Improvement of Mathematics Learning Process and Outcomes Using the *Realistic Mathematics Education* Model in Grade II Students at SDN 205/II Bangun Harjo

Sila Hastutik
Universitas Muhammadiyah Muara Bungo
Randi Eka Putra
Universitas Muhammadiyah Muara Bungo
Sundahry
Universitas Muhammadiyah Muara Bungo

Abstrak

Based on the initial observations made by the researcher, there are 20 students, and only 50% of them have achieved the KKTP (Learning Objective Achievement Criteria). Meanwhile, the school's KKTP is 75%. The purpose of this study is to describe the improvement in the learning process and cognitive learning outcomes through the application of the *Realistic Mathematical Education* Learning Model in class II of SDN 205/II Bangun Harjo. This study was conducted in two cycles using a classroom action research (CAR) design. Each cycle consisted of four phases: planning, implementation, observation, and reflection. Twenty second-grade students participated in the study. Data collection methods included learning outcome assessments, recording, and observation. The Realistic Mathematics Education model was applied using learning outcome test questions and teacher and student observation sheets as data collection tools. The results of the study indicate that students' understanding of the subject matter can be improved through the application of the Realistic Mathematics Education Model. The increase in teacher observation scores, from 87.5% in Cycle I to 95% in Cycle II, which is classified as excellent, demonstrates this. Additionally, students' learning process scores increased from 77.5% (good) in Cycle I to 92.5% (excellent) in Cycle II. Furthermore, students' cognitive learning outcomes in mathematics increased from 60% (adequate) in Cycle I to 90% (excellent) in Cycle II. Therefore, by applying the Realistic Mathematics Education Model, the mathematics learning process and outcomes can exceed the success indicators.

1 Introduction

Education can be understood as an effort to improve the quality of the younger generation, enabling them to become well-rounded individuals. The teaching and learning process is part of

this effort; both actions are significant because they can directly change and influence the lives of teachers and students through learning interactions. Education also serves as a means for students to develop into better individuals. Meanwhile, for educators, education requires a deep understanding of the mindset and way of life that is believed to embody the human values that form the basis of human existence itself(Pristiwanti et al., 2022).

In Indonesia's national education system, specific standards must be met within a specified timeframe to achieve the desired learning objectives (Purwani Puji Utam, 2022). To achieve these objectives, the curriculum is a crucial component of the education system. The curriculum serves not only as an administrative reference but also as a framework that determines the direction and content of learning at various levels of education. Without a structured and relevant curriculum, the educational process will lose direction, and it will be challenging to achieve the expected goals. Therefore, curriculum development in Indonesia is an urgent need to keep pace with the demands of the times and the needs of students (Jeflin & Afriansyah, 2020).

One subject that occupies a strategic position in the curriculum is mathematics. Mathematics develops through logical reasoning that involves the use of clearly defined, accurate, and unambiguous expressions. Mathematical representation through certain symbols has a deep meaning and can be used to solve various numerical and applied problems in everyday life (Fadul, 2019).

However, mathematics learning is not limited to understanding symbols or solving problems procedurally. Furthermore, mathematics learning involves active interaction among various learning elements, including students, teachers, materials, and the learning context. The aim is to improve critical thinking skills, creativity, and students' problem-solving abilities. Through the right learning approach, students are expected to develop their mathematical ideas more independently and meaningfully (Gusteti & Neviyarni, 2022).

Mathematics education also needs to be applied to primary school students in order to achieve the first objective, which is to train students to think effectively, efficiently, honestly, critically, rationally, and logically, preparing them to face various changes in real life. Second, they are equipped with the ability to apply mathematical principles in their daily activities. This is the main objective of mathematics education (Wijayanti & Yanto, 2023).

Based on observations conducted at SDN 205/II Bangun Harjo on 20 and 21 November 2024, it was observed that on the first day of observing the mathematics learning process in Grade II on the subject of numbers 1-100, the atmosphere in the classroom was such that the students were not very active when asked questions by the teacher. The students' responses to the teacher's questions were often nonexistent, with the students remaining silent. When the teacher explained the material, many students did not pay attention and instead focused on their own activities, such as playing with their classmates, during the presentation. Some students also left and re-entered the classroom to dispose of rubbish or wash their hands, thereby disrupting the learning process. During the learning process, teaching aids were not used. When explaining numbers 1-100, the teacher only explained verbally and wrote on the blackboard, which did not interest the students. Some students disturbed their neighbours or other friends, and many students chatted while the teacher was explaining the material. The material provided by the teacher was not related to the real world, making it difficult for students to understand. During the learning process, the teacher did not involve the students,

resulting in their limited participation and low interest in learning mathematics, which ultimately led to a decline in the students' grades in class II of SDN 205 / II Bangun Harjo. This is evidenced by the test scores below.
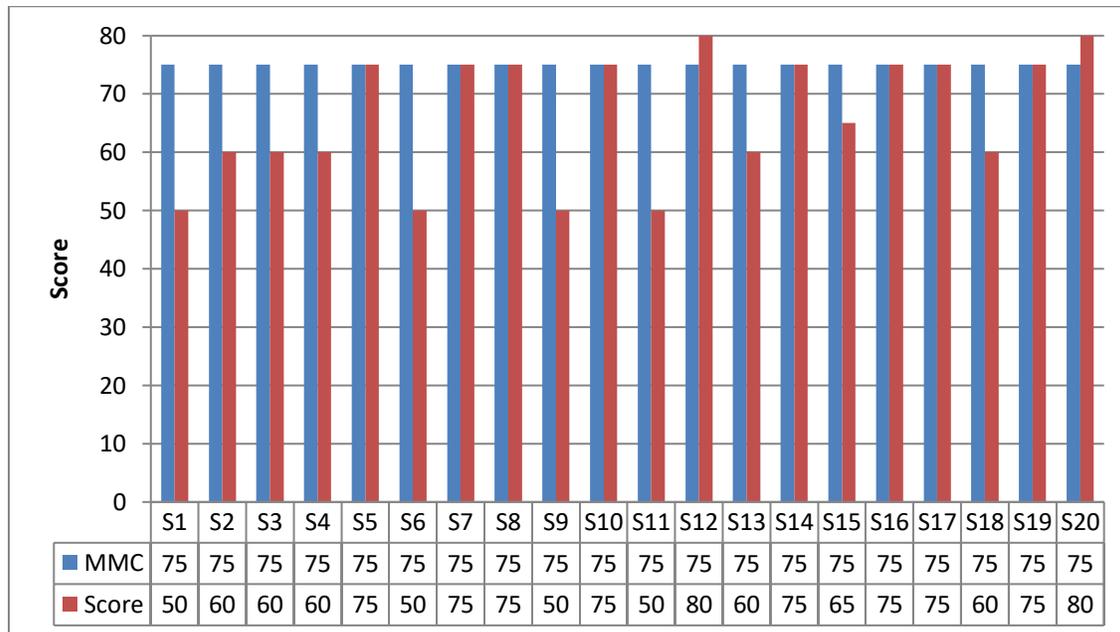

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
■ MMC	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
■ Score	50	60	60	60	75	50	75	75	50	75	50	80	60	75	65	75	75	60	75	80

Diagram 1. Daily Test Scores of Grade II Students at SDN 205 BANGUN HARJO

Based on Diagram 1, it is shown that in Grade II, with a total of 20 students and a Learning Objective Achievement Criteria (KKTP) set at 50%, the number of students who met the criteria was 10 students (50%). In comparison, the remaining 10 students (50%) did not meet the criteria. Several factors contributed to the low learning outcomes, including limited student engagement during the learning process. Many students were not actively participating and tended to focus on unrelated tasks during instruction.

This situation was influenced by the continued use of a traditional, teacher-centred approach that provided limited opportunities for student involvement. As a result, students became less motivated and showed reduced interest in mathematics, which negatively affected their performance and test scores. Only ten (50%) of the twenty Year 2 students who had a 50% Learning Objective Achievement Criteria (KKTP) were known to have achieved mastery, while the remaining ten (50%) did not.

Many problems in the learning process were the root cause of the poor learning outcomes of these students. Among these problems was the students' lack of active participation in learning activities. Many students focus on their personal affairs and do not pay attention when the teacher explains the material. In addition, teachers continue to use traditional, teacher-centred, one-way learning approaches, which inhibit students from actively participating in the learning process. Low interest in learning, especially in mathematics, which is often considered challenging and abstract, is influenced by low student engagement, which lowers learning performance in assessments.

Given these issues, a more interactive and contextual teaching strategy that actively involves students in the learning process is needed. Therefore, by employing the Realistic Mathematics Education (RME) learning model, researchers aim to provide a solution to this problem. This method is believed to enhance the learning experience by connecting mathematical concepts to real-world situations. Realistic mathematics education begins with real-world scenarios to help students develop and understand mathematical concepts in a more in-depth and concrete manner (Sari & Yuniati, 2018). Students are taught to think critically and actively when faced with problems, in addition to learning passively when given authentic learning situations.

The link between the RME approach and the need for more meaningful learning is crucial, particularly in classroom settings where student participation and interest in learning are low. In the RME approach, "the use of real-world contexts as a starting point for learning allows students to relate mathematical material to their everyday experiences", making it easier for them to understand and motivating them to learn. The term *"Realistic Mathematics Education" itself is derived from three key words*: realistic, mathematics, and education. Education refers to the teaching and learning process, mathematics refers to an exact science, while realistic refers to something actual or real. Thus, this approach directly addresses the weaknesses of conventional learning, which tends to be abstract and irrelevant to students' lives (Wati et al., 2020).

In addition to providing a stronger meaning in learning, RME also emphasises the importance of the social process in learning. This is particularly relevant to classroom conditions that previously showed a lack of interaction and student engagement. In RME, the learning process not only occurs individually, but also through discussion, collaboration, and sharing of strategies in problem-solving. This approach is considered capable of overcoming the challenges of traditional learning methods, which often lack interaction and the abstract nature of mathematics (Wati et al.. Thus, RME not only improves conceptual understanding but also trains students' social skills in communication and cooperation.

The *Realistic Mathematics Education* model has five main characteristics, namely: (a) Using contextual problems as the basis for learning (b) Utilising models or tools as a bridge to deeper understanding (c) Accommodating students' contributions and thoughts in the learning process (d) Encouraging interaction and cooperation between students and with teachers (e) Integrating mathematical concepts with other subjects for more comprehensive learning (Pritiswanti et al., 2022).

For this approach to be practical, several steps or syntaxes in RME learning can be integrated into the classroom learning process. These steps include: (1) presenting problems related to real life, (2) describing the problems in detail, (3) encouraging students to solve the problems independently, (4) inviting students to discuss and compare the solutions they have found with their classmates, and (5) summarising the results of the discussion together. This syntax emphasizes active, exploratory, and collaborative thinking processes that are particularly suitable for addressing the challenges of low learning outcomes and student interest in mathematics learning. By applying this approach, it is hoped that the learning process will become more lively, meaningful, and significantly improve student learning outcomes (Wulandari, 2021).

2   Method

Classroom action research, or CAR, is the term used to describe this type of study. Research aimed at improving teacher skills and helping students achieve learning objectives is known as classroom action research. Planning, implementation, observation, and reflection are the initial steps in the research process. Fifteen second-grade students from SDN 205/II Bangun Harjo were the subjects of this study. The Realistic Mathematics Education (RME) learning model was the focus of this study.
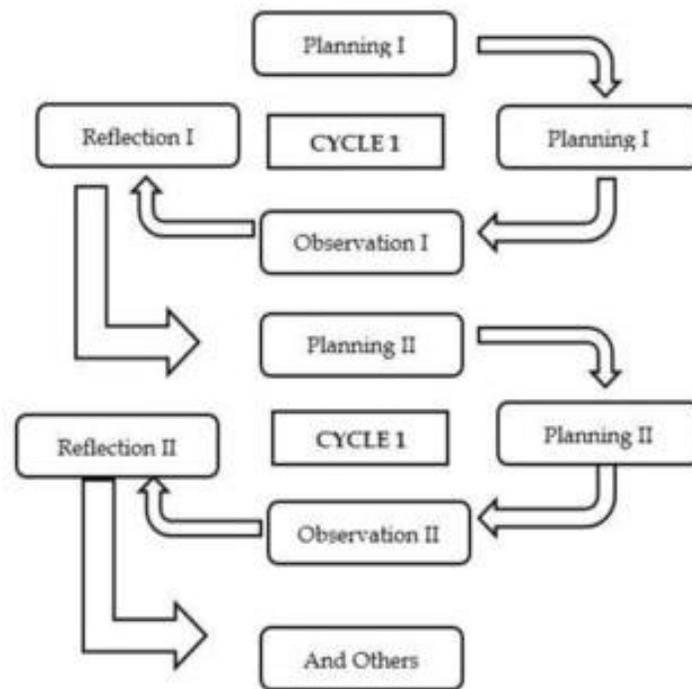

Figure 1. Design Research Cycle (Purnomo, 2015)

Test sheets, documents, and observations were used in the data collection process—observations involved observing how students and teachers participated in various learning activities. The purpose of this study's observation was to collect information on how second-grade students at SDN 205/II Bangun Harjo improved their mathematics learning outcomes and processes using the Realistic Mathematics Education learning paradigm. Student knowledge was evaluated using test sheets to see if there had been any improvement. In addition, the researchers used five essay questions and this test to support our observation findings. The photographs collected during the study served as documentation, providing visual evidence to support the findings from the students and the research. The documentation was collected when the Realistic Mathematics Education learning paradigm was employed to facilitate the learning.

The tool used to collect the data is known as a data collection tool. According to Alhamid & B (2019), this data collection tool is essentially separate from the data collection process. As described, a tick mark is placed in the specified column on the observation sheet. Examinations are used as data collection tools in addition to observation to assess students' abilities after the application of the Realistic Mathematics Education paradigm. Learning module indicators, which

include questions from cycles I and II, are considered when formulating questions. Five essay questions are provided for each cycle to assess students' overall abilities.

Quantitative data were calculated using simple statistical formulas on the Educator Observation Sheet, Student Observation Sheet, and Learning Outcomes. Formula (1) was used in the analysis of data from the teacher observation sheet (Arikunto, 2013), while formulas (1) and (2) were used on the student observation sheet in teaching and learning activities (Zainal et al., 2011).

$$Score = \frac{Achived}{Maximum} \; x \; 100 \tag{1}$$

$$Score = \frac{\text{Number of students categorized as "Good" or higher}}{\textit{Total Number of students}} \; x \; 100 \tag{2}$$

Table 1. Criteria for Assessing the Teaching Process of Students

Score Range	Criteria
90-100	Very Good
71-89	Good
61-70	Fair
51-60	Poor
0-50	Very insufficient

Source: Purwanto (2010)

Table 2. Criteria for Assessing Learning Outcomes

Value Range	Criteria
$0 - 60$	Needs Guidance
$61 - 70$	Fair
$71 - 80$	Good
$81 - 100$	Very Good

3   Results and Discussion

This classroom action research project consists of two cycles: cycle I and cycle II. Each cycle consists of two sessions covering the planning, implementation, observation, and reflection phases. Cycle II was conducted to improve the results of the first cycle. The assessment of learning outcomes, obtained from test questions and observation sheets that recorded the answers of teachers and students during mathematics teaching, became the data collected in this study. The Realistic Mathematics Education model was used to assess the progress of mathematics learning outcomes based on the results of both cycles

3.1 Results
3.1.1. Teacher Performance Achievement in Cycle I and Cycle II
The way teachers supervise learning activities also shows how well students learn. As shown in the table and graph below, there was an improvement in this aspect from Cycle I to Cycle II:

Table 3. Recapitulation of Teacher Observation in Cycle I and Cycle II

No	Cicle	Teacher Observation Sheet Percentage Score	
		Meeting I	Session II

3123-2043

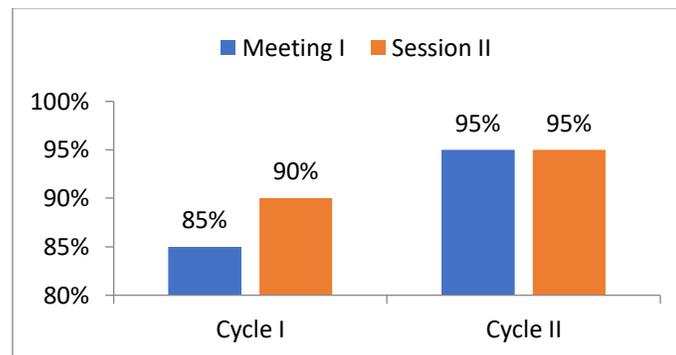| 1 | Cycle I | 85% | 90% |
| 2 | Cycle II | 95% | 95% |

Diagram 2. Teacher Observation in Cycle I and Cycle II

Based on the observation results, "the percentage value of teacher performance in the Mathematics learning process in Grade II increased from Cycle I to Cycle II. In Cycle I, the teacher observation value in the first meeting reached 85%, and increased to 90% in the second meeting, with an average of 87.5%. Furthermore, in Cycle II, the teacher's observation score in both meetings reached 95% with an average of 95%, indicating consistency and improvement in the quality of learning. This data indicates that the implementation of learning in Cycle II was more effective than in Cycle I.

Several key considerations for educators when implementing the Realistic Mathematics Education learning model in teaching include the following: students who grasp the material may become impatient waiting for their peers who have not yet finished, and the tools supporting the learning process should align with the material. Thus, teachers must carefully prepare the material and tools to prevent students from getting bored.

This is in line with the opinion of (Muliyah et al., 2020) that the weaknesses of the *Realistic Mathematics Education* (RME) approach are: (a) it takes longer, especially for students with low initial abilities; (b) students who understand the material more quickly sometimes feel impatient waiting for their friends to complete the task; and (c) the use of teaching aids depends on learning needs and conditions.

3.1.2. Achievement of Student Performance in Cycle I and Cycle II

The observation sheets also show how well the students learned. In this case, the accompanying tables and diagrams show an improvement from cycle I to cycle II:

Table 4. Recapitulation of Student Observation in Cycle I and Cycle II

No	Cicle	Percentage Score of Student Observation Sheets	
		Meeting I	Session II
1	Cycle I	75%	80%
2	Cycle II	90%	95%

Based on the recapitulation data from student observation sheets during the implementation of mathematics learning in Class II, there was an increase in the use of the

Realistic Mathematics Education learning model from Cycle I to Cycle II. At the beginning of Cycle I, the percentage of students observed in the first meeting was 75%, with 15 students having completed the learning process. This increased to 80% in the second meeting, with 16 students completing the learning process, and an average of 77.5%. Meanwhile, in Cycle II, there was a more significant increase, with the first meeting reaching 90% completion, as 18 students completed the learning process. The second meeting reached 95% completion, with 19 students completing the learning process, resulting in an average of 92.5% achieved. This increase indicates that educators have made improvements in the learning process, encompassing planning, implementation, observation, and reflection. Overall, the data demonstrate that the improvement efforts undertaken after Cycle I had a positive impact on the quality of learning and its implementation in Cycle II.
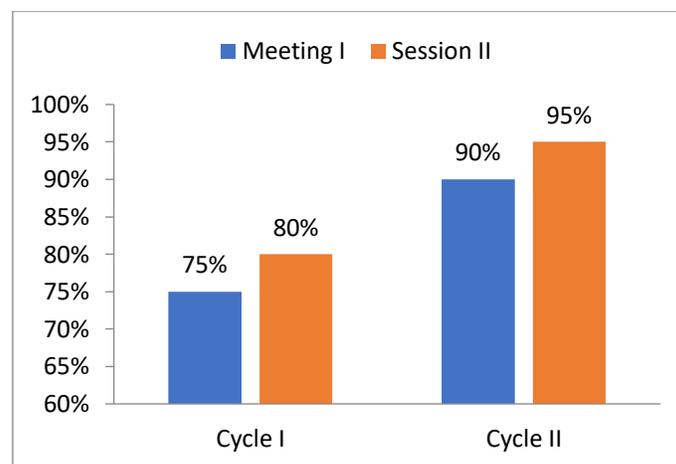

Diagram 3. Student Observation in Cycle I and Cycle II

These results suggest that the application of the *Realistic Mathematics Education* learning model has improved the learning process of students, led to changes in student behavior, and increased interest in learning by using real objects. Realistic Mathematics Education (RME), according to Muah (2022), is an effective strategy for improving mathematics learning outcomes because it provides students with opportunities to experience an understanding of mathematical concepts directly.

The learning process becomes apparent when there is a change in a child's behaviour compared to before. This is because learning is a series of processes aimed at improving the cognitive, emotional, and psychomotor aspects of students (Herawati, 2018). In line with this, improvements in the mathematics learning process can be achieved through the application of the *Realistic Mathematics Education* learning model, which emphasises the connection between mathematics material and real life, thereby encouraging a deeper and more meaningful understanding of concepts among learners.

3.2 Discussion

Student learning outcomes are the academic achievements obtained through various evaluations, such as tests, assignments, and active participation in question-and-answer sessions and responses, which support them in achieving learning objectives (Dakhi, 2020). Learning

outcomes refer to the skills acquired by students after completing an activity, including improvements in the cognitive, affective, and psychomotor domains. Learning outcomes can generally be categorized into three main aspects: cognitive, emotional, and psychomotor (Soraya, 2022).

The learning outcome data indicate that 12 students in Cycle I met the Learning Objective Achievement Criteria (KKTP) at a rate of 60%. The number of students who achieved KKTP increased to 18, or 90%, in Cycle II, indicating a significant improvement. This improvement shows that the learning process has improved, which is beneficial for student learning outcomes. The average test scores of students are summarised in the following table and diagram.

Table 5. Recapitulation of the Percentage of Learning Outcome Tests for Grade II Students in Mathematics Learning in Cycle I and Cycle II

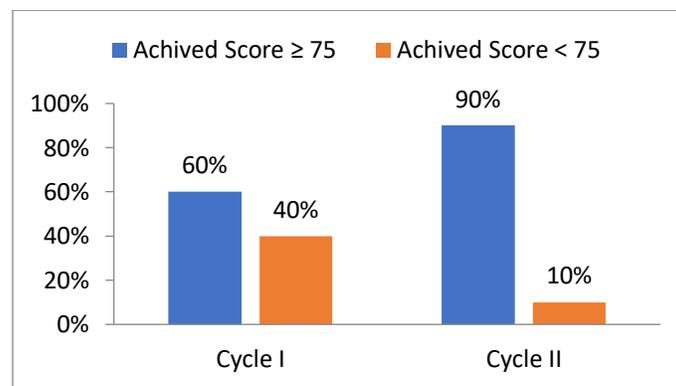| No	Cicle	Achieved Score ≥ 75	Achieved Score < 75
1	Cycle I	60%	40%
2	Cycle II	90%	10%

Diagram 4. Learning Outcome Tests for Students in Mathematics Learning in Cycle I and Cycle II

The table and diagram indicate that there was an increase in student learning outcomes from Cycle I (60%) to Cycle II (90%) when using the *Realistic Mathematics Education* learning model. This indicates that test questions using this learning model make it easier for students to understand the material. In line with Husna (2022), "The advantages of the *Realistic Mathematics Education* learning model are: (1) it makes the mathematics learning process more interesting, relevant, concrete, meaningful, and flexible; (2) it pays attention to the level of student understanding in learning; (3) emphasising learning based on direct experience or practice; (4) simplifying the solution of mathematical problems by providing algorithms or steps that are easier to understand; and (5) utilising real contexts as an introduction to mathematics learning".

Based on these results, there were two students whose learning test results did not reach the KKTP. From the analysis of the observation sheets with the Year 2 teacher, several factors caused these students' learning test results not to reach the KKTP, namely: 1) the students' focus was easily distracted; 2) the students were slow to absorb the learning material; and 3) active students easily became bored. To overcome this, a special approach is needed for these

students. First, the teacher can take an individual approach, giving more attention to each student, and a remedial approach, where the teacher repeats lessons that students have not understood.

Learning outcomes are essentially behavioural changes brought about by the learning process. Improvements in knowledge, understanding, skills, and attitudes are examples of such improvements and are usually measured using letters or numbers according to predetermined criteria. The degree of students' understanding of the material presented by teachers during the classroom learning process is also reflected in their learning outcomes (Irawati et al., 2021).

4   Conclusions

The following conclusions were drawn by researchers based on their study of improvements in the mathematics learning process and outcomes among Year 2 students at SDN 205/II Bangun Harjo using the Realistic Mathematics Education learning model: 1) The learning process improved, as seen in the observation sheets for cycle I and cycle II. The teacher's process observation sheet yielded a good category score of 87.5% in Cycle I and an excellent category score of 95% in Cycle II. The results of the student learning process assessment, as recorded on the observation sheet, showed a good category of 77% in cycle I and increased to 92.5% in cycle II. Teachers' opinions on the implementation of mathematics learning using the *Realistic Mathematics Education* model were positive. This model can enhance students' understanding of the material and increase their engagement with it. The learning model can be applied in higher grades, where students easily understand the material, learning is more enjoyable, and students are more active. There are weaknesses in the application of the model, such as when the teacher is unable or lacks control of the class, which can lead to disruption in the classroom; and 2) The learning outcomes of students in mathematics learning using the *Realistic Mathematics Education* learning model in grade II of SDN 205/II Bangun Harjo increased from cycle I to cycle II. In cycle I, the percentage of student learning outcomes reached 60% in the incomplete category, then increased to 90% in the complete category in cycle II. From the research results, it is recommended to use the *Realistic Mathematics Education* learning model in the learning process because: 1) For students, it is expected to improve their thinking skills and learning outcomes; 2) For educators, it will broaden their knowledge of classroom tasks, especially in using models in learning; and 3) For schools, it can be used by the research institution as a reference for learning in class II of SDN 205/II Bangun Harjo, so that improves the quality of learning.

5   References

Dakhi, A. S. (2020). Peningkatan Hasil Belajar Siswa. *Jurnal Pendidikan Indonesia*, *8*(2), 468–470. https://journal.ipts.ac.id/index.php/ED/article/view/1758

Gusteti, M. U. ., & Neviyarni, N. (2022). Pembelajaran Berdiferensiasi Pada Pembelajaran Matematika di Kurikulum Merdeka. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, *3*(3), 636-646. https://doi.org/10.46306/lb.v3i3.18

Herawati, H. (2018). Memahami Proses Belajar Anak. *Bunayya : Jurnal Pendidikan Anak*, *4*(1), 27–48. http://dx.doi.org/10.22373/bunayya.v4i1.4515

Husna, Amirotul. (2022) *Pengembangan e-modul realistic mathematics education dalam pembelajaran matematika berbasis literasi numerasi.* Undergraduate thesis, Universitas Islam Negeri Maulana Malik Ibrahim. http://etheses.uin-malang.ac.id/41057/

Irawati, I., Ilhamdi, M. L., & Nasruddin, N. (2021). Pengaruh Gaya Belajar Terhadap Hasil Belajar IPA. *Jurnal Pijar Mipa*, *16*(1), 44–48. https://doi.org/10.29303/jpm.v16i1.2202

Muah, T. (2022). Penerapan Pendekatan Pembelajaran Realistic Mathematics Education ({RME}) untuk Meningkatkan Hasil Belajar Matematika Materi Segiempat. *Paedagogia*, *25*(2), 132. https://doi.org/10.20961/paedagogia.v25i2.64545

Pristiwanti, D., Badariah, B., Hidayat, S., & Dewi, R. S. (2022). Pengertian Pendidikan. *Jurnal Pendidikan Dan Konseling (JPDK)*, *4*(6), 7911–7915. https://doi.org/10.31004/jpdk.v4i6.9498

Purnomo, J. (2015). Pendidikan Kecakapan Hidup (PHK) Pada Pembelajaran Matematika Untuk Meningkatkan Kecakapan Personal dan Kecakapan Sosial Serta Prestasi Belajar Siswa SMA. *Pedagogia : Jurnal Pendidikan*, *4*(1), 75–80. https://doi.org/10.21070/pedagogia.v4i1.75

Rabani, T. I., Dalimunthe, R., Yani, D. A., Nisa, A. N., Amanda, A. S., & Bangun, I. S. (2024). Analisis Sikap Siswa Terhadap Pembelajaran Matematika di SD Negeri 106224 Desa Kerapuh. Al-*Furqan: Jurnal Agama, Sosial, dan Budaya*, *3*(1), 1–23. https://publisherqu.com/index.php/Al-Furqan/article/view/810

Sari, A., & Yuniati, S. (2018). Penerapan Pendekatan Realistic Mathematics Education (RME) Terhadap Kemampuan Pemahaman Konsep Matematis. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *2*(2), 71–80. https://doi.org/10.31004/cendekia.v2i2.49

Wati, E. D. R., Sari, E. F., & Sismulyasih Sb, N. (2020). Keefektifan Model Realistic Mathematics Education Berbantuan Media Dakon Terhadap Hasil Belajar Perkalian. *Joyful Learning Journal*, *9*(1), 1–5. https://doi.org/10.15294/JLJ.V9I1.39114

Wijayanti, A., & Yanto, A. (2023). Pembelajaran Matematika Menyenangkan di SD Melalui Permainan. *Polinomial : Jurnal Pendidikan Matematika*, *2*(1), 18–23. https://doi.org/10.56916/jp.v2i1.316

Wulandari, R. (2021). Realistic Mathematics Education (RME) As Alternative Approach In Mathematics Learning. *Social, Humanities, and Educational Studies (SHEs): Conference Series*, *4*(6), 638–643. https://doi.org/10.20961/shes.v4i6.68513

Corresponding author

Sila Hastutik can be contacted at: SilaHastutik21@gmail.com