



Development of Indonesian Realistic Mathematics Education-Based Student Worksheets to Measure Students' Mathematical Problem-Solving Abilities

Rani Refianti¹, Maria Luthfiana², Idul Adha³

^{1,2,3}Universitas PGRI SILAMPARI, Indonesia.

E-mail*: ranirefianti834@gmail.com

Abstract

The design and creation of student worksheets based on the Indonesian Realistic Mathematics Education approach is the primary focus of this research. The goal is for these worksheets to meet the requirements of usability, validity, and efficacy for improving junior high school students' mathematical problem-solving abilities. The chronological framework employed in this study follows the ADDIE model, specifically targeting seventh-grade students and addressing linear equations with two variables. The validity of the developed product was assessed by experts in the fields of language, Material, and media, resulting in Aiken's V coefficients of 0.69, 0.73, and 0.70, respectively. These coefficients indicate that the worksheets are considered valid as per expert evaluations. To measure practicality, feedback was collected from both teachers and students via response questionnaires. The results indicated a high level of practicality, with 80% of teachers and a notable 80.05% of students expressing positive responses. Overall, these findings suggest that the developed worksheets are appropriate for classroom implementation and have the potential to support effective mathematics learning.

Keywords: Indonesian realistic mathematics education; linear equations of two variables; mathematical problem-solving ability



INTRODUCTION

The ability to solve mathematical problems is one of the fundamental competencies required by students in learning mathematics, serving to develop relevant skills in the 21st century (Helmon & Sennen, 2020; Szabo et al., 2020; Ting et al., 2023). This skill not only requires an understanding of mathematical concepts but also hones students' critical and creative thinking skills and relates knowledge to everyday life contexts (Luritawaty et al., 2022; Maslihah et al., 2020; Rahma et al., 2023; Uyen et al., 2020; Widodo et al., 2023). Mathematics must not, however, be understood to be only that set of formulas or processes, but to think, to think logically and critically, analytically and creatively too. Students' low ability to solve mathematical problems is a significant concern in education. International assessments such as TIMSS and PISA show that many students struggle to solve mathematical problems that require problem-solving. Among the causes of this are incomplete understanding of the problems, a lack of conceptual understanding, and the use of problem-solving strategies. According to Polya (1973), problem solving has four large steps: (1) understanding the problem, (2) making up a plan, (3) executing the plan, and (4) reviewing the answers. The stages will require students to actively participate in understanding the concepts, relating them to previously learned concepts, and applying them to various real-life situations. In reality, however, the achievement of the Indonesian learners in the solving of mathematical problems is very low, which in part is connected to the teaching methods that place greater emphasis on procedural chores and memorization than on substantive problem-solving (Jayantika et al., 2024; Sugita et al., 2024; Sumarni et al., 2025).

Hafizah et al. (2025) depict that low skills in mathematical problem-solving are a common issue across all levels of education. This is evidenced by students' limited understanding of basic concepts, their failure to apply formulas, and their inability to develop systematic problem-solving strategies. The population of internal/external variables that lead to this low level of skill is rather large. The internal causes refer to the students with their lack of interest and motivation towards mathematics, whereas the external causes are related to the poor learning environment and the inefficient teaching methods (Bahri et al., 2025; Pebrianti et al., 2023). Besides, students are less likely to have difficulties in situating problems, combining appropriate mathematical ideas, and applying the correct formula. The reports show that the poor problem-solving concept in mathematics is attributed to misunderstandings of the simplest concepts, a lack of depth in the practice, and other learning habits of learners (Rochsun et al., 2024). Not just that, most of the students demonstrate low achievement in problem solving, which is further divided into many sections, and would rather be engaged in some form of problem at a well-organized stage of the solution (Melindarwati & Munandar, 2022).

Research in Indonesia has also shown that students have poor problem-solving ability. As Amanda & Ruli (2022) remarkably, the competence criteria of problem solving are proven by only a small number of JHS students, and it means that the number of mathematical problem-solving skills possessed by them remains lower. Similarly, Ratnasari & TLS (2022) found that sixth-grade students experienced significant losses in solving non-routine mathematical problems, including difficulty understanding problem statements and transforming word problems into mathematical expressions. The lack of effective strategies also made it difficult for students to implement their problem-solving plans, often leading to computational errors and incorrect formulations. These results can be compared with the results received by Fauziah et al. (2022), which had an average score of 5.47 on mathematical problem solving. Some instructional strategies were attributed to this underperformance, which persists with orientation in memorization and procedure work that fails to accord the student sufficient opportunity to engage in critical and creative thinking (Mulyati et al., 2024; Yulianti, 2021). Additionally, as mentioned by Heldawati et al. (2024), another of the most effective ways to develop the capacity in students to solve mathematical problems is by getting acquainted with the strategies that can be associated with the real-life activities. Math concepts are not visual or tangible, and thus, students often struggle to perceive them purely procedurally. Therefore, the teachers are advised to adopt a contextual learning approach where the students can understand how mathematics can be applied in life (Amalia et al., 2024).

According to some literature reviews, implementing the RME approach would be effective in enhancing students' critical thinking, encouraging creativity, and developing communication skills.

Moreover, Purnamasari et al. (2023) reported that Realistic Mathematics Education made a substantial positive contribution to problem-solving in junior high school learners. In light of this, Anugrahana & Pamekas (2024) found that applying the Realistic Mathematics Education method would be effective in improving students' learning performance.

Another method of teaching mathematics, found in the Indonesian RME approach, uses the real world as a jumping-off point for learning various mathematical rules. The Indonesian realistic mathematics education facilitates the rediscovery of abstract skills in a more significant way on the part of the learners by using contexts that are much closer to the everyday life of the students (Aprilia & Zuliana, 2025; Hapsari et al., 2024). Consequently, learners not only acquire an opportunity to know the computational steps but also to think creatively and critically, and create and solve mathematical problems (Sulasih et al., 2022). Indonesian RME approach emphasizes real-life scenarios as the primary context of learning, and is also similar to the problem-solving stages outlined by Polya (1973) (Domu & Mangelep, 2020; Hapsari et al., 2024; Septimiranti & Hiltrimartin, 2022). Through Indonesian realistic mathematics education, learners are taught to perceive problems, use contextual tasks to correspond to real-world situations, create mathematical models, use a discovery-and-discussion approach, and check their answers through reflection. To implement this strategy effectively, the right learning materials will be required. One of the most strategic tools could be the student worksheet, as it provides learning instructions, organizes activities, discusses problems in context, and allows students to address all points, covering their strategies and solutions. This design allows independence and builds confidence in students (Idayanti et al., 2024; Nafisa et al., 2025; Simangunsong et al., 2024). There are various perspectives on how the combination of real-life approaches to mathematics tuition and methods of problem solving in Indonesian student work sheets might be. Mathematics education using student worksheets designed for an Indonesian context helps students address contextual challenges more effectively, as they are already familiar with the content. It also activates the strategies of discovery: doing things in bits, at one end, concrete representations, then mathematical models, and then formal symbols. In addition, the student worksheet provides opportunities to talk and cooperate, as it is designed for group work, which aligns with Indonesian realistic mathematics learning, with its emphasis on the social learning process. The questions also train students in developing reflective abilities to compare responses, draw conclusions, and rewrite steps to the answer (Arti et al., 2023).

The implementation of the Indonesian realistic mathematics education approach has faced several challenges, including teachers' difficulty creating realistic, practically connected settings for the mathematical concepts being taught, constraints on classroom time, and students' inability to extrapolate from real-world situations to formal mathematical forms. This alone is problematic as far as making Indonesian RME-based student worksheets is concerned (Lasti et al., 2025).

In this way, student problem-solving, creativity, and critical thinking capacity can be developed based on learning Indonesian mathematics via the construction of student worksheets (Rawani et al., 2024). Examples of applying mathematical concepts to real-world contexts: The realistic mathematics teaching approach in Indonesia not only improves numeracy literacy but also allows students to form knowledge of the real world directly rather than indirectly, thereby establishing general knowledge of mathematics. Indonesia's RME method improves students' knowledge and competence by connecting math instruction to real-life applications. The strategy helps students personalize their mathematical knowledge, which would be relevant to develop more profound knowledge, depending on the contextual and constructivist nature of the learning setting (Aprilia & Zuliana, 2025). Including the students in real-world problems, developing a high-quality of thinking, developing a more preferred construction of meaning in the mathematical concepts, and developing a better learning of mathematical concepts are solutions to an effective learning of mathematics (Putra & Purnomo, 2023). This paper aims to design a student worksheet that is realistic, valid, and functional for JHS students' capacity to solve mathematical problems.

METHOD

To measure students' mathematics skills, the study applied the ADDIE development model as a systematic approach to developing worksheets based on Indonesian RME. The development stages

mean the framework suggested by F. Hidayat et al. (2023) where the validation and product trials are in the central position to verify the quality and applicability of the instructional media to learning requirements, according to Kamalia et al. (2022), this is supported by the idea that the ADDIE model emphasizes validation and testing of products based on the needs of education. Moreover, this research employed both quantitative and qualitative methods. The quantitative part was completed through expert validation (media and content), response questionnaires, and problem-solving ability tests, and the qualitative part was based on descriptive analysis of students' answers and the implementation of a product. The steps of the development model of ADDIE were developed by Hidayat et al. (2023) The following:

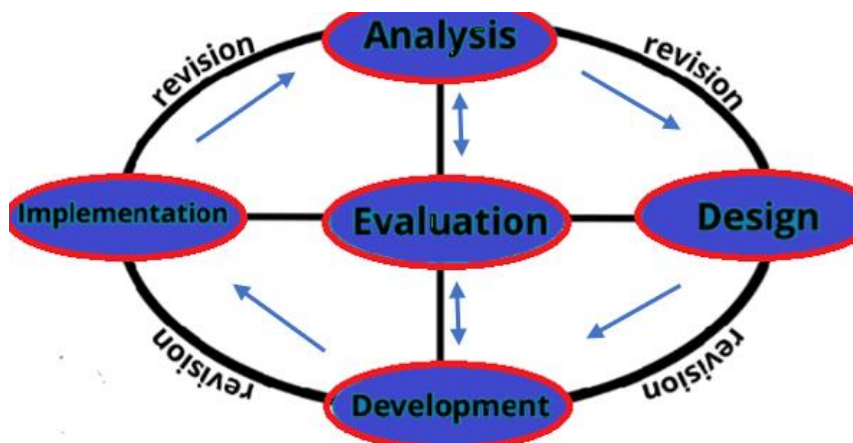


Figure 1. Research Procedure Flowchart of the ADDIE Model

The ADDIE development paradigm includes five core stages: Analysis, Design, Development, Implementation, and Evaluation (Dilaines et al., 2024). During the analysis phase, those three main tasks are done: curriculum analysis, needs analysis, and student characteristics analysis. To understand the classroom learning environment, researchers conducted interviews with the subject's teachers as part of the needs analysis. The information gathered included the learning model applied, the media used, challenges among teachers and students, and what teachers expect from the learning materials to be developed. Results obtained in this phase identified discrepancies between real and ideal conditions for learning practice and provided grounds for formulating appropriate solutions.

The design stage included several significant activities, such as formulating learning objectives and instructional strategies, designing instructional media or products, preparing learning materials, developing assessment instruments, and drafting the product to be developed. The Development phase involved creating the first item in accordance with the design, conducting expert testing, running small-scale tests, and making modifications to the item based on suggestions from the validator and trial outcomes. The major objective of the implementation stage is to apply the developed product in a real school classroom. At this stage, the product is used in the learning process, and information on its feasibility, effectiveness, and teacher and student responses is gathered. The key aim of this phase is to analyze the extent to which the product reinforces the learning goals achieved. The last stage of the ADDIE model is the Evaluation stage, which assesses the product's overall quality and effectiveness. Assessment was conducted in two ways: formative assessment, undertaken at every stage of development to continually improve the product, and summative assessment, conducted at the end of the implementation process to evaluate the product's effectiveness, viability, and feasibility. The analysis findings served as the foundation for recommendations and optimizations. Three validators (language expert, content expert, and media expert) were involved in assessing the validity of the student worksheet. The validity of the language, media, and content formula applied was the V of Aiken, as shown below:

$$V = \frac{\sum S}{[n(c-1)]} \text{ (Azwar, 2012)} \quad \dots (1)$$

with the following notations:

- V = validity coefficient,
- $S = r - l_0$
- r = score given by each validator,
- l_0 = the lowest score of the rating scale,
- c = the highest score of the rating scale,
- n = number of items assessed.

Next, change Aiken's V value into a qualitative value according to the conversion guidelines in Table 1.

Table 1. Aiken's V Value Conversion Guidelines

Score	Category
$0.8 < V \leq 0.1$	Very Valid
$0.6 < V \leq 0.8$	Valid
$0.4 < V \leq 0.6$	Quite Valid
$0.2 < V \leq 0.4$	Less Valid
$0 < V < 0.2$	Very Less Valid

Student worksheets from response questionnaires were evaluated not only for validity but also for usability. The following formula was then used to determine the level of practicality:

$$\frac{\sum X}{N} \times 100\% \quad \dots (2)$$

Next, the results of the practicality percentage are classified according to Table 2:

Table 2. Practicality Assessment Criteria

Percentage	Category
$p \geq 80$	Very Practical
$60 \leq p < 80$	Practical
$40 \leq p < 60$	Fairly Practical
$20 \leq p < 40$	Less Practical
$p < 20$	Impractical

Using pretests and posttests, students' mathematical problem-solving skills were evaluated to gauge how well their worksheets worked. Improvements in these skills were then assessed using:

$$N-Gain = \frac{\text{skor posttest} - \text{skor pretest}}{\text{skor maksimal} - \text{skor pretest}} \quad \dots (3)$$

Next, the N-Gain score criteria are classified in Table 3 or by using categories in the form:

Table 3. Interpretation Criteria for N-gain Values

Percentage	Category
$g > 0.7$	High
$0.3 < g \leq 0.7$	Moderate
$g \leq 0.3$	Low

The assessment criteria, which appear in Table 4 below, are used to measure how effective the worksheets that have been created are:

Table 4. N-gain Effectiveness Category

Percentage	Category
$40 \leq N - Gain < 55$	Less Effective
$55 \leq N - Gain < 75$	Fairly Effective
$N - Gain \geq 75$	Effective

(Rahmi et al., 2021)

RESULTS

Analysis

The three main procedures in the ADDIE model's analysis phase are curriculum analysis, needs analysis, and student characteristics analysis. Based on the needs analysis, students tend to be passive in their responses to math problems, the use of student workbooks remains minimal, and the lecture method still dominates the learning process. In the curriculum analysis, PLDV was selected because it aligns with the current Core and Basic Competencies and remains highly relevant to real-life contexts. In the student characteristics analysis, it was identified that seventh-grade students (aged 12–13 years) are generally at the early stage of formal operational thinking. Although they are beginning to develop the ability for abstract reasoning, they still require support through concrete representations. Consequently, an Indonesian realistic mathematics education-based student worksheet that presents contextual problems in a gradual progression from concrete to abstract was considered suitable for the students' cognitive development. In addition, it was found through interviews with mathematics professors that students often have difficulty converting word problems into mathematical models and using appropriate solution techniques for PLDV systems.

Design

The design stage of the ADDIE development model produced several key components that served as the foundation for developing the Indonesian realistic mathematics education based student worksheet, namely: (1) Learning objectives are made in line with Core Competencies, Basic Competencies and competency indicators on the PLDV system topic (2) The student worksheet framework, which includes the cover page, user guidelines, learning objectives, Indonesian realistic mathematics education based core activities, and practice exercises. (3) The design of the Indonesian realistic mathematics education-based learning syntax, consisting of contextual problem presentation, mathematical modeling, symbolic solution, and reflection. (4) The research instruments used were expert validation sheets, student and teacher response questionnaires, and a number of mathematics test questions (pre-test and post-test). (5) The student worksheet layout design, encompassing visual design, contextual illustrations, and an engaging format tailored to students' characteristics.

Development

At the development stage, the Indonesian realistic mathematics education-based student worksheet product that had been previously designed was realized and validated. The outcomes of this stage include: (1) the initial draft of the Indonesian realistic mathematics education -based student worksheet was completed in accordance with the predetermined framework and design; (2) the student worksheet was validated by subject media experts, matter experts, and language experts, with the results indicating that the student worksheet fell into the valid category and was therefore feasible for trial implementation; and (3) Product revisions are carried out in line with the suggestions from the validator, covering aspects of content, language, and presentation. The changes led to the ultimate draft of the student worksheet that was more appropriate for field testing. The constructed student working paper is shown in the following format :

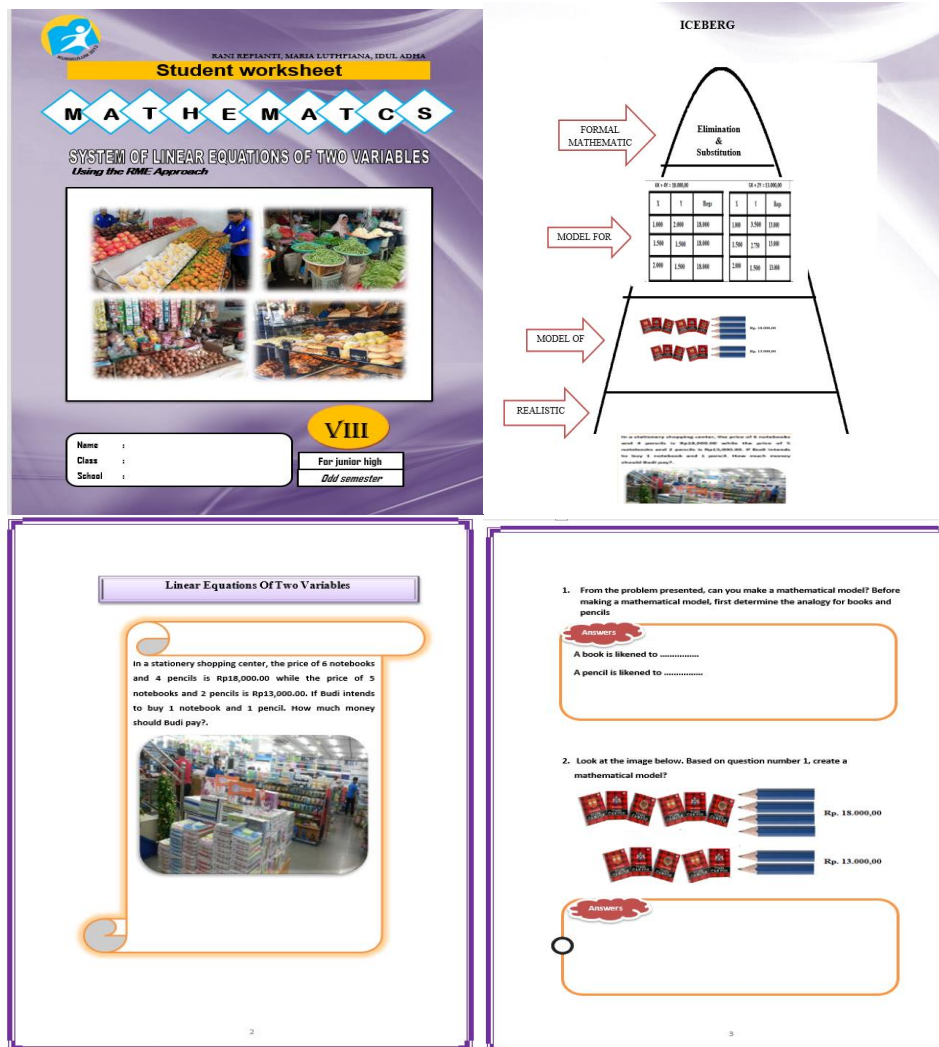


Figure 2. Student worksheet

The first student worksheet was then validated by the subject matter experts, language experts, and media experts to check its validity. A summary of the validation results of the experts is given in Table 5:

Table 5. Recapitulation of validation assessment

Number	Validator skor	Aiken's V
1	Matter Expert	0,73
2	Media Expert	0,70
3	Language Expert	0,69

According to the recapitulation table of validation tests, the V index of the material expert Aiken was 0.73, and it can be classified as valid. The media expert generated an Aiken V index of 0.70, which is also valid, and the language expert generated an Aiken V index of 0.69, which is also valid. These findings demonstrate that the finalized student worksheet can be said to comply with the requirements of validity and can be deemed as viable to be used with revisions, considering the recommendations that were given by the validators.

Implementation

The student worksheets were tested in small groups and large groups with respect to the Indonesian RME developed at the implementation phase. Questionnaires on teacher and student feedback were distributed during this stage in order to make sure that the student worksheets were usable. The results of the small-group trial with 80.05 pointed out that the student work sheets were rated *very practical*. In the same way, the teacher response questionnaire revealed that the student worksheet was also rated as *very practical* with a percentage score of 80.

Evaluation

The next step after the classroom learning process was evaluation. This step was to not only measure the attainment of learning competencies by the students and the effectiveness of the student worksheet, which is an Indonesian RME-based worksheet, but also to improve the math skills of the students. The evaluation involved two elements, which include: (1) formative evaluation, which was done by way of questionnaires containing teacher and student responses, and (2) summative evaluation, which was carried out by analysing the results of the students before and after the test. The teacher practicality questionnaire had shown that the student worksheet developed was in the very practical category with a percentage score of 80%. In the same way, the student practicality questionnaire has also indicated that the student worksheet was also rated *as very practical*, with a percentage of 80.05%.

The pretest and posttest results were made to allow the determination of differences in student learning outcomes at the pretest and posttest in order to evaluate the effectiveness of the student work form based on the Indonesian RME that had been developed with the aim of enhancing the mathematical performance of the students. Also, student response questionnaires that were given to 28 participants showed a good response of 81.95. The level of effectiveness based on the normalized gain score was 64.41% and was categorized as moderately effective.

DISCUSSION

An Indonesian RME is based on a pedagogical approach called Realistic Mathematics Education (RME), which focuses on the application of real-life situations as an initial point of learning mathematics. In such a way, students will be motivated to build knowledge through horizontal and vertical mathematization (Gravemeijer & Doorman, 1999; Lintong & Andries, 2022). Indonesian realistic mathematics education is based on meaningful learning because, in addition to being introduced into the world of abstract concepts, students are also instructed to connect them with their daily experiences. Consequently, this strategy encourages inquisitiveness, participation, and the acquisition of skills by the students in interpreting and solving mathematics problems.

Practically, student worksheets serve as a significant learning instrument that enhances concept discovery by means of context-based problem-solving tasks. The worksheet of Indonesian RME-based students is specially created to provide real-life problems, elicit a discussion, and develop the reflective skills of the students in a gradual pattern of moving towards concrete representations to abstract symbolic solutions (Arti et al., 2023; Fitriani et al., 2024; Mayangsari & Sukasno, 2024). This shows that the Indonesian RME method is a valuable method of assessing the mathematical problem-solving of students by involving them in real-life scenarios, and, therefore, students are able to build on their conceptual knowledge through social interaction. (Jayantika et al., 2024; Kurniawan et al., 2020).

The design of the Indonesian RME-based student form was carried out in a consecutive manner with the application of the developed ADDIE model or 4-D development model, with focus on the validity, practicality, and effectiveness. Concerning the validity, the evaluation conducted by 3 experts, that is, media, material, and language experts, revealed that the Indonesian RME-based student form met the predetermined validity criteria. The subject matter expert validation tool was composed of 20 questions, which evaluated the content feasibility, the quality of presentation, the mathematical capability of the students, and the compatibility of the instrument with the Indonesian RME principles. According to the evaluation of the material experts, the value of the developed learning media, $V = 0.73$, falls under the valid category. This observation shows that the RME principles, like the use of real contexts, modeling, and interactivity, have been effectively applied in the learning media. The developed student worksheet was classified as valid with an Aiken V value of 0.73, which is

based on the validation findings of the material expert, which means that the developed worksheet can be used after revision as recommended by the validator. In the meantime, the media expert validation sheet was composed of 24 items of assessment, including the elements of design appearance, ease of use, consistency, usefulness, and graphical quality. According to the validation findings of the media expert, the developed student work form is rated as being valid in relation to Aiken's V value, which is 0.70, whereby it can be tested after revision in line with the recommendations given. Moreover, the language expert validation sheet was based on 12 evaluation items, which covered the dimensions of clarity, communicativeness, and correspondence to linguistic rules. In accordance with the validation results of the language expert, the created student worksheet was classified as valid with an Aiken V of 0.69, which means that it is possible to be tested post-revisions based on the recommendations made. From the practicality, the findings of the small trial established that teachers and students were responsive to the application of the Indonesian RME-based student form. According to teachers, the worksheet given to students was practical since the instructions were coherently presented in a step-by-step manner, easy to incorporate into the lesson plan, and effective in classroom discussions. In the meantime, students were also able to find it useful because it contained clear instructions, a pleasant design, and the Indonesian RME approach, which facilitated easier cognition of the material. The general outcome of teacher and student practicality tests (small group trial) can be seen in Table 6:

Table 6. Overall Analysis Results of the Practicality Questionnaire

Number	Assesor	Number of Statements	Score Obtained	Maximum Score	Percentage
1	Teacher response	14	48	60	80%
2	Small group	15	269	336	80.05%

From the results of the practicality analysis, the questionnaire distributed to teachers achieved a percentage score of 80%, which falls into the category of *highly practical*. Meanwhile, the student practicality questionnaire in the small-group trial achieved a percentage score of 80.05%, which is also categorized as *highly practical*. In terms of effectiveness, the student worksheet was evaluated through students' mathematical test results and student response questionnaires in the large-group trial. The large-group implementation involved 28 students, each of whom was given four questions designed to assess mathematical skills, with a maximum total score of 16 points.

Table 7. Recapitulation of the results of students' mathematical problem-solving abilities

Number	Component	Average Value
1	Pretest score	5.36
2	Posttest score	12.21
3	N-Gain	0.64
4	Percentage Increase	64.41%

The analysis was conducted, and the N-Gain score was derived at 0.64 and is considered to be a moderate improvement with an average percentage of 64.41. This score is ranked as *fairly effective* according to the effectiveness criteria. These results show that there was an increase in the abilities of the students between pretest and posttest, and so the student worksheet developed positively influenced the students' mathematical abilities. This finding proves that despite the effectiveness being rated as *fairly effective*, the student worksheet based on the Indonesian RME still plays a positive role in improving the abilities of the students. Moreover, the mean student response questionnaire score of 28 participants amounted to 75 per cent, which can be classified as positive. Therefore, it can be concluded that the use of the developed Indonesian RME-based student worksheet was well received by the students.

CONCLUSION

This paper demonstrates that the resulting worksheet has passed the test of being considered valid, useful, and effective in enhancing the ability of students to solve mathematical problems. With Aiken's V values of 0.73 from material experts, 0.70 from media experts, and 0.69 from language experts, all of which fall into the valid category, the validation results indicate that the worksheet has a good level of validity. This indicates that the product is suitable for use in the learning process. In terms of practicality, the trial results show that teachers gave a score of 80% and students 80.5%, both of which are classified as very practical. At an N-Gain value of 0.64 (medium category), the results of the effectiveness test show that the use of form improves students' problem-solving skills and an average effectiveness of 64.41% (quite effective category). In addition, student responses to the worksheet reached 81.95% with a very positive category, which confirms that the developed worksheet is not only valid, practical, and effective, but also well-received by both teachers and students.

ACKNOWLEDGMENTS

The author gives his appreciation and thanks to the Mathematics Education Study Program, PGRI Silampari University, for all the support, assistance, and facilities provided during this research process. This support from various parties significantly contributed to the smooth running and success of this research.

DECLARATIONS

- Author Contribution : Rani Refianti: Writing - Original Draft, Writing - Review & Editing, and visualizing;
Maria Luthfiana: Writing - Review & Editing, formal analysis, and methodology;
Idul Adha: validation, and supervision.
- Funding Statement : This research was funded by Universitas PGRI Silampari Lubuklinggau for supporting and funding this research.
- Conflict of Interest : The authors declare no conflict of interest.
- AI Use Statement : We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.
- Additional Information : Additional information is available for this paper.”

REFERENCES

- Amalia, L., Makmuri, M., & Hakim, L. El. (2024). Learning Design: To Improve Mathematical Problem-Solving Skills Using a Contextual Approach. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, 7(3), 2353–2366. <https://doi.org/10.54371/jiip.v7i3.3455>
- Amanda, I. R., & Ruli, R. M. (2022). Kemampuan Pemecahan Masalah Matematis Siswa SMP dalam Menyelesaikan Soal Timss Pada Topik Data dan Peluang. *EduMatSains : Jurnal Pendidikan, Matematika Dan Sains*, 6(2), 389–406. <https://doi.org/10.33541/edumatsains.v6i2.3616>
- Anugrahana, A., & Pamekas, Y. (2024). Meta Analysis Of The PMRI (Indonesian Realistic Mathematics Education) Approach To Improving Primary Students Mathematics Learning Outcomes. *Didaktika Tauhidi: Jurnal Pendidikan Guru Sekolah Dasar*, 11(1), 117–130. <https://doi.org/10.30997/dt.v11i1.12712>

- Aprilia, N. D., & Zuliana, E. (2025). Penggunaan PMRI Berbantu Media Jaring-jaring Karakter. *Indo-MathEdu Intellectuals Journal*, 6(1), 826–835. <https://doi.org/10.54373/imeij.v6i1.2535>
- Arti, R. B., Saragih, R. M. B., & Maharani, I. (2023). Pengembangan Student Worksheet Berbasis Model Indonesian Realistic Mathematics Education Terhadap Kemampuan Pemecahan Masalah. *JURNAL MATHEMATIC PAEDAGOGIC*, 7(2), 188–194. <https://doi.org/10.36294/jmp.v7i2.3219>
- Bahri, I., Susiaty, U. D., & Hartono, H. (2025). Analisis Faktor-Faktor yang Mempengaruhi Rendahnya Minat Belajar Matematika Siswa di SMPN 5 Satap Kuala Mandor B. *Indo-MathEdu Intellectuals Journal*, 6(5), 7312–7315. <https://doi.org/10.54373/imeij.v6i5.3886>
- Dilaines, L. E., Astuti, E., & Yusdita, E. E. (2024). Improving Student Learning Outcomes Through Accurate Online Modules with the ADDIE Model. *Journal of Education Technology*, 8(2), 275–286. <https://doi.org/10.23887/jet.v8i2.67576>
- Domu, I., & Mangelep, N. O. (2020). The Development of Students' Learning Material on Arithmetic Sequence Using PMRI Approach. *Proceedings of the International Joint Conference on Science and Engineering (IJCSE 2020)*. <https://doi.org/10.2991/aer.k.201124.076>
- Fauziah, N., Roza, Y., & Maimunah, M. (2022). Kemampuan Matematis Pemecahan Masalah Siswa dalam Penyelesaian Soal Tipe Numerasi AKM. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 6(3), 3241–3250. <https://doi.org/10.31004/cendekia.v6i3.1471>
- Fitriani, L., Refianti, R., & Purwasi, L. A. (2024). Pengembangan LKPD Dengan Pendekatan PMRI pada Materi Persamaan Lingkaran Kelas XI. *FARABI: Jurnal Matematika Dan Pendidikan Matematika*, 7(2), 185–192. <https://doi.org/10.47662/farabi.v7i2.810>
- Gravemeijer, K., & Doorman, M. (1999). Context Problems in Realistic Mathematics Education: A Calculus Course as an Example. *Educational Studies in Mathematics*, 39(1–3), 111–129. <https://doi.org/10.1023/A:1003749919816>
- Hafizah, N., Nurhalimah, S., Utami, W. L., & Angraini, L. M. (2025). Analysis of Problem-Solving Ability of Junior High School Students in A System of Linear Equations With One Variable. *International Journal of Contemporary Studies in Education (IJ-CSE)*, 4(1), 1–14. <https://doi.org/10.56855/ijcse.v4i1.1046>
- Hapsari, Y. D., Nadia, S., & Zuliana, E. (2024). Lintasan Belajar Pengelompokan Data Bagi Siswa Kelas I Sekolah Dasar Menggunakan Pendekatan PMRI. *Populer: Jurnal Penelitian Mahasiswa*, 3(1), 184–197. <https://doi.org/10.58192/populer.v3i1.1907>
- Heldawati, H., Yulianti, D., Nurhanurawati, N., Nurwahidin, M., & Sutiarmo, S. (2024). E-Modules with Realistic Mathematics Education (PMR) Approach to Improve Students' Mathematical Problem Solving Skills. *Jurnal Teknologi Pendidikan: Jurnal Penelitian Dan Pengembangan Pembelajaran*, 9(4), 599. <https://doi.org/10.33394/jtp.v9i4.12651>
- Helmon, A., & Sennen, E. (2020). Pembelajaran Matematika Melalui Pemecahan Masalah: Urgensi dan Penerapannya. *JIPD (Jurnal Inovasi Pendidikan Dasar)*, 4(1), 51–56. <https://doi.org/10.36928/jipd.v4i1.318>
- Hidayat, F., Supratman, S., & Rahayu, D. V. (2023). Pengembangan LKPD Berbasis HOTS Terintegrasi Nilai Keislaman untuk Mengeksplor Kemampuan Literasi Matematis. *Prisma*, 12(2), 535–550.
- Hidayat, W., Rohaeti, E. E., Hamidah, I., & Putri, R. I. I. (2023). How can android-based trigonometry learning improve the math learning process? *Frontiers in Education*, 7. <https://doi.org/10.3389/feduc.2022.1101161>

- Idayanti, Z., Suleman, M. A., & Suhardi, M. (2024). LKPD-Based Learning To Improve Science Learning Outcomes Of Grade IV SD/MI Students. *ACTION: Jurnal Inovasi Penelitian Tindakan Kelas Dan Sekolah*, 4(2), 38–44. <https://doi.org/10.51878/action.v4i2.3835>
- Jayantika, I. G. A. N. T., Kesumawati, N. W. A., & Septiani, N. M. A. (2024). Peningkatan Kemampuan Pemecahan Masalah Siswa Melalui Implementasi Pendekatan PMRI Berbasis Diskusi Kelompok. *SAP (Susunan Artikel Pendidikan)*, 9(2), 192. <https://doi.org/10.30998/sap.v9i2.24526>
- Kurniawan, R., Putri, R. I. I., & Sunaryati, S. (2020). Pemecahan Masalah Matematis Siswa Kelas VIII Menggunakan PMRI melalui LSLC pada Materi Gradien. *Jurnal Elemen*, 6(2), 346–356. <https://doi.org/10.29408/jel.v6i2.2214>
- Lasti, N., Zulkardi, Z., Susanti, E., & Meryansumayeka, M. (2025). Learning Design of Arithmetic Sequence Material Based on PMRI with the Context of the Roof of Banyuasin Traditional House. *Journal of Education and Learning Mathematics Research (JELMaR)*, 6(1), 1–12. <https://doi.org/10.37303/jelmar.v6i1.3811>
- Lintong, A., & Andries, J. (2022). Penggunaan Pembelajaran Matematika Realistik Indonesia (Indonesian Realistic Mathematics Education) Dalam Pembelajaran Materi Persamaan Garis Lurus di SMP Negeri 1 Airmadidi. *Literacy: Jurnal Pendidikan Ekonomi*, 3(1), 150–167. <https://doi.org/10.53682/literacyjpe.v3i1.4084>
- Luritawaty, I. P., Herman, T., & Prabawanto, S. (2022). Analisis Cara Berpikir Kritis Mahasiswa pada Materi Bangun Ruang Sisi Datar. *Mosharafa: Jurnal Pendidikan Matematika*, 11(2), 191–202. <https://doi.org/10.31980/mosharafa.v11i2.698>
- Maslihah, S., Waluya, S. B., Rochmad, & Suyitno, A. (2020). The Role Of Mathematical Literacy To Improve High Order Thinking Skills. *Journal of Physics: Conference Series*, 1539(1), 012085. <https://doi.org/10.1088/1742-6596/1539/1/012085>
- Mayangsari, J., & Sukasno, S. (2024). Pengembangan LKPD Pecahan Berbasis PMRI Menggunakan Konteks Wisata Taman Boreg. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, 6(2), 264–272. <https://doi.org/10.31851/indiktika.v6i2.15084>
- Melindarwati, T., & Munandar, D. R. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMP Dalam Menyelesaikan Materi Bilangan Bulat. *Jurnal THEOREMS (The Original Research of Mathematics)*, 7(1), 13. <https://doi.org/10.31949/th.v7i1.3720>
- Mulyati, Y., 'Ainunnizar, D., Hasan, S., Wicaksono, A., & Ichsan, M. (2024). Enhancing Students' Critical and Creative Thinking Skills Through Problem-Based Learning. *Indonesian Journal of Biology Education*, 7(2), 20–27. <https://doi.org/10.31002/ijobe.v7i2.2069>
- Nafisa, S., Rohadi, M., Ahmad, A., Fadhillah, A., Febrianti Z, M., & Rahmadhar, Y. (2025). Pengembangan Lembar Kerja Peserta Didik (LKPD) Ipaberbasis Model Problem Based Learning (PBL) di Kelas. *Jurnal Padamu Negeri*, 2(1), 19–25. <https://doi.org/10.69714/vrrpc385>
- Pebrianti, A., Usdiyana, D., Dedy, E., & Sudihartinih, E. (2023). Kesulitan Siswa Dalam Menyelesaikan Soal Pemecahan Masalah Ditinjau Dari Kemampuan Awal Matematika Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(3), 3530. <https://doi.org/10.24127/ajpm.v12i3.7400>
- Purnamasari, S., Turmudi, T., & Juandi, D. (2023). Studi Meta-Analisis: Pengaruh Realistic Mathematics Education Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Sekolah Menengah Pertama. *Jurnal Penelitian Dan Pembelajaran Matematika*, 16(2), 202. <https://doi.org/10.30870/jppm.v16i2.21442>

- Putra, D. O. P., & Purnomo, Y. W. (2023). Pengaruh Pendekatan Pendidikan Matematika Realistik Indonesia (Indonesian Realistic Mathematics Education) Terhadap Kemampuan Numerasi Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(1), 512. <https://doi.org/10.24127/ajpm.v12i1.6231>
- Rahma, F. I., Sutadji, E., & Aynin, A. (2023). Urgensi Media Pembelajaran Pada Pembelajaran Matematika Ditinjau Dari Minat Siswa Belajar Matematika / The Urgency of Learning Media in Mathematics Learning in View of Students' Interest in Learning Mathematics. *Journal AL-MUDARRIS*, 6(1), 34–48. <https://doi.org/10.32478/al-mudarris.v6i1.1259>
- Rahmi, F., Iltavia, I., & Zarista, R. H. (2021). Efektivitas Pembelajaran Berorientasi Matematika Realistik untuk Membangun Pemahaman Relasional pada Materi Peluang. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(3), 2869–2877. <https://doi.org/10.31004/cendekia.v5i3.673>
- Ratnasari, R., & TLS, D. S. (2022). Common Difficulties of 8th Grade Students When Solving Non-Routine Problems. *Jurnal Pendidikan MIPA*, 23(1), 67–77. <https://doi.org/10.23960/jpmipa/v23i1.pp67-77>
- Rawani, D., Putri, R. I. I., Zulkardi, & Susanti, E. (2024). *Application of the Indonesian realistic mathematics learning approach (PMRI) using the context of South Sumatera dance to improve numeracy literacy skills*. 020025. <https://doi.org/10.1063/5.0194767>
- Rochsun, R., Yazidah, N. I., Argarini, D. F., & Sulistyorini, Y. (2024). Correlation between Relational Understanding and Cognitive Style on Mathematical Problem Solving Ability. *INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS*, 07(03). <https://doi.org/10.47191/ijmra/v7-i03-26>
- Septimiri, D., & Hiltrimartin, C. (2022). Development of the Pythagorean Theorem Learning Path with the PMRI Approach using the Context of Tiled Tangram. *Proceedings of the 2nd National Conference on Mathematics Education 2021 (NaCoME 2021)*. <https://doi.org/10.2991/assehr.k.220403.010>
- Simangunsong, I. T., Uskenat, K., Damanik, D. P., Simangunsong, I. P., & Purba, A. A. (2024). Improvement of High School Students' Physics Problem Solving Skills Through Problem Based Learning Assisted by LKPD (Student Worksheets). *Lensa: Jurnal Kependidikan Fisika*, 12(2), 275. <https://doi.org/10.33394/j-lkf.v12i2.13544>
- Sugita, G., Nurhayadi, N., & Sukayasa, S. (2024). Ability Reasoning Mathematical Students on Solving Problem. *International Journal of Current Science Research and Review*, 07(12). <https://doi.org/10.47191/ijcsrr/V7-i12-58>
- Sulasih, S., Mufidatik, M., & Fauziah, N. (2022). Literasi Dan Numerasi Pembelajaran Matematika Berbasis Masalah Untuk Mengembangkan Kemampuan Berfikir Kritis Dan Kreatif Siswa. *SIGMA*, 7(2), 151. <https://doi.org/10.36513/sigma.v7i2.1396>
- Sumarni, A., Nurcahyono, N. A., & Setiani, A. (2025). Kemampuan Pemecahan Masalah Matematika Siswa SMP dalam Menyelesaikan Soal Sistem Persamaan Dua Variabel (SPLDV). *Jurnal PEKA (Pendidikan Matematika)*, 8(2), 168–175. <https://doi.org/10.37150/jp.v8i2.3223>
- Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of Problem-Solving Strategies in Mathematics Education Supporting the Sustainability of 21st-Century Skills. *Sustainability*, 12(23), 10113. <https://doi.org/10.3390/su122310113>
- Ting, K. S., Talib, O., Mohd Ayub, A. F., Zolkepli, M., Yee, C. C., & Hoong, T. C. (2023). Word Problems as a Vehicle for Teaching Computational Thinking. *International Journal of Academic*

Research in Progressive Education and Development, 12(1).
<https://doi.org/10.6007/IJARPED/v12-i1/16543>

Uyen, B. P., Tong, D. H., & Yen, L. T. N. (2020). A Case Study of Teaching Real-world Problems Related to Exponential and Logarithmic Equations to Develop Students' Problem-solving Competency. *Universal Journal of Educational Research*, 8(11B), 6152–6165.
<https://doi.org/10.13189/ujer.2020.082252>

Widodo, S., Santia, I., & Katminingsih, Y. (2023). Increasing Students' Mathematical Problem Solving Ability Through Realistic Mathematics Education (RME). *International Journal of Research and Review*, 10(1), 68–76. <https://doi.org/10.52403/ijrr.20230109>

Yulianti, D. (2021). Problem Based Learning Learning Model improve Critical Thinking Ability. *Social, Humanities, and Educational Studies (SHEs): Conference Series*, 3(4), 46.
<https://doi.org/10.20961/shes.v3i4.53250>