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DEVELOPMENT OF LKPD BASED ON LOCAL WISDOM TO IMPROVE SCIENCE SKILLS PROCESSES AND CRITICAL THINKING ABILITIES OF STUDENTS

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Abstract

Science process skills and critical thinking abilities are very necessary for students in science learning, which is the task of educators to be able to train students in solving problems both in the learning process and in everyday life. This research is a Research and Development study which aims to develop LKPD based on local wisdom that is valid, practical and effective. Development of LKPD to improve students' science process skills and critical thinking abilities using the ADDIE (analyze, design, development, implementation and evaluation) model. The research subjects were students in class VIII B of SMPN 1 Bungku Pesisir. The results of the research show that the LKPD developed is very valid with a validity score on validator 1, namely 85.00% and validator 2, namely 92.50%, very practical with a practicality score of 92.42%, and quite effective for science process skills with a Cohen's d=13.65 while critical thinking skills average score was 84 are very effective with Cohen's d = 7.77.

Keywords: LKPD, local wisdom, critical thinking skills, science process skills

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Introduction

The rapid advancement of science and technology in the 21st century has significantly influenced science education. This era is characterized by the development of human thinking abilities across various aspects of life (Ahmad *et al.*, 2020). To align with these advancements and the characteristics of modern science education, it is essential to implement educational models that enhance science process skills and critical thinking abilities. One such model is problem-based learning (PBL), which places students in the role of active learners who solve problems and acquire investigative knowledge, thereby enabling them to grasp scientific concepts more effectively (Arifuddin *et al.*, 2020).

In the context of science education, students must develop a range of scientific skills, including observing, planning experiments, asking questions, formulating hypotheses, conducting experiments, drawing conclusions, and communicating findings. However, the current educational practices in many schools primarily focus on knowledge and understanding, often neglecting the application, analysis, synthesis, and evaluation aspects. This lack of emphasis on higher-order thinking skills (HOTS) leads to rote learning, which hinders the development of critical thinking abilities essential for students' success in life and work (Lakusa *et al.*, 2022).

Critical thinking is crucial as it helps students navigate and respond to the rapid changes brought about by scientific and technological advancements. It involves developing basic skills through engaging learning activities and diverse teaching methods tailored to the educational context and the students' developmental stages (Marudut *et al.*, 2020). In addition to critical thinking, science process skills are vital as they enable students to actively engage in discovering information, leading to a deeper understanding and application of knowledge (Kastawaningtyas & Martini, 2017; Fransiska *et al.*, 2018).

Despite the recognized importance of these skills, many existing student worksheets (LKPD) used in schools do not adequately support the development of critical thinking and science process skills. Sari *et al.* (2020) and Rosidi (2016) found that most LKPDs fail to engage students in activities that promote these skills, as they primarily consist of simple questions without encouraging observation and investigation.

To address these shortcomings, science learning must be designed to be engaging and capable of developing students' thinking abilities. Problem-based learning (PBL) is an effective model that stimulates higher-order thinking by presenting real-world problems, including those related to local wisdom (Rusman, 2012). Integrating local content into science education aligns with the 2013 Curriculum's emphasis on thematic and contextual learning, making science concepts more relatable and easier for students to understand (Fitriani *et al.*, 2019; Saputra *et al.*, 2016).

Innovative approaches are essential for teachers to improve the effectiveness of science education. Observations and needs analysis at SMP Negeri 1 Bungku Pesisir revealed that the existing LKPDs, which are not yet in book form and do not meet the criteria set by the Ministry of National Education (Depdiknas, 2006), are inadequate. These worksheets lack alignment with the applicable curriculum, appropriate assessment tools, and material organization based on basic competencies.

Given these issues, there is a clear need for LKPDs that incorporate local wisdom and employ the problem-based learning model. These LKPDs aim to enhance students' science process skills and critical thinking abilities, making it easier for them to understand scientific concepts and become more active in inquiry and problem-solving. Therefore, this study aims to determine the validity, practicality, and effectiveness of LKPDs based on local wisdom in improving science process skills and critical thinking abilities of students at SMP Negeri 1 Bungku Pesisir.

Methods

The type of research conducted is development research using the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). In this development research, the product generated is a student worksheet (LKPD) for the science subject on the topic of pressure. This research was carried out in December during the odd semester of the 2023/2024 academic year. The subjects of this research are the science teacher and all eighth-grade students at SMP Negeri 1 Bungku Pesisir, consisting of 30 students from class VIIIA consisting of 12 male and 18 female and 30 students from class VIIIB consisting of 14 male and 16 female. All subjects in this study were an average of 14 years old. The subjects used a local wisdom-based LKPD on the topic of pressure, with classroom learning employing a problem-based learning model. The learning was conducted over three meetings, discussing the material on pressure of substances and its applications in daily life.

The research procedure follows the product development procedure with the ADDIE model adapted from (Branch, 2010). The research procedure is as follows:

Analysis

The first stage of this analysis involved observation during the science learning process and interviews with the subject teachers, based on the researcher's findings that there was a lack of development in the use of LKPD (student worksheets) in science learning. Subsequently, the material analysis stage was conducted by observing the lesson plans (RPP) used, ensuring that the material in the developed learning tools aligns with the learning indicators that students must achieve. This analysis was based on observations and the researcher's experiences with eighth-grade classes at SMP Negeri 1 Bungku Pesisir.

Design

The second stage of the ADDIE model is the design phase, which involves designing or planning the product according to the needs of the students and the learning material. The product designed is a local wisdom-based learning tool using the Problem Based Learning model. The design of the local wisdom-based learning tool using the Problem Based Learning model includes:

- Development focused on LKPD (student worksheets)
- Material: "Pressure of substances and their application in daily life"
- Printed media format
- Written in Indonesian combined with local languages

Development

The third stage in this development process is the further development phase of the previously produced product, which involves adapting the learning tools to the LKPD product. In this stage, the product is analyzed using specially designed instruments for validation sheets. This validation is conducted by media experts and subject matter experts. After the validation test, revisions are made based on the evaluation results. Several aspects of the LKPD that were developed include:

1) Design Specifications: Previously, no local wisdom-based LKPD oriented towards the Problem-Based Learning (PBL) model covering the material on the pressure of substances and their application in daily life existed at SMP Negeri 1 Bungku Pesisir. The developed LKPD is designed with a more appealing appearance for students.
2) Content Aspects: The LKPD includes various essential elements such as the title, subject, semester, location, learning instructions, competencies to be achieved, indicators, supporting information, tasks, steps, and assessment.
3) LKPD Validation: The LKPD is validated by experts available at the postgraduate program of Untad. Validators perform product validation by completing the provided questionnaires. Validators are also asked to provide feedback to improve the quality of the developed product as a basis for product trials with students.

Implementation

The fourth stage in this process is the implementation of the developed product design. This development product is directly applied in the learning process of eighth-grade classes at SMP Negeri 1 Bungku Pesisir. The aim is to review the responses of students and science teachers to the product and evaluate the learning outcomes after using the product to achieve the desired research objectives. The researcher acts as an observer with the help of the classroom teacher in the implementation of the development product. Subsequently, science teachers and students are asked to complete questionnaires to gauge their responses to the developed LKPD. In this stage, the trial subject's complete evaluation questionnaires on the product, resulting in quantitative data being obtained.

Evaluation

The fifth stage, Evaluation, involves obtaining feedback from various parties on the developed LKPD. To gather user responses, questionnaires are distributed to science teachers and students. Suggestions and feedback from the science teachers and students are analyzed and used for further revisions, resulting in a final product suitable for use in the learning process of eighth-grade classes at SMP Negeri 1 Bungku Pesisir.

Data Collection

During the data collection stage, data are gathered using research instruments. Two instruments are utilized in this study. The first instrument comprises learning tools, including the syllabus, lesson plans (RPP), and student worksheets (LKPD). The second instrument supports the research and includes expert validation questionnaires to assess product development on Likert scale (1-5), questionnaires to determine the practicality of the developed LKPD, and observation sheets used by teachers during the learning process to measure students' science process assessed on a Likert scale (1-5) with 14 statement items. Written tests are used to measure students' critical thinking abilities, utilizing 5 essay questions. These tests include a pre-test to determine the initial critical thinking abilities of students before the LKPD treatment and a post-test to assess the final critical thinking abilities of students after the LKPD treatment.

Data Analysis

Once the research data are collected, data analysis is conducted based on the validity, practicality, and effectiveness of the learning tools, as described below:

1) Validity Analysis: Validation sheets assessed by experts are analyzed to determine the validity level of the developed LKPD, calculated based on observable descriptors and compared according to validity categories.
2) Practicality Analysis: Data from the questionnaire sheets given to teachers and students are analyzed to measure the practicality of the developed LKPD. The questionnaire data are calculated based on observable descriptors. The data from the questionnaires are calculated based on the descriptors shown in Table 2.
3) Effectiveness Analysis: The effectiveness analysis of the implemented LKPD to enhance students' science process. Analysis of the effectiveness of implementing LKPD to improve students' science processes obtained through measuring the average percentage of assessments (Cohen, 1988).

The effectiveness of the developed learning tools is analyzed using effect size tests. The effect size test provides an overview of score improvements between pre-test and post-test treatments. Statistical software was used for this testing with the classification of effect size. The effectiveness of the learning tools was determined from essay test data on critical thinking skills. The effectiveness of the learning tools regarding science process skills was analyzed from observation sheet data.

Results and Discussion

This research aims to produce a product in the form of local wisdom-based LKPD using a problem-based learning model for the topic of substance pressure and its application in daily life. Before proceeding to the ADDIE development stages, the instruments to be used were first validated by validators. The purpose of instrument validation is to determine and measure the validity and feasibility of the instruments to be used in the learning process. The results of the instrument validation are presented in Table 1, and the suggestions and results of the instrument improvements are presented in Table 2.

Table 1. Result of validation instruments

Instruments	Description	Validator 1	Validator 2
Lesson Plan (RPP)	Total Score	75	80
	Mean	4,41	4,71
	Percentage (%)	88,24	94,12
	Interpretation	**Very Valid**	**Very Valid**
Science Process Skills Observation Sheet	Total Score	75	80
	Mean	4,41	4,71
	Percentage (%)	88,24	94,12
	Interpretation	**Valid**	**Very Valid**
Critical Thinking Skills Test	Total Score	40	45
	Mean	4,0	4,5
	Percentage (%)	80	90
	Interpretation	**Valid**	**Very Valid**

The first validation process conducted was the validation of the lesson plans (RPP). There are three (3) aspects of evaluation in the RPP validation: the RPP format, learning activities, and the language used in writing the RPP. The RPP format evaluation aims to assess the conformity of the RPP format used with the applicable curriculum and the alignment of the learning steps in the RPP with the problem-based learning model. Based on the validation results conducted by two validators, the validated RPP falls into the "very valid" category.

Next, the validation of the science process skills observation sheet was conducted. The observation sheet for science process skills consists of 14 assessment indicators, including identifying tools and materials, using senses, searching for information, classifying tools and materials, posing questions and solutions, summarizing experimental results, presenting discussion results, making hypotheses, searching for theories, providing evidence, linking data and experimental results, seeking supporting references for conclusions, selecting appropriate theories, and drawing conclusions. The validation results showed that the observation sheet for science process skills was considered "valid" by Validator 1 and "very valid" by Validator 2.

Table 2. Recommendations and improvements

Aspect	Improvement Suggestions	Improvement Results
Lesson Plan (RPP)	• Adapted to PBL syntax in designing lesson plans • The learning objectives at the second meeting are adjusted to the indicators	• Has been adapted to the PBL model in designing the lesson plan • The learning objectives at the second meeting have been adjusted to the indicators
Science Process Skills Observation Sheet	• Adapted to PBL syntax in designing lesson plans	• Has been adapted to the PBL model in designing the lesson plan
Critical Thinking Skills Test	• Adapt indicators of critical thinking skills to learning experiences as part of the curriculum bill	• Has been adjusted to critical thinking indicators and curriculum bills in accordance with the syllabus

Subsequently, the critical thinking skills test was validated. The critical thinking skills test consists of five essay questions covering several critical thinking indicators, such as analyzing arguments, making inductions and considering induction results, adjusting to sources deciding on an action, and identifying an action. The validation results indicated that the test was considered "valid" by Validator 1 and "very valid" by Validator 2.

In this study, the instruments used were validated by expert validators. This research employs the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation

Analysis

At this stage, curriculum analysis, student analysis, material analysis, and learning objectives analysis were conducted. This analysis aims to identify the fundamental issues necessary as a reference and consideration for the development of the LKPD product.

(1) ***Curriculum analysis***

The curriculum analysis was conducted by reviewing the curriculum documents of SMPN 1 Bungku Pesisir. The curriculum used for eighth-grade classes is the 2013 curriculum.

(2) ***Student analysis***

The results of the analysis of the characteristics of the ninth-grade students at SMPN 1 Bungku Pesisir are presented in Table 3.

Table 3. Results of the student characteristics analysis

Indicator	Result Analysis
Characteristic	• Student learning outcomes are low • Student learning motivation is low • Interest in learning is still low • Problem solving skills are lacking • Less active in the learning process
Content Material	• Students are less interested in taking science lessons related to physics material • Students tend to find physics lessons difficult, one of which is material about pressure
Learning Style	• Students are happier when learning by doing practicums

(3) ***Material Analysis***

Material analysis was conducted by examining the curriculum and syllabus used, ensuring that the materials included in the developed LKPD align with the learning outcomes that students need to achieve. The results of the material analysis can be seen in Table 4.

Table 4. Results of teaching material analysis

No	Result Analysis
1	In class VIII, there are several materials that make it possible to develop LKPD based on local wisdom with a problem-based learning model, namely material Pressure, vibrations and waves and Optics.
2	The material on pressure of substances and its application in everyday life is suitable for use in developing local wisdom-based LKPD
3	Material Pressure of substances and its application in everyday life is suitable for use in problem-based learning
4	The material Pressure of substances and its application in everyday life has sub-topics that make it possible to train students' scientific process skills and critical thinking

Design

The initial design of the LKPD product, which integrates local wisdom using a problem-based learning model, has been planned. The LKPD is structured into three main sections: the introduction, the main content, and the conclusion.

1) Introduction: The introduction section of the LKPD consists of the cover page, preface, table of contents, concept map, steps of the problem-based learning model, syllabus, core competencies, basic competencies, competency achievement indicators, learning objectives, and usage instructions.
2) Main Content: The main content of the LKPD is divided into: LKPD 1: Solid pressure; LKPD 2: Hydrostatic pressure; LKPD 3: Gas pressure
3) Conclusion: The conclusion section contains practice questions and a bibliography.

Development

This stage is a continuation of the design phase to produce an LKPD that incorporates local wisdom using a problem-based learning model for the topic of pressure and its application in everyday life. The outcomes of this stage are as follows:

(1) ***LKPD validation***

The LKPD was validated by expert validators. The purpose of this validation is to measure and evaluate the validity of the developed product. The validation instrument used a mean validity scale. The results of the LKPD validation analysis can be seen in Table 5.

Table 5. Result of Validation Instruments

Description	Validator 1	Validator 2
Total Score	136	148
Mean	4,25	4,63
Percentage (%)	85,00	92,50
Interpretation	**Very Valid**	**Very Valid**

Recommendations and improvements were made to the LKPD to enhance its relevance and effectiveness. One key suggestion for improvement was to direct the LKPD questions towards topics related to local wisdom. Following this suggestion, the questions were adjusted to focus more on local wisdom, ensuring that the LKPD content is more relevant and engaging for the students.

After being assessed by the advisor, the LKPD underwent necessary revisions and improvements. Subsequently, the validation stage was conducted by two validators, resulting in a classification of highly valid. Despite this, further adjustments were made based on the feedback provided by the validators, ensuring the LKPD's effectiveness and alignment with educational goals.

(2) ***Teacher assessment***

The next step involves the assessment of the LKPD by three science teachers. This evaluation aims to determine the suitability of the LKPD for teaching purposes. The results of the evaluation conducted by the teachers can be seen in Table 6.

Table 6. Teacher assessment analysis result

Description	Evaluator 1	Evaluator 2	Evaluator 3
Total Score	39	39	37
Mean	3,90	3,90	3,70
Percentage (%)	97,50	97,50	92,50
Interpretation	**Suitable for use**	**Suitable for use**	**Suitable for use**

(3) ***Individual and small group testing***

Individual testing was conducted by 5 students, while small group testing involved 15 students. The analysis of individual and small group testing results can be seen in Table 7.

Table 7. Individual and small group test analysis results

Test	Description	Result

Individual	Total Score	192
	Mean	3,72
	Percentage (%)	93,06
	Interpretation	**Suitable for use**
Small Group	Total Score	554
	Mean	3,69
	Percentage (%)	92,33
	Interpretation	**Suitable for use**

Implementation

The developed LKPD based on local wisdom with a problem-based learning model on the topic of pressure of substances, aimed at enhancing scientific process skills and critical thinking, has been validated by experts. Subsequently, it entered the next phase, which involved implementing the LKPD product tested with a group of students. This pilot study was carried out in class VIII B. Students engaged in learning activities using the developed product.

(1) ***Practicality of LKPD***

The practicality of the LKPD was assessed based on feedback from teachers during the classroom implementation process. The results of the practicality assessment of the LKPD are presented in Table 8.

Table 8. The practicality of LKPD result

Aspect	Score	Category
• Knowledge Construction	3,66	Practical
• Design	3,50	Practical
• Language	4,00	Practical
• PBL Activities	3,66	Practical
Conclusion	**3,71**	**Practical**

The practicality of the LKPD can be observed from the questionnaire responses of teachers regarding the product after the learning activities using the developed LKPD were conducted. Based on the analysis of teacher responses, an average score of 3.71 was obtained, indicating a practical category. Overall, this demonstrates that the problem-based learning model with local wisdom-based LKPD is practical for use in teaching. The questionnaire on teacher responses to the product covers four aspects: knowledge construction, design, language, and problem-based learning activities.

(2) ***The Effectiveness of LKPD***

The effectiveness of the LKPD is measured through the results of observing students' science process skills and pre-test and post-test scores for critical thinking skills.

(a) *Science process skills*

Students' science process skills are assessed using an observation sheet with 14 evaluation aspects, covering 5 indicators of science processes. The observation sheet used has been validated by expert validators. Assessment of science process skills is conducted before and after the treatment, averaged over three sessions. The data on students' science process skills can be seen in Table 9.

From the data analysis shown, it is evident that there is a significant increase in science process skills scores between the pretest and posttest. The study sample consisted of 30 students. The average pretest score was 42.3, while the average posttest score increased to 77.5. The ideal score for both tests is 100. The t-test results show a significance (Sig 2-tailed) of 0.000, indicating that the difference between the pretest and posttest is statistically significant. Additionally, the Cohen's d value of 13.65 indicates a huge effect of the intervention.

Table 9. Result of science process skills

Indicators	Score	
	Pretest	**Posttest**
Observation	1.73	3.04
Classification	1.68	3.05
Communication	1.59	3.25
Hypothesize	1.68	3.22
Conclusion	1.78	2.95

This is further supported by the effectiveness test of the local wisdom-based LKPD in improving science process skills shown in Table 11. The use of the problem-based learning model with local wisdom-based LKPD on the topic of pressure substances has led to significant improvements across the 5 science process indicators over the first, second, and third sessions. These improvements include students' ability to formulate concepts, theories, principles, laws, facts, and their capability to provide proofs.

Science process skills are commonly applied from secondary school levels to higher education, respecting the cognitive, affective, and psychomotor domains. In the cognitive domain, students engage their thinking abilities in mastering science process skills. In the affective domain, collaboration and discussion among students are crucial in task completion. In the psychomotor domain, students are required to proficiently handle tools and materials. Training students in science process skills necessitates appropriate methods, such as practical activities or experiments. Practical activities serve as excellent means to develop students' senses, thereby achieving science learning objectives (Samputri, 2020).

Designing an experiment in learning requires LKPD or LKS. According to Yaumi (2018), LKPD, which stands for Student Worksheets, is used by teachers as a tool to facilitate the learning process, providing a series of tasks for students to work on independently. In this research, tasks within LKPD are assigned to students, evaluated by researchers, and returned to them for understanding their strengths and weaknesses in their work. Therefore, LKPD can also be considered a learning resource for students. Worksheets provided by teachers serve to monitor students' mastery of the material. LKPD is designed to assist teachers in facilitating students' abilities. Its use is expected to develop and refine the concepts presented to students. Consequently, students who struggle with understanding can receive appropriate guidance from teachers. LKPD utilizes the problem-based learning (PBL) model, focusing solely on student activities. PBL is a learning model that introduces real-world problems to students, serving as both a source and a means of learning, aiming to enhance scientific process skills and problem-solving abilities, without neglecting the knowledge or concepts that are the learning objectives (Palennari, 2018).

In this study, the researcher employed the PBL learning model to help students actively and independently develop their thinking and problem-solving skills through data collection, thereby deriving rational solutions to address issues. Learning that presents real-world problems (contextual) can utilize a local wisdom-based learning model. The conducive learning environment for science education varies, but from one perspective, such as the contextual perspective, students would benefit from optimizing local wisdom. Regarding the role of the environment in education, it is recognized that both the physical (natural) and socio-cultural environments harbor various potentials that can be explored and developed to support science education. From the socio-cultural perspective, communities possess technological traditions, lifestyles, and life values that have been passed down through generations (Azizahwati, 2015).

From the explanation above, the researcher developed LKPD based on local wisdom. The LKPD developed by the researcher incorporates local wisdom found in the coastal areas of Bungku Pesisir Subdistrict, specifically focusing on the practices of the majority fishing community. Consequently, the researcher developed LKPD 1 on the local wisdom of boat craftsmen or the boat-making process, LKPD 2 on the local wisdom of fishermen diving to harvest sea cucumbers, and LKPD 3 on the local wisdom found in Morowali, specifically the production activities at the PT IMIP factory, given Morowali's reputation as an industrial area.

Developing LKPD based on local wisdom makes the material more relevant and contextual for students. When implemented in the PBL model, where students are confronted with real-world problems to solve, this local context provides a richer and more meaningful background, facilitating students' understanding of scientific concepts. Using local wisdom in LKPD can enhance students' motivation and engagement. They feel that learning is closer to their daily lives and culture, thereby being more motivated to actively participate in PBL activities. This high level of engagement contributes to a deeper understanding of scientific concepts. The PBL model encourages students to think critically and creatively in problem-solving. When LKPD based on local wisdom is used, students are encouraged to solve problems relevant to their cultural and environmental contexts. This not only improves their problem-solving skills but also provides opportunities to apply scientific knowledge in real-world contexts.

By utilizing local wisdom, LKPD can tap into local resources such as plants, animals, natural phenomena, or traditional technologies. PBL based on local resources allows students to learn science directly through exploration and experimentation, enhancing conceptual understanding and practical skills. This approach helps strengthen students' cultural identity. By understanding and appreciating local wisdom in the context of science, students can see the relationship between their culture and science, which in turn can enhance pride and appreciation for their own culture.

In conclusion, LKPD based on local wisdom in the PBL model provides various benefits in the science learning process. Integrating local wisdom makes learning more relevant and meaningful, enhances student motivation and engagement, and develops critical thinking and problem-solving skills. Moreover, this approach also strengthens cultural identity and fosters collaboration among students. Therefore, this combination can significantly improve students' scientific process skills. These findings align with the research of Sriyati *et al.* (2021), which concluded that developing biology learning tools based on local potential can enhance scientific process skills.

(b) ***Critical thinking skills***

Students' critical thinking skills were measured based on the results of pretests and posttests. The test questions consisted of five essay questions covering five indicators of critical thinking. The results of the pretest and posttest data on critical thinking skills can be seen in Table 7, while the results of the difference test and effect size test are presented in Table 10.

Table 10. Result of critical thinking skill score

Indicators	Scorer	
	Pretest	Posttest
Provide a Simple Explanation	26.27	94.17
Conclude	6.67	75.73
Building Basic Skills	22.5	93.33
Setting Strategy and Tactics	4.17	75.83
Make Further Explanations	30.83	91.67

Based on the data analysis presented in Table 12, it is evident that there is a significant increase in critical thinking skills scores between the pretest and posttest. The study sample consisted of 30 students. The average pretest score was 14, while the average posttest score increased to 84. The ideal score for both tests is 100. The T-test results show a significance (Sig 2-tailed) of 0.000, indicating that the difference between the pretest and posttest is statistically significant. Additionally, the Cohen's D value of 7.77 indicates a huge effect of the intervention.

Critical thinking skills are crucial for students to navigate changing circumstances and challenges in an ever-evolving life. Enhancing critical thinking through school-based learning efforts not only improves the quality of national education in Indonesia but also prepares students for the competitive globalization era. Thinking is a mental activity experienced when individuals confront problems or situations that require resolution. Essentially, critical thinking encompasses two aspects: disposition and ability. Disposition reflects the willingness to solve problems, while ability demonstrates one's capability to solve them. These aspects involve affective and psychomotor domains, respectively, and are closely interrelated.

Critical thinking demands rigorous effort to scrutinize every assumption or assumptive knowledge based on supporting evidence and ensuing conclusions. It is a complex thinking ability where individuals solve problems, make decisions, and grasp new concepts through reasoning and reflective thinking grounded in credible evidence and logic (Irawan *et al*, 2017). According to Pierce and Associates cited by Desmita (2014), several characteristics are essential for critical thinking: (1) the ability to draw conclusions from observations; (2) identifying assumptions; (3) deductive reasoning; (4) making logical interpretations; and (5) evaluating weak and strong arguments.

Improvement in students' critical thinking can be observed when they master these skills articulated by Pierce and Associates. Achieving these skills requires practical learning experiences. Practical learning in schools often involves student worksheets (LKPD) or student work sheets (LKS). Structured LKPD is designed to guide students through the learning process, whether independently or with teacher guidance. Structured LKPD provides instructions, information, examples, and tasks for students. However, LKPD does not replace the role of teachers in classroom teaching. Teachers play a critical role in supervision, guidance, and motivation for students. Examples of structured LKPD include conventional worksheets (booklet/sheets) and interactive worksheets (used with software). On the other hand, unstructured LKPD contains materials, whether explained or not by teachers, to help students review and better understand the subject matter. This accelerates the learning process and guides students through required activities. Student worksheets also encourage active thinking to solve problems related to learning materials (Umbaryati, 2016).

In the process of learning, utilizing problem based learning (PBL) models with the aim of problem solving is highly beneficial. The primary goal of Problem Based Learning extends beyond mere knowledge transmission to students; it focuses on developing critical thinking and problem-solving skills, fostering learner autonomy, and enhancing social skills through group collaboration in identifying issues, strategies, and relevant learning resources to solve problems. Thus, PBL aims to cultivate and develop learning across three domains: cognitive (problem-solving encourages students to apply existing foundational knowledge), psychomotor (training students in problem-solving skills), and affective (developing personal character through group interactions in problem-solving) (Arifin, 2021).

LKPD based on local wisdom presents relevant and contextual problems that resonate with students' daily lives. In the PBL model, students are challenged to solve real-world problems related to local wisdom that they are familiar with. This relevance motivates students to approach problem-solving more seriously and critically, as these problems directly impact their lives.

When students are confronted with problems related to local wisdom, they feel more connected and motivated to delve deeper. This heightened motivation prompts students to engage in critical thinking by analyzing problems, considering various perspectives, and seeking the most effective and relevant solutions.

Local wisdom often encompasses knowledge and practices that have stood the test of time. In PBL, students are encouraged to use this knowledge as a basis for problem analysis. This process develops their ability to identify, evaluate, and integrate information from various sources, including traditional and scientific knowledge, which are crucial aspects of critical thinking skills.

The PBL model promotes group work and collaborative discussions. When students work in groups to solve problems based on local wisdom, they share knowledge, opinions, and experiences. These discussions facilitate the development of critical thinking skills, as students must consider and evaluate various arguments, formulate their own arguments, and engage in constructive debates.

It is also consistent with previous research conducted by Arfika *et al.* (2020) on LKPD in science based on local wisdom aimed at enhancing critical thinking skills of eighth-grade junior high school students, which was deemed suitable for use in science learning. Similarly, Nurhayati *et al.* (2022) aimed to produce LKPD based on the cultural values of Bojonegoro batik motifs to enhance critical thinking skills. Their findings indicated that (1) the Student Activity Sheet developed was highly valid, (2) it was practical based on the implementation of lesson plans categorized as excellent, with student activities relevant to the learning process, and (3) it was effective based on critical thinking test results. The N-gain calculation also showed high categories, and student learning completeness also increased. The conclusion drawn from this research is that LKPD based on the local cultural values of Bojonegoro batik motifs is suitable for enhancing critical thinking skills among elementary school students.

Problem-based learning (PBL) encourages students not only to find solutions but also to evaluate the effectiveness of these solutions and reflect on the processes they undertake. With problems based on local wisdom, students can critically evaluate solutions to determine their contextual relevance, effectiveness, and practical applicability in their lives. Issues related to local wisdom often evoke high emotional and cognitive involvement from students. When students feel they are contributing to the preservation and utilization of local knowledge, they are more likely to engage deeply in the problem-solving process, thereby enhancing their critical thinking skills.

PBL based on local wisdom allows students to see real-world applications of scientific concepts and local knowledge in problem-solving. This experience teaches students to critically analyze how theories are applied in practice and how solutions can be adapted and implemented in real-world contexts. In PBL, students are prompted to think about their thinking processes, known as metacognition. With local wisdom as the context, students can reflect on their own problem-solving processes, consider the strengths and weaknesses of their approaches, and develop better critical thinking strategies for the future.

Using LKPD based on local wisdom in the PBL model can significantly enhance students' critical thinking skills. The relevance and contextualization of problems, higher motivation, use of local knowledge, collaborative learning, and real-world application all contribute to the development of critical thinking skills. This process not only helps students understand and solve problems more effectively but also prepares them to be critical thinkers capable of facing challenges in broader contexts.

Evaluation

The final stage of developing this LKPD involves conducting an evaluation to assess the feasibility of the local wisdom-based LKPD on the topic of pressure and its application in daily life for students. The questionnaire consisted of 10 items to gauge participant responses. The success of this LKPD development is measured by the feedback provided by the students through the completed questionnaires. The results of the student response questionnaire analysis can be seen in Table 11.

Table 11. Results of student response questionnaire analysis

Description	Result
Total Score	1109
Mean	3,70
Percentage (%)	92,42

Based on Table 11 above, the average score of student responses obtained was 3.70, with a percentage of 92.42%. This indicates that the score falls within the practical category, ranging from 3.41 to 4.20. This demonstrates that the local wisdom-based LKPD on the topic of pressure and its practical application in daily life is effectively utilized in learning.

Conclusions

Based on the research findings, it can be concluded that the local wisdom-based LKPD aimed at enhancing scientific process skills and critical thinking abilities of students at SMPN 1 Bungku Pesisir has a feasibility percentage of 92.50%, classified as highly valid. From the analysis of teacher response questionnaires, this LKPD obtained an average score of 3.71, categorized as practical. Moreover, the locally-based LKPD developed proves to be effective in enhancing students' scientific process skills at SMPN 1 Bungku Pesisir, as indicated by the achievement percentage in the first meeting at 72.14%, the second meeting at 78.39%, and the third meeting at 81.85%, all classified as very high. Furthermore, this LKPD is also effective for science process skills with a Cohen's d score was 13.65 while critical thinking skills are very effective with Cohen's d score 7.77.

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Conflict of interest

The authors declares that there is no conflict of interest in this research. All parties involved have given their consent and contributed without any bias or influence that could affect the research results.

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