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Development of problem-solving-based worksheets to improve critical thinking skills in IPAS subjects

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ABSTRACT

Student Worksheets (Lembar Kerja Peserta Didik or LKPD) are currently being developed into innovative learning media and play a crucial role in supporting the 21st-century learning process, particularly in enhancing critical thinking skills for students. This study aims to develop problem-solving-based LKPD that can improve critical thinking skills in science in grade IV of elementary school/Islamic elementary school. The need for this LKPD is supported by the low critical thinking skills of students today, as well as the importance of active and meaningful learning to face the challenges of 21st-century education. The research method used is development research with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The research sample was taken by simple random sampling from grade IV students of the elementary school/Islamic elementary school in two schools, with a pretest-posttest control group experimental design. The results of the study showed that the critical thinking scores of students who used problem-solving-based LKPD increased significantly from the average pretest and posttest scores. In contrast, students who used conventional methods only experienced a smaller increase. Based on these results, it can be concluded that the development of problem-solving-based LKPD is effective in improving students' critical thinking skills, so it is recommended for use as an innovative teaching material.

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ABSTRAK

Lembar Kerja Peserta Didik (LKPD) saat ini berkembang menjadi media pembelajaran yang inovatif dan sangat penting dalam mendukung proses pembelajaran abad 21, khususnya dalam meningkatkan keterampilan berpikir kritis. Penelitian ini bertujuan untuk mengembangkan LKPD berbasis problem solving yang dapat meningkatkan keterampilan berpikir kritis pada mata pelajaran IPAS di kelas IV SD/MI. Kebutuhan terhadap LKPD ini didukung oleh rendahnya kemampuan berpikir kritis peserta didik saat ini, serta pentingnya pembelajaran yang aktif dan bermakna untuk menghadapi tantangan pendidikan abad 21. Metode penelitian yang digunakan adalah penelitian pengembangan dengan model ADDIE yang meliputi tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Sampel penelitian diambil secara simple random sampling dari peserta didik kelas IV SD/MI di dua sekolah, dengan desain eksperimen pretest-posttest control group. Hasil penelitian menunjukkan bahwa skor berpikir kritis peserta didik yang menggunakan LKPD berbasis problem solving meningkat secara signifikan dari nilai rata-rata pretest dan posttest, sedangkan peserta didik yang menggunakan metode konvensional hanya mengalami kenaikan lebih sedikit. Berdasarkan hasil tersebut, dapat disimpulkan bahwa pengembangan LKPD berbasis problem solving efektif dalam meningkatkan keterampilan berpikir kritis peserta didik, sehingga direkomendasikan untuk digunakan sebagai bahan ajar yang inovatif.

Kata Kunci: *berpikir kritis; inovasi media pembelajaran; lembar kerja peserta didik; pemecahan masalah; pengembangan media pembelajaran*

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INTRODUCTION

Critical thinking is a very important skill to develop, both in an academic context and in everyday life. This skill enables a person to make effective decisions, communicate well, and solve problems that arise. Specifically, critical thinking is a deep and systematic approach to analyzing an idea or concept, grounded in the careful and accurate collection of information to solve problems. (Susanti *et al*., 2023). In the teaching of Natural and Social Sciences (IPAS), critical thinking is a key skill students must master. However, based on the researcher's initial observations through tests of critical thinking skills among fourth-grade students at MIN 1 Pesawaran and SD Roudlatul Qur'an Empat, Jati Agung, South Lampung, it was found that critical thinking skills at both schools are categorized as very low. This condition reflects challenges in developing critical thinking skills in IPAS subjects, caused by several factors, including students' inability to analyze problems, provide reasoning, and solve questions systematically.

The model educators use remains conventional: teachers dominate the classroom, and students are not required to argue or express their ideas. Students are only involved in memorization activities, with little analytical or evaluative work. This is reinforced by an interview with an IPAS subject teacher, who reported that they have not yet implemented a problem-solving learning model in their teaching, leaving students unaccustomed to problem-solving or critical thinking. The problem-solving model involves identifying an issue and devising a solution; setting a solution as the goal for problem solving requires preparation, ability, creativity, and knowledge (Aedi, 2020).

The initial interview results indicated that the teaching materials used were not yet varied; for example, Student Worksheets (LKPD) had not been utilized. In particular, IPAS subjects were not designed to foster critical thinking and problem-solving skills. As a result, students have difficulty applying problem-solving concepts to real-world situations, particularly in IPAS subjects. One teaching Material that can aid the learning process is the LKPD. In this LKPD, students are presented with questions and tasks that support individual or group work (Purwasi & Fitriyana, 2020). The questions in the LKPD are presented well and creatively, in line with the provided Material. However, at present, the LKPD has not been used optimally by educators to enhance students' skills in IPAS learning. The LKPD serves as a guideline to assist students' activities in investigating problems. Efforts to improve students' critical thinking skills can be carried out through problem-solving-based LKPD. Improving critical thinking skills is an important area that must be taught to students and can be applied across educational levels, from elementary school through junior high and high school. (Sukmawati & Ghofur, 2023). LKPD plays an important role for teachers by encouraging students to be more active in learning. In addition, LKPD improves critical thinking skills and encourages students to collaborate to address 21st-century challenges (Raudoh, 2023).

Research on problem-solving-based student worksheets (LKPD) to improve critical thinking skills among fourth-grade elementary/madrasah students, particularly in science, remains limited, particularly in the development of e-LKPD based on Higher-Order Thinking Skills (HOTS) questions to enhance critical thinking in science learning in elementary schools. This Research used electronic student worksheets as a medium to improve critical thinking skills. (Putra *et al*., 2023). Research on the effectiveness of the digestive system E-Module based on problem-solving ability shows that this study assesses the effectiveness of the problem-solving-based electronic module on the digestive system Material, which is shown to significantly improve students' problem-solving abilities. This module emphasizes the problem-solving approach as an active learning method. (Permana *et al*., 2021), and the development of STEAM-based diorama media to enhance the critical thinking skills of elementary school students. This study emphasizes the use of diorama learning media in the context of Science, Technology, Engineering, Arts, and Mathematics (STEAM) (Lailiyah & Widiyono, 2023). Given this condition, efforts to address the problem involve using the Student Worksheet (LKPD) teaching materials based on an innovative problem-

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solving model, in accordance with the context of the IPAS subject. Therefore, the aim of this study is to attract students' interest through problem-solving-based LKPD and encourage students to participate in learning. This Research is expected to have a significant impact on students' critical thinking skills.

LITERATURE REVIEW

Teaching materials

Teaching materials are educational resources that teachers systematically introduce and use in the teaching process (Ritonga *et al*., 2022). eaching materials have a specific nature, meaning they are intended solely to achieve learning objectives. Using language that aligns with students' characteristics and the materials used can help students achieve their learning goals (Puspitasari & Purbosari, 2021). Teaching materials are categorized into four types based on their form: printed materials, audiovisual materials, interactive teaching materials, and programmed audio materials. Examples of printed teaching materials include books, photos, cards, sheet-based student worksheets (LKPD), and other printed media. Audiovisual teaching materials include records, music, tapes, radio, as well as audiovisual instructional materials such as films, videos, TV, and others. Interactive teaching materials are teaching materials that combine two or more types of materials that users can use to analyze an interest in performance, for example, interactive compact disks.

Student Worksheets

Student Worksheets or *Lembar Kerja Peserta Didik* (LKPD) are sheets on which students work on Material related to what they are learning. LKPD teaching materials serve as a supporting medium in student learning. LKPD contains Material explanations, activity objectives, tools or materials used in learning, and steps for completing tasks. LKPD is prepared to facilitate students in carrying out learning activities systematically and effectively, while also making learning easier to conduct. (Rahmasari, 2024). LKPD is applied in nature and aims to train students in developing the skills they have learned in school, which are then applied in daily life. For example, in school, in the problem-based IPAS subject, students are required to enhance their critical thinking skills by answering questions related to everyday life. (Fauziyah *et al*., 2020).

Problem Solving

Marzono defines problem-solving as a model educators use to present tasks in science subjects (Susilawati *et al*., 2024). This problem-solving model is a form of learning grounded in problems or issues that aims to sharpen memory skills, develop creativity, and train students' critical thinking to deepen understanding (Utami, 2022). The stages of the problem-solving model are understanding the problem, devising a plan, carrying out the plan, and evaluating or looking back (Renda, 2019). This learning model focuses on problem-solving skills and is reinforced by students' existing skills. The problem-solving process provides students with the opportunity to actively participate in learning by finding and evaluating information to be transformed into concepts, theories, principles, and conclusions (Sofiana *et al*., 2021).

Berpikir Kritis

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The word thinking means speaking to oneself in the heart, related to the knowledge present in the mind. Thinking is the process of considering a problem to make decisions and deliberate with reason (Harun *et al*., 2024). The process of thinking comprises three aspects: understanding concepts, forming opinions, and drawing conclusions (Bintang *et al.*, 2023). Critical thinking skills in elementary school children affect their cognitive development; they tend to demonstrate the ability to understand a problem, gather information, and draw conclusions. (Rahman *et al*., 2024). Indicators of critical thinking include providing simple explanations, building basic skills, drawing conclusions, giving further explanations, and organizing strategies and tactics (Amalia *et al*., 2021). The concept of critical thinking is a skill that students must have to address problems, distinguish facts from opinions, develop solutions through a decision-making process, and evaluate issues. It prepares students to face future challenges in both education and daily life based on their experiences (Ariadila *et al*., 2023).

METHODS

This Research is a Research and development (R&D) study conducted at two schools: MIN 1 Pesawaran and SD Roudlatul Quran Empat, Jati Agung, South Lampung. The model used is the ADDIE model, with five phases: analysis, design, development, implementation, and evaluation.

The analysis stage will conduct a needs analysis of students' low levels of critical thinking. The design stage will design the materials, plan the problem-solving-based LKPD products, and ensure language appropriateness. The development stage will involve creating LKPD products with input from experts in materials, language, and media. The implementation stage is the phase in which the developed teaching materials are practiced with educators and students. The evaluation stage, the final step in the ADDIE model, will involve evaluating all ADDIE stages.

The subjects in the development Research trial were media experts, language experts, Material experts, educators, and fourth-grade students from IV A MIN 1 Pesawaran and IV C SD Roudlatul Quran Empat. The completed products were then tested in learning activities. The trial of the problem-solving-based LKPD development product was conducted on a small group of fourth-grade SD/MI students to identify its effectiveness in improving critical thinking skills. This test involved 15 students as respondents and 1 teacher to assess the product's attractiveness and feasibility. Subsequently, a large-scale trial was conducted, applied to several fourth-grade SD/MI classes. This large-scale test used two classes, namely an experimental class and a control class. The sample was determined using a simple random sampling technique, in which every member of the population has an equal chance of being selected. This study involved 30 fourth-grade students from class IV A as the experimental class and 30 fourth-grade students from class IV B as the control class at MIN 1 Pesawaran. The Research design used was a pretest-posttest only control. The pretest-posttest-only control-group design is an experimental method that involves two groups: the experimental group and the control group, both of which are tested before (pretest) and after (posttest). Before administering the pretest, a validity test was conducted in a class that had already studied the Material, consisting of 10 questions, and yielded 10 valid questions. After that, pretests and posttests were carried out on a larger scale using the 10 validated questions.

The data collection techniques used in this study were interviews, questionnaires, tests, and validation instruments involving several experts in their respective fields. The data analysis technique used in this study was qualitative, aimed at improving the LKPD based on validator feedback. The qualitative data, in the form of educators' and students' assessment scores, were quantified using a Likert scale. The data were collected by assigning scores of 1 to 4 to the assessed aspects.

RESULTS AND DISCUSSION

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The development of problem-based worksheets (LKPD) aims to enhance students' critical thinking by using the ADDIE method. The development of problem-based worksheets follows the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. (Pitriyana & Arafatun, 2022).

Analysis (Analisis)

This stage analyzes the needs of both schools, indicating that critical thinking skills remain low. Based on the results of the preliminary study, the lack of innovative teaching materials was identified, prompting the design of the Student Worksheet (LKPD) to provide meaningful and challenging learning experiences, encourage more critical thinking, and actively engage students at each stage of learning. Through innovative and contextual LKPD design, it is expected that students will be able to explore ideas, connect science concepts (IPAS) with everyday life, and make wise decisions based on rational thinking. In developing this LKPD, students are trained to provide simple explanations, build basic skills, draw conclusions, provide further explanations, and logically organize strategies and tactics from given contextual problems. By integrating a problem-solving approach into the LKPD, the learning process is not only theoretical but also practical, encouraging students to construct knowledge and actively improve their learning outcomes.

Design (Desain)

At this stage, the product design is developed, including planning materials based on curricular needs and students' developmental levels. The designed Material must include clear, measurable indicators of competency achievement. The Material should not only contain theoretical knowledge, but also practical and applicable experiences that can stimulate students to think analytically and critically. Then, the LKPD planning covers preparing learning activity content that aligns with the established competencies and indicators, as well as arranging the sequence of activities to ensure the learning process runs effectively and efficiently. At this stage, the designer determines the main components of the LKPD, including activity steps, problem statements, instructions, and questions that guide students to actively think critically and develop problem-solving skills. The LKPD design needs to be adjusted to integrate a comprehensive problem-solving approach. This aims to ensure that LKPD not only includes activities and exercises but also components that stimulate students to identify problems, formulate problems, design solutions, and evaluate the results. In addition, the language used should be simple, straightforward, and easy to understand, given the developmental level of fourth-grade elementary/madrasah students. Using effective, clear sentences will help students understand instructions, questions, and prompts, thereby preventing confusion.

Development (Pengembangan)

Steps for developing problem-solving-based LKPD to improve students' critical thinking in the IPAS subject on the photosynthesis Material for fourth grade, which includes product development steps and expert validation in Table 1, as follows.

Table 1. Students Worksheets

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No	LKPD Figure	Description
1	 Front Cover	The cover of the IPAS Student Worksheet (LKPD) for Grade IV elementary/madrasah students on the topic of photosynthesis is designed to capture the students' attention and provide a brief overview of the material that will be studied.
2	 Goals and Indicators	The goals in the problem-solving based LKPD are to enhance critical thinking skills as a guide that directs students in the learning process to be able to identify, analyze, solve problems, and apply them in real life.
3	 Instructions for using LKPD	The LKPD usage instructions contain clear guidance for students to first read the Material, understand the learning objectives, and complete the tasks carefully. These instructions are designed so that students can carry out learning activities independently and effectively, aligned with the competencies they aim to achieve.
4	 Learning Material	This material explains plants as a source of life, the benefits of plants, and the importance of taking care of the plants around us.

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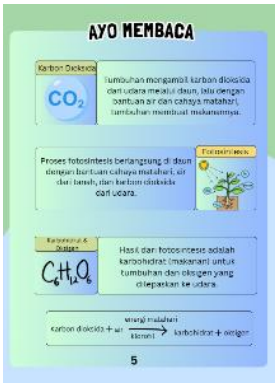
No	LKPD Figure	Description
5	 Learning Material	This section explains the topic of photosynthesis, the materials needed in the photosynthesis process, and provides a complete explanation.
6	 Learning Material	This Material explains the process of photosynthesis, including images of the materials needed. This allows students not only to read but also to analyze the process of photosynthesis.
7	 Discussion question	The discussion questions in the problem-solving-based LKPD guide students to practice, discuss, and analyze the photosynthesis process that occurs in leaves. In addition, students are also asked to answer questions designed to train critical thinking skills and systematically solve problems.
8	 Problem Solving	Problem-solving questions are designed to encourage students to identify, analyze, and find solutions to given problems, thereby improving their critical thinking skills and their ability to make decisions logically and systematically.

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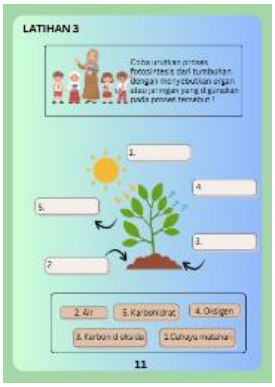
No	LKPD Figure	Description
9	 Question	A question that requires students to arrange the stages of the photosynthesis process correctly, designed to train and enhance critical thinking skills.
10	 Bibliography	This bibliography contains the references used in preparing the LKPD on photosynthesis. These references provide a scientific basis to ensure that the Material and procedures in the LKPD align with learning standards and to help students understand the concept of photosynthesis in depth.

Source: 2025 Research

The stage carried out after the design is ready is validation by content, media, and language experts according to the Research needs in the scientific article. At the expert validation stage, the instrument used is a questionnaire with a four-category Likert scale. The experts' assessment is shown in **Table 2** below.

Table 2. Expert Assessment

Subject matter expert		Media expert		language expert	
Stage 1	**Stage 2**	**Stage 1**	**Stage 2**	**Stage 1**	**Stage 2**
55%	92,5%	45,31%	87,49%	62,49%	92,18%

Source: 2025 Research

Table 2 shows the results of expert assessments of problem-solving-based LKPD teaching materials using stage 1 (before revision) and stage 2 (after revision). The results indicate a 'very feasible' category in the stage after revision.

Table 3. Average Results of Critical Thinking Scores of Students in the Control Class and the Experimental Class

Class	Total	Pretest	Posttes	N-Gain
Experimental	30	31,82	88,16	0,82
Control	30	36,58	58,75	0,34

Source: 2025 Research

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Table 3 presents the assessment of effectiveness, measured by improvements in students' critical thinking as indicated by pretest and posttest evaluations. The analysis results indicate that the experimental class experienced a significant improvement, with an N-Gain score of 0.82 (very high), whereas the control class achieved only 0.34 (medium). The distribution of N-Gain categories shows that the experimental class achieved much better results than the control class. A total of 26 students (86.6%) in the experimental class were in the high N-Gain category (≥0.7), whereas none in the control class were. Conversely, the majority of students in the control cass, namely 20 students (66.6%), were only in the medium category (0.3 ≤ N-Gain < 0.7), and the remaining 10 students (33.3%) were even in the low category (N-Gain < 0.3).

Normality Test

A normality test is a statistical procedure used to determine whether a sample's data are normally distributed. This test was carried out using the Jamovi application based on the Shapiro-Wilk criteria, with the pretest of the experiment showing a p-value of 0.137, indicating α > 0.05. The posttest of the experiment showed a significance of 0.188, which means α > 0.05. The pretest of the control class showed a significance of 0.062, which means α > 0.05. The posttest yielded a p-value of 0.425, indicating α > 0.05. Based on the decision-making in this test, the data are "normally" distributed. The results of the normality test are shown in **Table 4**.

Table 4. Normality Test Results

Class / Result	Control Class Pretest	Control Class Posttest	Experimental Class Pretest	Posttest of the Experimental Class
Standard deviation	5.55	5.44	4.50	6.50
Minimum	27.5	45.0	25.0	75.0
Maximum	52.5	70.0	42.5	100
Shapiro-Wilk W	0.934	0.966	0.947	0.952
Shapiro-Wilk p	0.062	0.425	0.137	0.188

Source: 2025 Research

Homogeneity Test

The homogeneity test is a statistical test used to determine whether two or more data groups have the same variance. This test is important to perform before conducting parametric statistical tests such as the Independent T-test. One commonly used method is the Levene Statistic test. The significance value can be seen from the fact that the mean value of 0.224 > 0.05, which means it can be concluded that the variance of the pretest groups in the experimental class and control class is "homogeneous." The results of the homogeneity test calculations are shown in Table 5.

Table 5. Homogeneity Test Results

	Levene Stastic	df1	df2	Sig.
Based on Mean	1.51	1	58	0.224

Source: 2025 Research

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Independent T-Test

The independent t-test is a statistical test used to compare the means of two unrelated (independent) groups. The hypothesis for the independent t-test is that if HO is stated, there is no effect of problem-solving-based LKPD media on critical thinking skills in the IPAS subject for fourth-grade SD/MI students. Meanwhile, H1 states that problem-solving-based LKPD media have an effect on critical thinking skills in the IPAS subject for fourth-grade SD/MI students. The decision criteria for the independent t-test are that if the sig. (2-tailed) value < 0.05, there is a significant difference between the learning outcomes of the control and experimental classes, and if the significance. (2-tailed) value > 0.05 indicates no significant difference in learning outcomes between the control and experimental classes. The T-Test results show a significance value of 0.001 for the critical thinking test, which is < 0.05, so the data support rejecting H_0 and accepting H1. It is reported that problem-solving-based LKPD media have an effect on critical thinking skills in the IPAS subject for 4th-grade SD/MI students. The results of the Independent T-Test are shown in **Table 6**.

Table 6. Independent T-Test Results

		Statistic	df	p
N-gain kelas	Stundent's t	-18.5	58.0	<.001

Source: Research 2025

Evaluation (Evaluasi)

The evaluation stage in this study was conducted at each stage because it refers to the ADDIE development model. This study underwent several stages of product trials and effectiveness testing. After conducting small- and large-scale trials to measure interest in the problem-solving-based student worksheet (LKPD) on natural science and social studies (IPAS), Material on photosynthesis, the results showed that the LKPD was highly appealing, so no retesting was required. Therefore, this LKPD is deemed suitable for use as one of the teaching materials to support learning and enhance students' critical thinking skills in grade IV of elementary schools (SD/MI).

The trial was conducted extensively by providing questionnaires to students to assess the problem-solving-based LKPD. The assessment results are shown in **Figure 1**, with an average of 92.16% on the criterion "very feasible," indicating that the problem-solving-based LKPD product is very interesting.

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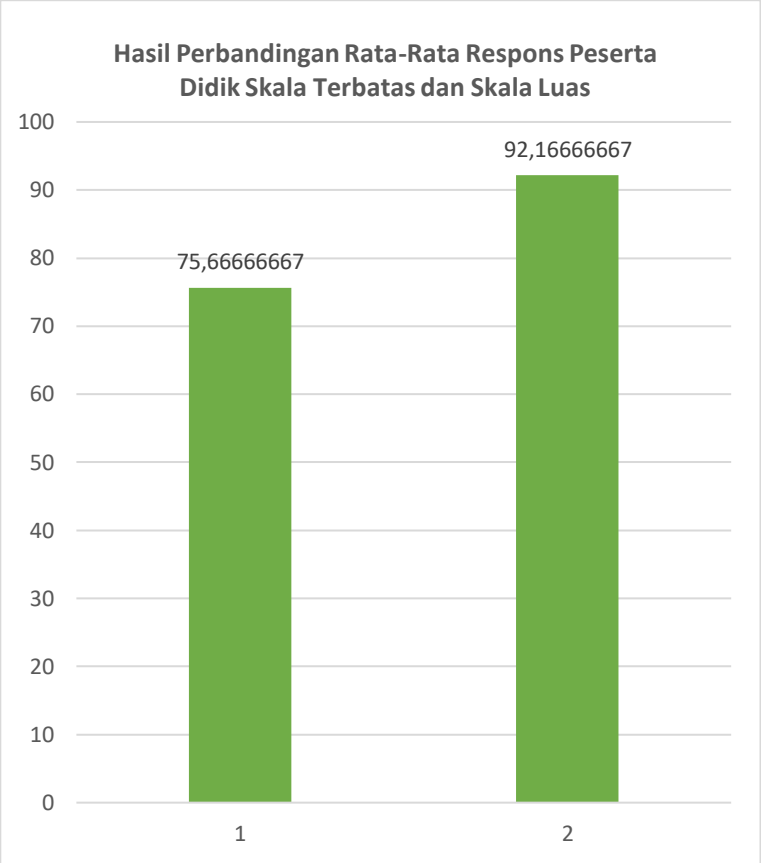

Figure 1. Graph of the Comparison of Average Student Response on a Small Scale and Large Scale
Source: Research 2025

Based on the results of extensive trials, educators were given a questionnaire to assess the LKPD based on problem-solving. The results showed an average of 98.3% for the criterion “very feasible,” indicating that the problem-solving-based LKPD product is very attractive. The improvement in educators’ responses before and after the revision can be seen in **Figure 2** as follows.

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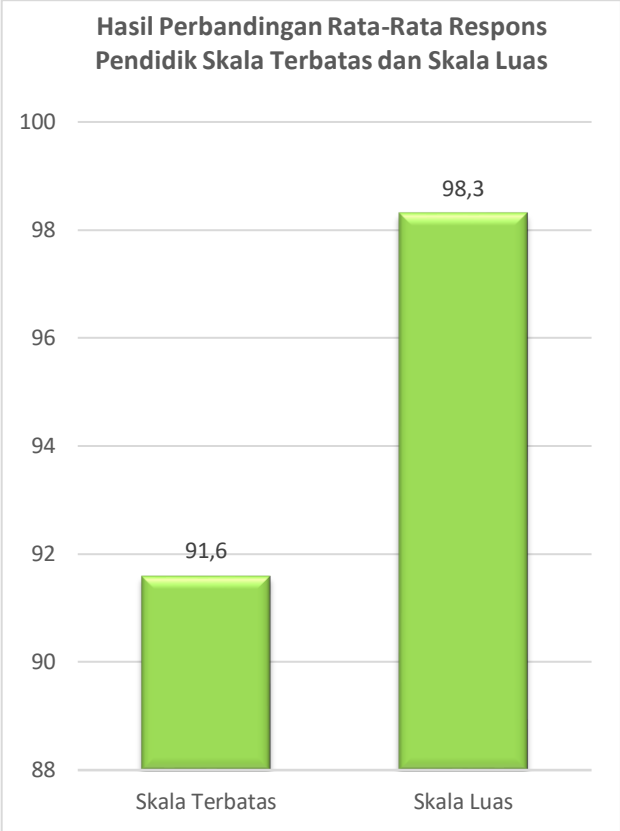

Figure 2. Comparison of Average Educator Responses on Narrow and Broad Scales
Sumber: Penelitian 2025

Discussion

The development of education in the 21st century demands innovation in the learning process that aligns with the times (Hanipah, 2023). Changes in modern life have a significant impact on how children learn and interact with their surroundings. In this context, a problem-solving-based learning approach is highly relevant for developing students' abilities, particularly in critical thinking. Learning using the problem-solving method can enhance students' critical thinking skills by accommodating the learning experiences they acquire (Fajriah *et al*., 2021). On the other hand, national education aims to prepare a generation capable of competing and building the nation, so the learning design must be directed towards shaping students who are creative, critical, and highly competitive (Fitriani *et al*., 2022). One important competence that must be developed is critical thinking skills, especially in subjects such as Natural and Social Sciences (IPAS), which require students to understand, analyze, and solve various natural and social phenomena. The researcher developed a problem-solving-based Student Worksheet (LKPD) intended to serve as a learning medium that encourages students to think critically.

This study shows that the trial of the developed LKPD received very positive responses from teachers and students. The LKPD was considered attractive, easy to use, and capable of facilitating students to think critically. This proves that the application of problem-solving syntax, such as understanding the problem, planning a solution, implementing the plan, and evaluating the results, is very effective in stimulating students' critical thinking indicators, namely giving simple explanations, building basic skills, concluding, providing further explanations, and organizing strategies and tactics (Pratiwi *et al*., 2022). In addition, the benefits of the LKPD will be felt by teachers, as it can serve as a learning guide that makes it easier to implement the independent curriculum in a contextual manner. (Meha *et al*., 2025; Wirasti *et al*., 2024).

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The results of this study support the development of the Student Worksheet (LKPD) based on problem-solving. Theoretically, problem-solving aligns with the demands of 21st-century learning, which emphasize critical, creative, collaborative, and communicative skills (4C) (Rozali *et al*., 2024; Sapitri *et al*., 2022). According to Constructivist Learning theory by Piaget and Vygotsky, effective learning is learning that allows students to build their own understanding through direct experience and contextual problem solving (Salsabila *et al*., 2024). In this context, the problem-solving approach requires students to understand the problem, analyze relevant information, develop strategies, test solutions, and reflect on the results. All these stages reflect indicators of critical thinking, namely analysis, evaluation, logical reasoning, and reflection (Amalia *et al*, 2021). This is also supported by the metacognition theory, which asserts that problem-based learning increases students' awareness of their own thinking processes, thereby enhancing their ability to formulate arguments, compare alternative solutions, and make data-driven decisions (Aminah, 2025). The results of this study align with previous studies that confirm that problem-solving-based student worksheets are effective in improving students' critical thinking skills. One such study shows that worksheets designed with a PBL approach can significantly enhance students' critical thinking skills by guiding them to explore real problems, collaborate, and make data-based decisions (Sukmawati, 2023).

CONCLUSION

The Influence of LKPD on critical thinking skills, as indicated by the independent t-test, shows that problem-solving-based LKPD media significantly improve students' critical thinking skills in fourth-grade science subjects at elementary schools/Islamic elementary schools. The pretest and posttest scores in the experimental class increased to a very high level. Meanwhile, the control class experienced an increase in the moderate category. This confirms that problem-solving-based LKPD is more effective than conventional methods in enhancing critical thinking skills.

Based on the media validity test, the LKPD is deemed feasible and valid according to the validation results from media, Material, and language experts. Large-scale trial results show that the LKPD is highly attractive and well-suited for students. This indicates that problem-solving-based LKPD is not only academically effective but also engaging and easy to use for teachers and students. All stages of the ADDIE development model were completed, with evaluations conducted at each stage to ensure that the product met needs and was effective.

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AUTHOR'S NOTE

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