JURNAL ABSIS
Jurnal Pendidikan Matematika dan Matematika
Vol. 9 No. 1, April 2026

DEVELOPMENT OF PYTHAGOREAN THEOREM WORKSHEETS BASED ON REALISTIC MATHEMATICS EDUCATION TO FACILITATE STUDENTS' MATHEMATICAL REASONING ABILITY

Maya Aulia Putri[1], *Elfis Suanto[2], Susda Heleni[3]
[1-3] Universitas Riau, Indonesia
elfis.suanto@lecturer.unri.ac.id

ABSTRACT This study was motivated by students' low mathematical reasoning ability, particularly in the geometry topic of the Pythagorean theorem. The 2022 PISA results also indicate that Indonesian students' mathematical performance remains relatively low, partly due to learning practices that emphasize memorization and provide limited non-routine problems that support reasoning. Therefore, this study aimed to develop Pythagorean theorem worksheets based on Realistic Mathematics Education (RME) to facilitate students' mathematical reasoning ability. This research employed a Research and Development (R&D) design using the 4-D development model, consisting of define, design, develop, and disseminate stages. The product was developed for eighth-grade students and was validated by three expert validators. Product trials were conducted through one-to-one evaluation involving three students, a small group trial involving six students, and a field trial involving 34 students at SMPN 8 Pekanbaru. The instruments used were validation sheets and student practicality questionnaires. The results showed that the developed worksheets obtained an average validation score of 4.40, categorized as very valid. The practicality test obtained an average score of 3.48 in the small group trial and 3.48 in the field trial, both categorized as very practical. These findings indicate that the RME-based Pythagorean theorem worksheets are valid and practical for use as teaching materials to facilitate students' mathematical reasoning ability.

Keywords: student worksheets, realistic mathematics education, mathematical reasoning ability, pythagorean theorem

ABSTRAK Penelitian ini dilatarbelakangi oleh rendahnya kemampuan penalaran matematis siswa, khususnya pada materi geometri teorema Pythagoras. Hasil PISA 2022 juga menunjukkan bahwa capaian matematika siswa Indonesia masih relatif rendah, salah satunya disebabkan oleh pembelajaran yang masih menekankan hafalan dan minimnya soal nonrutin yang mendukung penalaran. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan LKPD teorema Pythagoras berbasis *Realistic Mathematics Education* (RME) untuk memfasilitasi kemampuan penalaran matematis siswa. Penelitian ini merupakan penelitian pengembangan dengan model 4-D yang terdiri atas tahap *define*, *design*, *develop*,

dan *disseminate*. Produk dikembangkan untuk siswa kelas VIII dan divalidasi oleh tiga validator ahli. Uji coba produk dilakukan melalui *one-to-one evaluation* yang melibatkan tiga siswa, uji kelompok kecil yang melibatkan enam siswa, dan uji lapangan yang melibatkan 34 siswa di SMPN 8 Pekanbaru. Instrumen yang digunakan berupa lembar validasi dan angket praktikalitas siswa. Hasil penelitian menunjukkan bahwa LKPD yang dikembangkan memperoleh rata-rata skor validasi sebesar 4,40 dengan kategori sangat valid. Hasil uji praktikalitas memperoleh rata-rata skor 3,48 pada uji kelompok kecil dan 3,48 pada uji lapangan, keduanya termasuk kategori sangat praktis. Temuan ini menunjukkan bahwa LKPD teorema Pythagoras berbasis RME valid dan praktis digunakan sebagai bahan ajar untuk memfasilitasi kemampuan penalaran matematis siswa.

Kata-kata kunci: LKPD, *realistic mathematics education*, kemampuan penalaran matematis, teorema pythagoras

INTRODUCTION

Mathematics is one of the essential sciences and holds a vital position in education because it equips students with the ability to think scientifically. According to Sumarmo (2017), fundamental mathematical abilities can be divided into five categories: understanding and using mathematical concepts, procedures, principles, and ideas; mathematical problem solving; mathematical reasoning; mathematical connection; and mathematical communication. Among these abilities, mathematical reasoning is one of the key focuses in mathematics learning. This is in line with Gusnarsi et al. (2017), who stated that mathematical concepts are understood through reasoning, while reasoning ability is developed and mastered through mathematics. Considering the importance of mathematical reasoning, mathematics learning needs to be designed in such a way that students are able to reason about mathematical ideas.

However, students' mathematical reasoning ability is still relatively low. Vebrian et al. (2021) found that students' mathematical reasoning ability was very low in each indicator, including proposing conjectures, performing mathematical manipulation, compiling evidence or providing reasons, and drawing conclusions from statements. Low mathematical reasoning ability can be caused by learning processes that still tend to use conventional teaching models and do not sufficiently emphasize the application of mathematical concepts in real-life situations. This condition may reduce students' motivation to understand mathematics more deeply (Gusnarsi et al., 2017).

To facilitate students' mathematical reasoning ability, teachers need to select learning approaches that are appropriate to the characteristics of the material being taught (Wijayanti et al., 2019). One approach that can be used is Realistic Mathematics Education (RME). RME provides an alternative strategy for developing students' mathematical reasoning ability because it connects mathematics with reality and views mathematics as a human activity. Therefore, mathematics learning should be relevant to students' daily lives and real-world contexts (Yetri et al., 2019). Through the mathematization process, the RME approach can help students reason

https://doi.org/10.30606/absis.v9i1.4129

in solving mathematical problems because its learning steps bridge students' thinking from contextual situations to formal mathematical solutions (Ariati & Juandi, 2022).

One way to support an active mathematics learning process is through the use of teaching materials, such as student worksheets. Student worksheets can help students engage more actively in learning activities and guide them in constructing knowledge (Alfiansyah & Rusmining, 2023). Utami et al. (2020) stated that student worksheets function as learning aids that contain tasks students need to complete in order to develop their understanding and solve mathematical problems. Based on interviews with an eighth-grade mathematics teacher at SMPN 8 Pekanbaru, the learning process still relied mainly on textbooks provided by the school. The observation results also showed that the worksheets used only contained questions and did not include contextual problems. In addition, worksheets that specifically facilitate students' mathematical reasoning ability had not yet been found.

Geometry is one of the mathematical topics that can be used to develop students' mathematical reasoning ability (Elfariana et al., 2024). One geometry topic taught in the Merdeka Curriculum is the Pythagorean theorem, which is generally taught in Grade VIII of junior high school (Kemendikbudristek, 2022). However, the Pythagorean theorem is still considered difficult for students in terms of mathematical reasoning. Ramdan and Roesdiana (2022) found that students still experienced difficulties in reasoning when solving Pythagorean theorem problems. Learning using RME can facilitate students' mathematical reasoning because students are encouraged to be more active, process mathematical ideas, and draw conclusions based on facts.

Several previous studies have shown that RME has a positive contribution to mathematics learning, particularly in supporting students' reasoning and problem-solving processes (Gusnarsi et al., 2017; Yanti et al., 2022; Gunawan & Hadi, 2024). However, student worksheets specifically designed based on RME to facilitate students' mathematical reasoning ability on the Pythagorean theorem topic are still limited. The worksheets used in schools generally do not include contextual problems that support the reasoning process. Previous studies have also tended to examine the effect of RME or develop worksheets in general, without specifically integrating RME into Pythagorean theorem worksheets to facilitate mathematical reasoning ability.

Therefore, this study aims to develop Pythagorean theorem student worksheets based on Realistic Mathematics Education to facilitate the mathematical reasoning ability of eighth-grade junior high school students. The developed worksheets are expected to provide contextual learning activities that guide students in understanding the Pythagorean theorem, constructing mathematical models, and developing reasoning through real-life problems.

METHODS

This study was development research, also known as Research and Development. According to Mesra et al. (2023), Research and Development in education is needed to produce valid and practical products related to educational practice. The objective of this research was to produce student worksheets on the Pythagorean theorem based on Realistic Mathematics Education to facilitate students' mathematical reasoning ability and to evaluate the validity and practicality of the developed product.

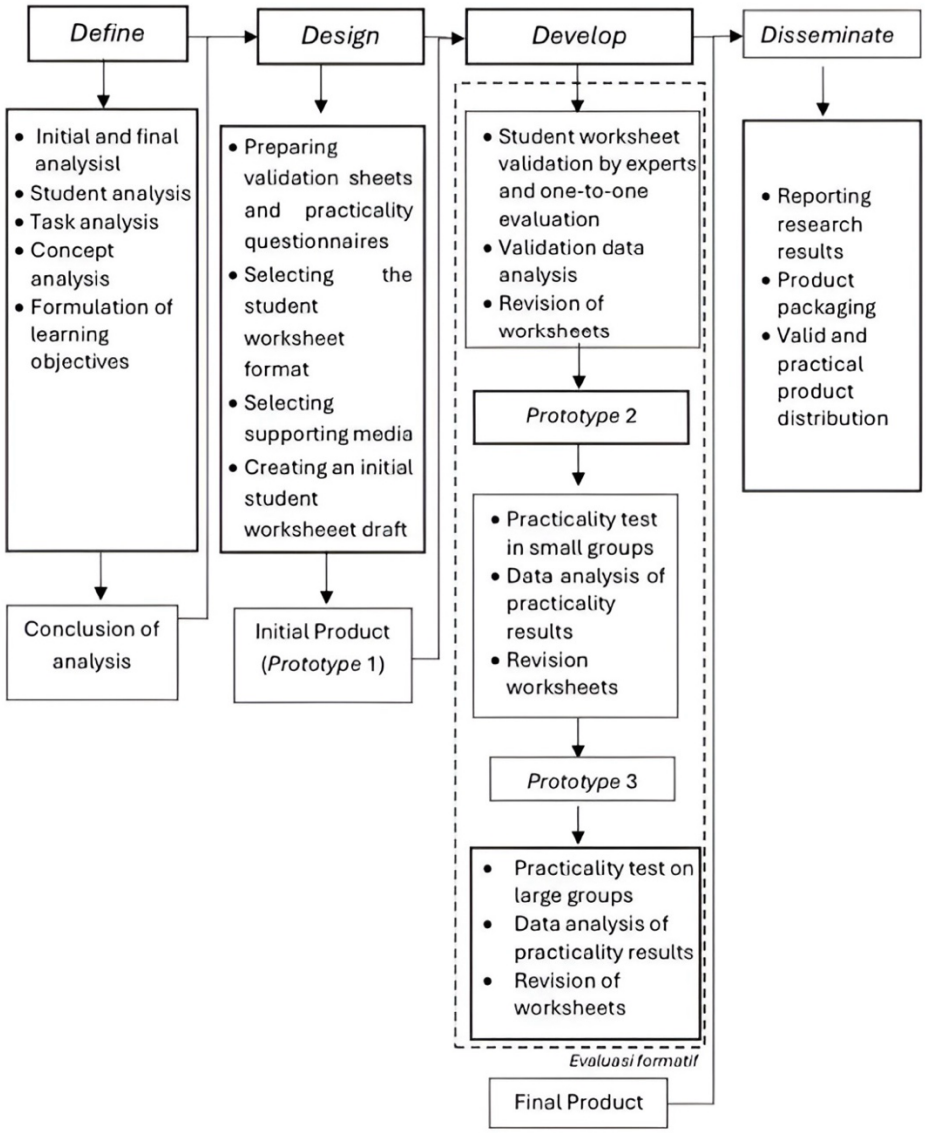

Figure 1. 4-D Development Research Procedure

This research adopted the 4-D development model by Thiagarajan et al. (1974), which consists of four stages: define, design, develop, and disseminate. The define stage consisted of preliminary-final analysis, learner analysis, task analysis, concept analysis, and formulation of learning objectives. The design stage included preparing

https://doi.org/10.30606/absis.v9i1.4129

validation sheets consisting of face validation, content validation, and construct validation; preparing practicality questionnaires with assessment aspects including ease of use based on worksheet appearance, ease of understanding the material in the worksheet, and the suitability of the worksheet to students' interests, needs, and situations; selecting the student worksheet format; selecting supporting media; and designing the initial student worksheet. The develop stage consisted of expert validation, one-to-one evaluation, small group testing, and field testing. The disseminate stage consisted of packaging and distributing the product that had met valid and practical criteria.

Product trials on the Pythagorean theorem worksheets involved students at SMPN 8 Pekanbaru as research participants. The one-to-one evaluation involved three students from class VIII.E, selected based on high, medium, and low ability levels. The small group test was conducted with six students from class VIII.D, while the field test was conducted with 34 students from class VIII.C with heterogeneous abilities based on teacher recommendations. The instruments used for data collection were validation sheets for the student worksheets and student practicality questionnaires.

The validity assessment of the student worksheets referred to Damanik and Syahputra (2018). The validity assessment used a five-point Likert scale and covered three aspects: face validity, content validity, and construct validity. The validity criteria are presented in Table 1.

Table 1. Student Worksheet Validity Assessment Criteria

Interval	Validity Category
$\bar{x} \geq 4{,}20$	Very valid
$3{,}40 < \bar{x} \leq 4{,}20$	Valid
$2{,}60 < \bar{x} \leq 3{,}40$	Quite valid
$1{,}80 < \bar{x} \leq 2{,}60$	Less valid

A student worksheet is considered valid if the average score obtained is greater than 3,40. The practicality assessment criteria for the student worksheet followed Sudijono (2016), as presented in Table 2.

Table 2. Student Worksheet Practicality Assessment Criteria

Interval	Category
$3{,}25 \leq \bar{T} \leq 4{,}00$	Very practical
$2{,}50 \leq \bar{T} < 3{,}25$	Practical
$1{,}75 \leq \bar{T} < 2{,}50$	Quite practical
$1{,}00 \leq \bar{T} < 1{,}75$	Impractical

A student worksheet is considered practical if the average score obtained is greater than or equal to 2,50.

FINDING AND DISCUSSION

Define

The purpose of this phase was to identify the fundamental problems that required the development of student worksheets. The define stage consisted of preliminary-final analysis, learner analysis, task analysis, concept analysis, and formulation of learning objectives. This phase involved literature review, interviews, and observations at SMPN 8 Pekanbaru.

The results of the preliminary-final analysis showed that students still experienced difficulties in mathematical reasoning ability, especially on the Pythagorean theorem topic. This finding is in line with Vebrian et al. (2021) and Ramdan and Lessa Roesdiana (2022), who reported that students' mathematical reasoning ability in solving mathematical problems was still low. Based on observations during learning activities, the use of student worksheets specifically designed to support mathematical reasoning ability had not been found. The teacher still tended to use a conventional approach, and learning activities were dominated by explanation and practice. This is consistent with Putri and Sutarni (2025), who stated that conventional learning does not make students actively involved because students are more often directed to memorize concepts rather than understand them.

The learner analysis was conducted by observing students at SMPN 8 Pekanbaru. The students were generally 14 years old. According to Piaget (in Jailani, 2018), children aged 11–15 years are in the formal operational stage, in which they are able to use logical thinking and reasoning for concrete and abstract problems. Therefore, learning activities should provide opportunities for students to reason, make conjectures, construct models, and draw conclusions.

The researchers also conducted task analysis and concept analysis by formulating the flow of learning objectives based on the Decree of the Head of BSKAP No. 032/H/KR/2024. Four subtopics were identified in the Pythagorean theorem chapter: proving the Pythagorean theorem, Pythagorean triples, special right triangles, and the application of the Pythagorean theorem. The total learning time allocation was 10 lesson hours. The learning objectives are presented in Table 3.

Table 3. Analysis Results of Learning Objectives for the Pythagorean Theorem Topic

Code	Learning objectives	Lesson hours
G.1	Students prove the Pythagorean theorem.	1
G.2	Students determine the hypotenuse and the other sides of right triangles using the Pythagorean theorem.	2

https://doi.org/10.30606/absis.v9i1.4129

Code	Learning objectives	Lesson hours
G.3	Students determine Pythagorean triples.	2
G.4	Students compare the sides of special right triangles.	2
G.5	Students solve everyday problems related to the Pythagorean theorem.	3
	Total	**10**

Design

At the design stage, the researcher prepared validation sheets and practicality questionnaires to evaluate the validity and practicality of the developed student worksheet. The validation sheet was adapted from Nainggolan (2022) and Yodiatma (2024), covering three aspects: face validity, content validity, and construct validity. The practicality questionnaire was adapted from Yodiatma (2024), covering three aspects: ease of use based on worksheet appearance, ease of understanding the material, and the suitability of the worksheet to students' interests, needs, and real-life situations.

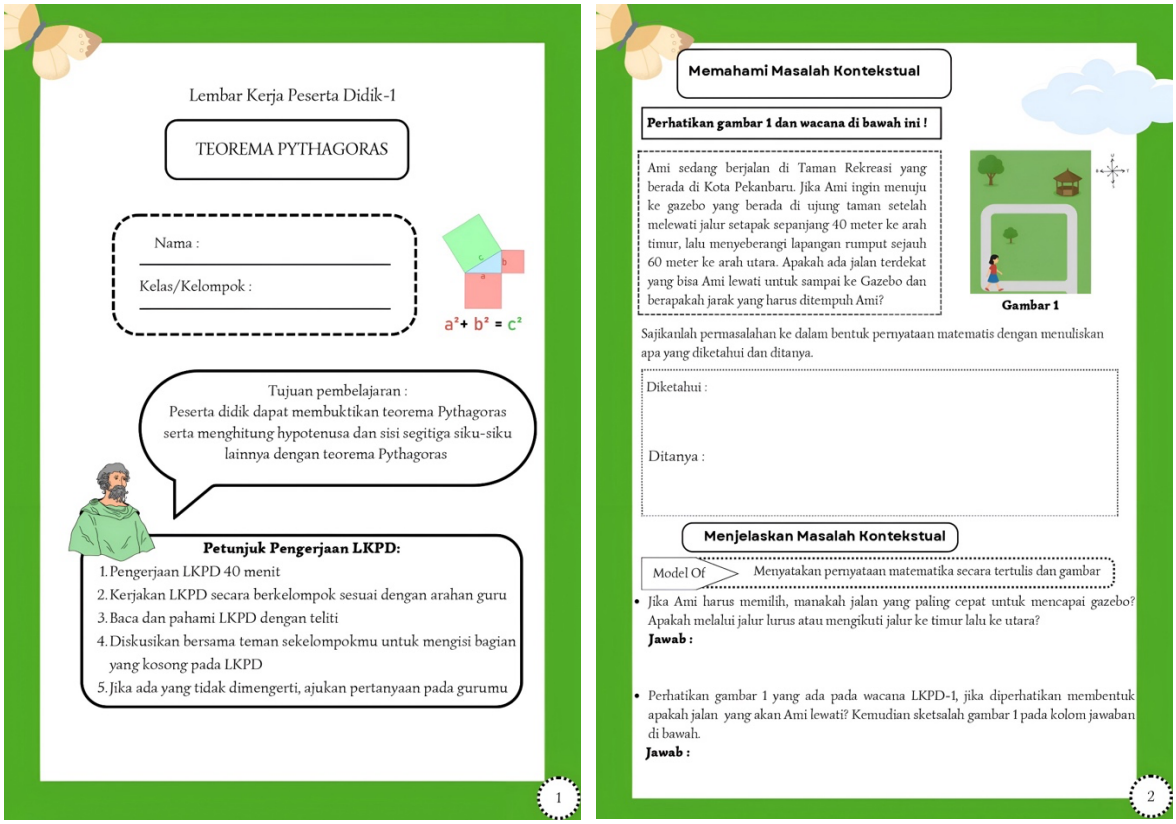

Figure 2. Initial Design of the RME-Based Student Worksheet: (a) worksheet cover page and (b) steps 1–2 of RME-based activities

The student worksheet format was designed based on the Realistic Mathematics Education (RME) approach to facilitate students' mathematical reasoning ability. The worksheet was developed using Microsoft Word 2019 and Canva. The initial draft, referred to as prototype 1, consisted of the cover, main learning activities, and practice questions. The worksheet cover contained the title, learning material, student identity, learning objectives, and work instructions.

The main content of the worksheet was arranged according to five RME-based learning steps. In the first step, students were presented with realistic problems related to the Pythagorean theorem and were asked to identify the known information and the questions to be answered. This step was intended to help students understand the contextual situation before moving to mathematical representation. In the second step, students were guided to represent the problem in the form of mathematical statements, diagrams, or written explanations. This activity reflected the *model of* stage, in which students began to transform contextual problems into mathematical representations.

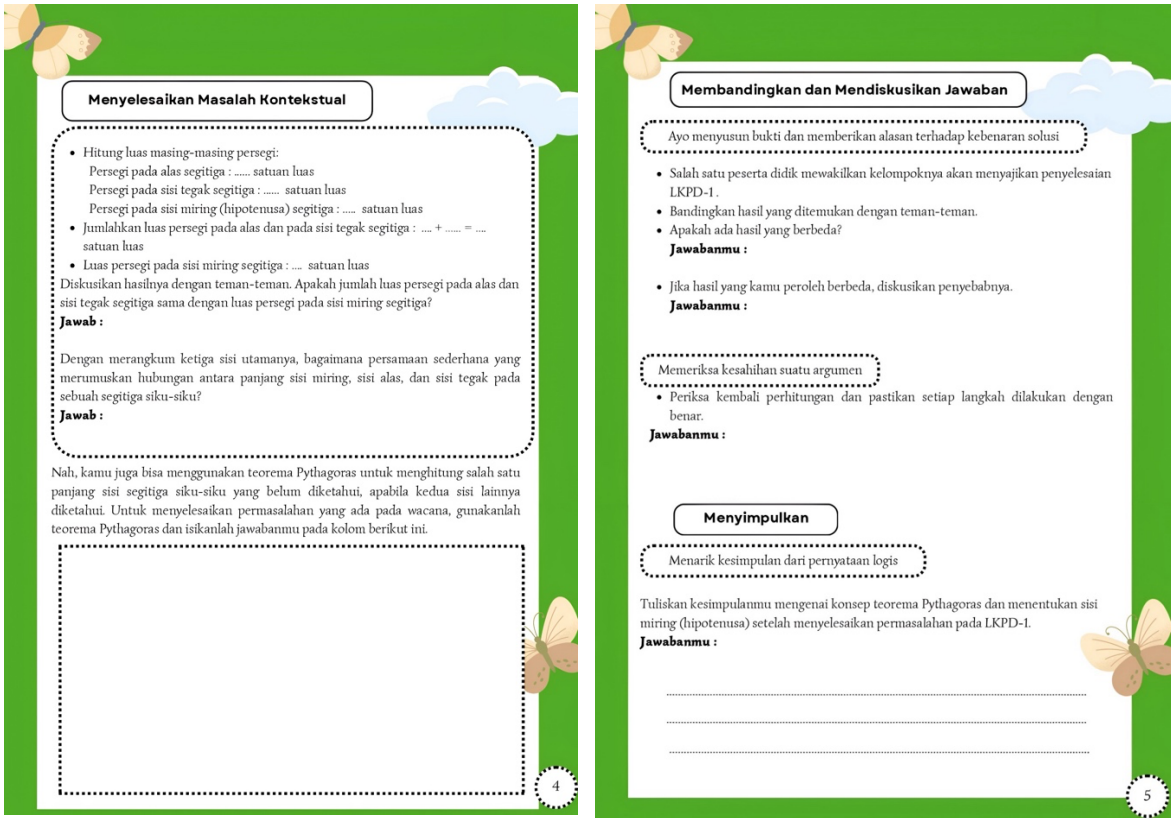

Figure 3. Main RME Activities in the Student Worksheet: (a) step 3 or model-for activity and (b) steps 4–5 involving discussion and conclusion

In the third step, students carried out activities to find solutions to the given problems. At this stage, students were guided to propose conjectures, develop solution strategies, and use mathematical models to solve the problems. This activity reflected the *model for* stage, in which students moved from contextual

https://doi.org/10.30606/absis.v9i1.4129

representations toward more formal mathematical reasoning. In the fourth step, students compared and discussed their answers with other students. This activity allowed students to evaluate different solution strategies, identify possible errors, and strengthen their reasoning through discussion. In the fifth step, students were asked to write conclusions based on the concepts they had learned.

At the end of the worksheet, practice questions were provided to strengthen students' understanding after completing the RME-based learning activities. These practice questions were designed to train students to apply the Pythagorean theorem in contextual situations and to support the development of mathematical reasoning. However, the practice question section is not displayed as a separate figure because the main characteristics of the worksheet have already been represented in Figure 2 and Figure 3.

Develop

At the development stage, the researchers carried out two main activities, namely expert appraisal and development testing. The expert appraisal consisted of expert validation and one-to-one evaluation, while development testing consisted of small group testing and field testing.

The initial prototype from the design stage was validated by three experts: a mathematics education lecturer from Universitas Islam Riau, a mathematics education lecturer from Universitas PGRI Jombang, and a mathematics teacher from SMAN 12 Pekanbaru. The results of the student worksheet validation are presented in Table 4.

Table 4. Results of Student Worksheet Validation Analysis

Student worksheet	Face validity	Content validity	Construct validity	Average
Worksheet 1	4.42	4.33	4.27	4.34
Worksheet 2	4.42	4.40	4.33	4.39
Worksheet 3	4.47	4.43	4.39	4.43
Worksheet 4	4.53	4.40	4.39	4.44
Average	4.46	4.39	4.35	4.40
Average percentage	89.22%	87.83%	86.97%	88.01%
Category	Very valid	Very valid	Very valid	Very valid

Source: Data processed by the researchers.

Table 4 shows that the student worksheets obtained an average validation score of 4.40, which was categorized as very valid. The highest score was obtained in the face validity aspect, with an average of 4.46, followed by content validity with an average of 4.39 and construct validity with an average of 4.35. These results indicate that the

student worksheets met the validity criteria in terms of appearance, content suitability, and construction of activities based on the Realistic Mathematics Education approach.

Although the student worksheets were categorized as very valid, revisions were still made based on the validators' suggestions to improve the quality of the product. The validators' suggestions and the revision results are presented in Table 5.

Table 5. Validator Suggestions and Revision Outcomes

Validator suggestions	Follow-up actions
Bold the word "answer" for clarity.	The word "answer" was bolded.
Check whether the space for writing answers was sufficient.	Answer columns were added.
Step 4 of the worksheet contained multiple questions in one sentence.	The questions in Step 4 were separated one by one.
Add answer columns to practice activities.	Answer columns were added to the practice questions.
Add illustrative images to practice questions.	Illustrations were added to the practice questions.

Source: Data processed by the researchers.

A one-to-one evaluation was conducted with three students from Class VIII.E at SMPN 8 Pekanbaru, selected based on high, medium, and low ability levels. The selection was based on recommendations from the mathematics teacher. The results of the one-to-one evaluation showed that students found several typographical errors in Student Worksheet 3, including errors in the terms "known" and "asked". Students also commented that the student worksheet helped them apply the Pythagorean theorem material. One suggestion from students was to provide answer columns for the practice questions. After revisions were made based on the validators' and students' suggestions, Prototype 2 was obtained.

Next, the researchers conducted a small group trial involving six students from Class VIII.D of SMPN 8 Pekanbaru with heterogeneous abilities. The results of the small group trial showed that the student worksheets were very practical, with an average score of 3.48. The results of the student response questionnaire in the small group trial are presented in Table 6.

Table 6. Results of the Student Response Questionnaire in the Small Group Trial

Student worksheet	Ease of use based on worksheet appearance	Ease of understanding the worksheet material	Relevance to students' interests, needs, and situations	Average
Worksheet 1	3.28	3.38	3.50	3.38

https://doi.org/10.30606/absis.v9i1.4129

Student worksheet	Ease of use based on worksheet appearance	Ease of understanding the worksheet material	Relevance to students' interests, needs, and situations	Average
Worksheet 2	3.61	3.42	3.43	3.49
Worksheet 3	3.56	3.50	3.57	3.54
Worksheet 4	3.50	3.46	3.50	3.49
Average	3.49	3.44	3.50	3.48
Average percentage	87.15%	85.94%	87.50%	86.86%
Category	Very practical	Very practical	Very practical	Very practical

Table 6 shows that the student worksheets obtained an average practicality score of 3.48 in the small group trial, which was categorized as very practical. The highest average score was obtained in the relevance aspect, with a score of 3.50. This indicates that the student worksheets were considered suitable for students' interests, needs, and real-life situations. The ease of use based on worksheet appearance obtained an average score of 3.49, while the ease of understanding the worksheet material obtained an average score of 3.44. These results indicate that the student worksheets were easy to use, understandable, and relevant to students' learning needs.

The field test was then conducted with 34 students from Class VIII.C with heterogeneous abilities. The field test was conducted over four meetings with different time allocations. Students' responses in the practicality questionnaire showed that the Realistic Mathematics Education-based student worksheets helped them apply the Pythagorean theorem and motivated them to learn. The field test results showed that the developed student worksheets obtained an average practicality score of 3.48, which was categorized as very practical. The results of the student response questionnaire in the field test are presented in Table 7.

Table 7. Results of the Student Response Questionnaire in the Field Test

Student worksheet	Ease of use based on worksheet appearance	Ease of understanding the worksheet material	Relevance to students' interests, needs, and situations	Average
Worksheet 1	3.61	3.55	3.45	3.54
Worksheet 2	3.54	3.41	3.41	3.45
Worksheet 3	3.43	3.46	3.36	3.42
Worksheet 4	3.57	3.50	3.44	3.50
Average	3.54	3.48	3.42	3.48

Student worksheet	Ease of use based on worksheet appearance	Ease of understanding the worksheet material	Relevance to students' interests, needs, and situations	Average
Average percentage	88.42%	87.00%	85.44%	86.95%
Category	Very practical	Very practical	Very practical	Very practical

Table 7 shows that the student worksheets obtained an average practicality score of 3.48 in the field test, which was categorized as very practical. The ease of use based on worksheet appearance obtained the highest score, with an average of 3.54. This indicates that students considered the worksheet appearance clear and easy to use. The ease of understanding the worksheet material obtained an average score of 3.48, while the relevance aspect obtained an average score of 3.42. These results indicate that the developed student worksheets were practical for use in learning activities.

Overall, the validation and practicality results indicate that the Realistic Mathematics Education-based student worksheets on the Pythagorean theorem met the criteria of very valid and very practical. The student worksheets were designed to facilitate students' mathematical reasoning ability through contextual problems, modeling activities, discussion, and conclusion drawing. These components are aligned with the characteristics of Realistic Mathematics Education, which emphasizes the use of real-world contexts and the mathematization process in learning mathematics.

The developed student worksheets can facilitate students' mathematical reasoning ability because each activity guides students to understand problems, identify known and asked information, construct representations, propose conjectures, compare strategies, and draw conclusions. This is consistent with previous studies showing that Realistic Mathematics Education can support students' mathematical reasoning ability (Nurhafizah & Fauzan, 2019; Yanti et al., 2022; Subroto et al., 2025; Ardiniawan et al., 2024; Gunawan & Hadi, 2024). Therefore, the developed student worksheets can be used as an alternative teaching material for the Pythagorean theorem topic.

The strength of this research lies in the development of student worksheets that integrate Realistic Mathematics Education with contextual activities on the Pythagorean theorem. The worksheets guide students from realistic problems toward mathematical models and formal conclusions. However, this study was limited to validity and practicality testing. The effectiveness of the product in improving students' mathematical reasoning ability has not yet been examined. In addition, the research was conducted in one school and focused only on the Pythagorean theorem topic. Therefore, further research is needed to test the effectiveness of the developed student worksheets with broader participants, longer implementation, and different mathematical topics.

https://doi.org/10.30606/absis.v9i1.4129

Disseminate

The dissemination stage was carried out by presenting the research results in a seminar, packaging the developed student worksheet as a learning product, and distributing it to SMPN 8 Pekanbaru. This stage aimed to ensure that the RME-based Pythagorean theorem student worksheet could be used as a reference for teachers in developing independent teaching materials and as supporting material in learning the Pythagorean theorem.

The developed student worksheet was designed to facilitate eighth-grade students' mathematical reasoning ability through the steps of Realistic Mathematics Education. The worksheet guides students to begin with realistic problems, identify relevant information, construct mathematical models, discuss solution strategies, and draw conclusions based on the concepts learned. These activities are expected to help students connect contextual situations with formal mathematical ideas, particularly in understanding and applying the Pythagorean theorem.

The results of the validation and practicality tests indicate that the developed worksheet met the criteria of being very valid and very practical. This finding is consistent with previous studies showing that RME-based learning materials can support students in understanding mathematical concepts and developing reasoning through contextual learning activities (Gusnarsi et al., 2017; Yanti et al., 2022; Gunawan & Hadi, 2024). Thus, the RME-based Pythagorean theorem worksheet can be considered a feasible teaching material for supporting mathematics learning at the junior high school level.

The novelty of this study lies in the development of a Pythagorean theorem worksheet that systematically integrates the RME approach with contextual problems close to students' daily lives. Unlike conventional worksheets that generally emphasize routine exercises, this worksheet guides students from informal reasoning based on real situations toward more formal mathematical reasoning. Through this process, students are encouraged to make conjectures, construct models, compare answers, and formulate conclusions.

However, this study has several limitations. The research focused only on validity and practicality, so the effectiveness of the worksheet in improving students' mathematical reasoning ability has not yet been tested through an experimental design. In addition, the trials were conducted in only one school with a limited number of participants, and the developed worksheet was limited to the Pythagorean theorem topic. Therefore, further research is recommended to test the effectiveness of the product using a more robust experimental design, involve broader research subjects, and develop similar RME-based worksheets for other mathematics topics.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the development process, it can be concluded that the Pythagorean theorem student worksheets based on Realistic Mathematics Education (RME) are valid and practical for facilitating eighth-grade students' mathematical reasoning ability. The validity results showed an average score of 4.40, which was categorized as very valid. This indicates that the developed worksheets are appropriate in terms of appearance, content, construction, and alignment with the RME approach.

The practicality results also showed that the worksheets were very practical to use in mathematics learning. The small group trial involving six students obtained an average practicality score of 3.48, while the field trial involving 34 students also obtained an average score of 3.48. These results indicate that the worksheets are easy to use, understandable, and relevant to students' interests, needs, and learning situations. Through RME-based activities, the worksheets guide students to understand realistic problems, construct mathematical models, discuss solutions, and draw conclusions related to the Pythagorean theorem.

Therefore, the developed worksheets can be used as alternative teaching materials to support mathematics learning, particularly in facilitating students' mathematical reasoning ability on the Pythagorean theorem topic. Further research is recommended to test the effectiveness of these worksheets through an experimental design to determine their impact on students' mathematical reasoning ability. In addition, similar RME-based worksheets can be developed for other mathematics topics, different grade levels, and broader school contexts to strengthen the generalizability of the findings.

REFERENCES

Alfiansyah, M., & Rusmining, R. (2023). Pengembangan lembar kerja peserta didik dengan pendekatan *realistic mathematics education* untuk menanamkan kemampuan penalaran siswa kelas VII. *JIPM (Jurnal Ilmiah Pendidikan Matematika), 11*(2), 307–317. https://doi.org/10.25273/jipm.v11i2.12649

Ardiniawan, D. Y., Subiyantoro, S., & Kurniawan, S. B. (2024). Effectiveness of the RME (*realistic mathematics education*) approach to learning achievement in view of students' mathematic reasoning. *QALAMUNA: Jurnal Pendidikan, Sosial, dan Agama*. https://doi.org/10.37680/qalamuna.v14i2.3520

Ariati, C., & Juandi, D. (2022). Kemampuan penalaran matematis: *Systematic literature review. Jurnal Lemma, 8*(2), 61–75. https://doi.org/10.22202/jl.2022.v8i2.5745

https://doi.org/10.30606/absis.v9i1.4129

Damanik, W. J., & Syahputra, E. (2018). Pengembangan perangkat pembelajaran untuk meningkatkan kemampuan berpikir kreatif matematis siswa menggunakan model *discovery learning*. *Jurnal Inspiratif, 4*(1), 27–38. https://doi.org/10.24114/jpmi.v4i1.9294

Elfariana, O. R. (2024). *Pengembangan e-LKPD interaktif materi teorema Pythagoras untuk mendukung penalaran matematis peserta didik di SMP* [Unpublished thesis].

Gunawan, W., & Hadi, S. (2024). The effect of a realistic mathematics education (RME) approach and reasoning ability on students' conceptual and procedural understanding. *Contemporary Educational Researches Journal, 14*(2). https://doi.org/10.18844/cerj.v14i2.9318

Gusnarsi, D., Utami, C., & Wahyuni, R. (2017). Pengaruh model pembelajaran *realistic mathematics education* (RME) terhadap kemampuan penalaran matematis siswa pada materi lingkaran kelas VIII. *Jurnal Pendidikan Matematika Indonesia, 2*(1), 32–36. https://doi.org/10.26737/jpmi.v2i1.207

Jailani, M. S. (2018). Perkembangan bahasa anak dan implikasinya dalam pembelajaran. *INNOVATIO: Journal for Religious Innovation Studies, 18*(1), 15–26. https://doi.org/10.21154/innovatio.v18i1.1234

Kemendikbudristek. (2022). *Keputusan Kepala BSKAP Nomor 008 Tahun 2022 tentang capaian pembelajaran pada pendidikan anak usia dini, jenjang pendidikan dasar, dan jenjang pendidikan menengah pada Kurikulum Merdeka*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Mesra, R., Salem, V. E. T., Polii, M. G. M., Daniel, Y., Santie, A., Wisudariani, N. M., Sarwandi, Sari, R. P., Yulianti, A., Nasar, Y., Yenita, D., & Santiari, N. P. L. (2023). *Research & development dalam pendidikan*. PT Mifandi Mandiri Digital. https://doi.org/10.31219/osf.io/d6wck

Nainggolan, M. S. H. (2022). *Pengembangan media pembelajaran berbantuan Adobe Flash Professional CS6 pada materi aritmatika sosial untuk memfasilitasi kemampuan pemahaman matematis siswa kelas VII SMP/MTs* [Master's thesis, Universitas Riau].

Nurhafizah, & Fauzan, A. (2019). Pengaruh penerapan pendekatan *realistic mathematics education* terhadap kemampuan penalaran matematis peserta didik di kelas XII IPA SMA Pertiwi 1 Padang. *Jurnal Edukasi dan Penelitian Matematika, 8*(4). https://jepm.ppj.unp.ac.id/index.php/jepm

Putri, I. K. Q., & Sutarni, S. (2025). Penerapan pendekatan *realistic mathematic education* (RME) dalam pembelajaran matematika SMP ditinjau dari aktivitas pembelajaran siswa. *Jurnal Pendidikan Matematika: Judika Education, 8*(3), 441–452. https://doi.org/10.31539/99x5dx90

Ramdan, M. G. A. R., & Roesdiana, L. (2022). Analisis kemampuan penalaran matematis siswa SMP pada materi teorema Pythagoras. *Jurnal Educatio FKIP UNMA, 8*(1), 386–395. https://doi.org/10.31949/educatio.v8i1.1996

Subroto, P. W., Raharjo, S., Tyas, S. A., & Firdaus, N. (2025). Pengaruh model pembelajaran RME terhadap kemampuan penalaran matematis. *Jurnal Jendela Matematika, 3*(1), 60–65. https://doi.org/10.57008/jjm.v3i01.1209

Sudijono, A. (2016). *Pengantar statistik pendidikan*. Rajawali Pers.

Sumarmo, U. (2017). *Hard skills dan soft skills matematik siswa*. Refika Aditama.

Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional development for training teachers of exceptional children: A sourcebook*. Indiana University, Center for Innovation in Teaching the Handicapped.

Utami, A. P., Zuhdiyah, & Paradesa, R. (2020). Lembar kerja siswa berbasis *problem based learning* untuk materi segiempat. *Suska Journal of Mathematics Education, 6*(1), 61–68. https://doi.org/10.24014/sjme.v6i1.9149

Vebrian, R., Putra, Y. Y., Saraswati, S., & Wijaya, T. T. (2021). Kemampuan penalaran matematis siswa dalam menyelesaikan soal literasi matematika kontekstual. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 10*(4), 2602–2614. https://doi.org/10.24127/ajpm.v10i4.4369

Wijayanti, R., Hermanto, D., & Zainuddin. (2019). Efektivitas penggunaan pendekatan pembelajaran *realistic mathematic education* (RME) dengan berbantuan media pembelajaran aplikasi Kahoot. *SIGMA, 5*(1), 1–7. http://dx.doi.org/10.53712/sigma.v5i1.640

Yanti, F., Nurva, M. S., & Fikriani, T. (2022). Pengembangan lembar kerja peserta didik (LKPD) berbasis *realistic mathematic education* (RME) untuk meningkatkan kemampuan penalaran matematis peserta didik. *Edukatif: Jurnal Ilmu Pendidikan, 4*(2), 1743–1751. https://doi.org/10.31004/edukatif.v4i2.2132

Yetri, O., Fauzan, A., Desyandri, Fitria, Y., & Fahrudin, F. (2019). Pengaruh pendekatan *realistic mathematics education* (RME) dan *self-efficacy* terhadap kemampuan pemecahan masalah matematis siswa di sekolah dasar. *Jurnal Basicedu, 3*(4), 2000–2008. https://doi.org/10.31004/basicedu.v3i4.249

Yodiatma. (2024). *Pengembangan lembar kerja peserta didik berbasis kearifan lokal untuk memfasilitasi kemampuan penalaran matematis menggunakan pendekatan realistic mathematics education pada materi SPLDV* [Master's thesis, Universitas Riau].

https://doi.org/10.30606/absis.v9i1.4129