been described, this research can be used by teachers to carry out learning activities that are more meaningful to students. The implementation of such learning activities is carried out to improve the quality of the learning process. Improving the quality of the learning process can be seen in students' learning activities, such as interest, activeness, and cooperation. In addition, the application of PMRI is also useful in improving students' numeracy skills, especially in understanding opportunities. This is because the approach uses the context of everyday life that students easily imagine. Therefore, this research can be used and developed by teachers who face similar problems.

5.2 Advice

Based on the research results and conclusions above, the following suggestions are expected to be valid and considered for further research, among others:

a. Use various daily life contexts close to students so that they are easy to imagine and understand.

b. Apply to the subject matter of other mathematics materials or other numeracy domains.
c. PMRI can be used as an alternative to learning but must be carefully planned so that each activity's stages and basic characteristics can be carried out correctly.

6. Reference

Afriansyah, E.A. 2016. 'Makna Realistic dalam RME dan PMRI', *Lemma*, II(2), pp. 96–104.

Amelia, I., Syamsuri & Novaliyosi. 2020. 'Identifikasi Proses Penyelesaian Soal Literasi', *Journal Cendekia: Jurnal Pendidikan Matematika*, 04(01), pp. 331–345.

Aningsih, A. 2018. 'Kemampuan Berpikir Tingkat Tinggi', *Journal Reseapedia*, 1(1).

Armiati *et al.* 2022. 'Local instructional theory of probability topics based on realistic mathematics education for eighth-grade students,' *Journal on Mathematics Education*, 13(4), pp. 703–722. doi:10.22342/jme.v13i4.pp703-722.

Astuti, R.N., . G. & . M. 2020. 'The Effect of RME on Mathematics Learning Outcomes Viewed Mathematic Communication Skills,' *International Journal of Educational Research Review*, 5(1), pp. 43–53. doi:10.24331/ijere.650864.

Ayuningtyas, N. & Sukriyah, D. 2020. 'Analisis Pengetahuan Numerasi Mahasiswa Matematika Calon Guru', *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika*, 9(2), pp. 237–247.

Bilad, D.I.B. & Ekawati, R. 2022. 'MATHE dunesa', *Jurnal Ilmiah Pendidikan Matematika*, 11(2). Available at: https://jurnalmahasiswa.unesa.ac.id/index.php/mathedunesa/article/view/25554/23429.

Cahyanovianty, A.D. & Wahidin. 2021. 'Analisis Kemampan Numerasi Peserta Didik Kelas VIII dalam Menyelesaikan Soal Asesmen Kompetensi Minimum', *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 05(02), pp. 1439–1448.

Chairunnisa Inayatusufi & Tian Abdul Aziz. 2021. 'Design of Quadrilateral Learning with RME Approach for Junior High School Students', *Jurnal Riset Pembelajaran Matematika Sekolah*, 5(2), pp. 1–13. doi:10.21009/jrpms.052.01.

Dickinson, P. *et al.* 2010. 'Using Realistic Mathematics Education with low to middle attaining pupils in secondary schools,' *Proceedings of the British Congress for Mathematics Education*, (April), pp. 73–80. Available at: http://www.bsrlm.org.uk/IPs/ip30-1/BSRLM-IP-30-1-10.pdf.

Ellefson, M.R. *et al.* 2020. 'Do Executive Functions Mediate The Link Between Socioeconomic Status And Numeracy Skills? A Cross-Site Comparison of Hong Kong and the United Kingdom, *Journal of Experimental Child Psychology*, 194, p. 104734. doi:10.1016/j.jecp.2019.104734.

Fauziah, A. *et al.* 2018. 'Primary School Student Teachers' Perception To Pendidikan Matematika Realistik Indonesia (PMRI) Instruction,' *Journal of Physics: Conference Series*, 943(1). doi:10.1088/1742-6596/943/1/012044.

Gravemeijer, K. 1994. *Developing Realistic Mathematics Education*. Utrecht: CD-β Press.

Gravemeijer, K. 2010. *Realistic Mathematics Education Theory as A Guideline for Problem-Centered, Interactive Mathematics Education. In R. Sembiring, K Hoogland & M. Dolk (Eds.), A decade of PMRI in Indonesia (pp.41-50). Bandung*. Utrecht: APS International.

Gregersen. 2011. *The Britannica Guide to Statistics and Probability*. New York: Britannica Publication Publishing.

Han, W. *et al.* 2017. *Materi Pendukung Literasi Numerasi*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

P-ISSN: 1693-2226
E-ISSN: 2303-2219

Handayu, A.R. 2020. *Analisis Terhadap Butir Soal Asesmen Kompetensi Minimum (AKM) Tingkat SMP Ditinjau dari Domain Literasi Matematis Pisa*. Universitas Pendidikan Indonesia.

Heuvel-panhuizen, M. Van Den *et al.* 2014. 'Encyclopedia of Mathematics Education', *Encyclopedia of Mathematics Education*, pp. 521–525. doi:10.1007/978-94-007-4978-8.

Heuvel-Panhuizen, M. Van den & Drijvers, P. 2020. 'Realistic Mathematics Education,' *Encyclopedia of mathematics education*, pp. 713–717.

Ijariah. 2016. 'Pendidikan Matematika Realistik di Kelas I SD Negeri 24 Bengkulu Selatan Tahun Pelajaran 2014 / 2015 (Penelitian Tindakan Kelas)', *Pakar Pendidikan*, 14(1), pp. 55–66.

Julie, H., Suwarsono, S. & Juniati, D. 2014. 'Understanding profile from the philosophy, principles, and characteristics of RME', *Journal on Mathematics Education*, 5(2), pp. 148–159. doi:10.22342/jme.5.2.1499.148-159.

Laurens, T. *et al.* 2018. 'How Does Realistic Mathematics Education (RME) Improve Students' Mathematics Cognitive Achievement?', *Eurasia Journal of Mathematics, Science and Technology Education*, 14(2), pp. 569–578. doi:10.12973/ejmste/76959.

Mahendra, R., Slamet, I. & Budiyono. 2017. 'Problem Posing with Realistic Mathematics Education Approach in Geometry Learning,' *Journal of Physics: Conference Series*, 895(1). doi:10.1088/1742-6596/895/1/012046.

Mahmud, M.R. & Pratiwi, I.M. 2019. 'Literasi Numerasi Siswa dalam Pemecahan Masalah Tidak Terstruktur', *KALAMATIKA Jurnal Pendidikan Matematika*, 4(1), pp. 69–88. doi:10.22236/kalamatika.vol4no1.2019pp69-88.

Martadinata, I. *et al.* 2020. 'Design of mathematics learning in the grand mosque of Palembang,' *Journal of Physics: Conference Series*, 1480(1). doi:10.1088/1742-6596/1480/1/012005.

Mawaddah, S. *et al.* 2022. 'Instrumen Asesmen Kompetensi Minimum Numerasi Konteks Lingkungan Lahan Basah Khas Kalimantan Selatan', *EDU-MAT: Jurnal Pendidikan Matematika*, 2759, pp. 24–32. doi:10.20527/edumat.v10i1.12062.

Nafiah, H.S. 2020. 'Education and Human Development Journal', *Education and Human Development Journal*, 5(April), pp. 9–22.

Nasional, G.L. 2017. *Materi Pendukung Literasi Numerasi*. Jakarta: Kemdikbud.

Nugraha, D. & Octavianah, D. 2020. 'Diskursus Literasi Abad 21 di Indonesia', *Jurnal Pendidikan Edutama*, 7(1).

OECD. 2019. *PISA 2018 Results Combined Executive Summaries Volume I, II & III*. Paris: OECD Publishing.

Pangesti, F.T.P. 2018. 'Menumbuhkembangkan Literasi Numerasi Pada Pembelajaran Matematika Dengan Soal Hots', *Indonesian Digital Journal of Mathematics and Education*, 5(9), pp. 566–575. Available at: http://idealmathedu.p4tkmatematika.org.

Parnis, A.J. & Petocz, P. 2016. 'Secondary School Students' Attitudes Towards Numeracy: An Australian Investigation Based on The National Assessment Program—Literacy And Numeracy (NAPLAN),' *Australian Educational Researcher*, 43(5), pp. 551–566. doi:10.1007/s13384-016-0218-3.

Putri, M., Inayah, F. & Hadiany, D.A. 2021. 'Analisis Kemampuan Literasi Numerasi Siswa Smp Ditinjau dari Kemandirian Belajar Matematika', *Prosiding Seminar Nasional Pendidikan Matematika (SNPM)*, 3, pp. 196–207.

Sibarani, G. & Syahputra, E. 2019. 'Analisis Kemampuan Penalaran Siswa Melalui Proses Pemecahan Masalah Matematika Pada Materi Peluang', *Αγαη*, 8(5), p. 55.

Sidik, G.S. & Wakih, A.A. 2019. 'Kesulitan Belajar Matematik Siswa Sekolah Dasar Pada Operasi Hitung Bilangan Bulat'.

Sitorus, J. & Masrayati. 2016. 'Students' Creative Thinking Process Stages: Implementation of Realistic Mathematics Education, *Thinking Skills and Creativity*, 22, pp. 111–120. doi:10.1016/j.tsc.2016.09.007.

Sumirattana, S., Makanong, A. & Thipkong, S. 2017. 'Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy,' *Kasetsart Journal of Social Sciences*, 38(3), pp. 307–315. doi:10.1016/j.kjss.2016.06.001.

Suriyani & Wahyuni, M.S. 2021. 'Pengembangan Instrumen Penalaran Matematis Untuk Menstimulasi Kemampuan Numerasi Siswa Dengan Konteks "Rumahku"', *Jurnal Education and Development*, 9(1), pp. 26–29.

Tohir, M. 2019. *Empat Pokok Kebijakan Merdeka Belajar*. Available at: https://doi.org/10.17605/OSF.IO/8SNV2 (Accessed: 4 February 2022).

Treffers, A. 1987. *Three Dimensions: A Model of Goal and Theory Description in Mathematics Instruction*. Netherland: SpringerNetherland.

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), pp. 375–383. doi:10.29333/iejme/5721.

Vithal, R. & Bishop, A.J. 2006. 'Mathematical Literacy: A new literacy or a New Mathematics?', *Pythagoras*, 0(64), pp. 2–5. doi:10.4102/pythagoras.v0i64.93.

Walpole. 2012. *Probability & Statistics for Engineers & ScientistI (9th Ed.)*. Boston: Pearson Education, Inc.

Wijaya, A. 2012. *Pendidikan Matematika Realistik*. Yogyakarta: Graha Ilmu.

Wulandari, E. & Azka, R. 2018. 'Menyambut Pisa 2018: Pengembangan Literasi Matematika Untuk Mendukung Kecakapan Abad 21', *De Fermat : Jurnal Pendidikan Matematika*, 1(1), pp. 31–38. doi:10.36277/defermat.v1i1.14.

Zuhri, Z. *et al.* 2023. 'Implementation of Ethnomathematics Strategy in Indonesian Traditional Games as Mathematics Learning Media,' *Journal of Innovation in Educational and Cultural Research*, 4(2), pp. 294–302. doi:10.46843/jiecr.v4i2.613.

P-ISSN: 1693-2226
E-ISSN: 2303-2219