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Development of Problem-Based Physics Learning Tools: Evaluation of Validity and Practicality

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Abstract
This research aims to develop a valid and practical problem-based learning tool for the Independent Curriculum in Physics. The type of research used is Research and Development (R&D) with a 4D development design, consisting of the stages: define, design, develop, and disseminate. The development stage includes creating the learning tool, validation, and practicality testing. Three validators conducted validation testing to assess the learning tool. Practicality testing was carried out to obtain responses from students and teachers and evaluate the learning process's feasibility. The study involved 18 students from class XI Science 1 at a school in the Pringgabaya district as trial subjects. Data collection techniques included validation questionnaires, teacher responses, student responses, and learning feasibility sheets. Data analysis was performed using Aiken's V validity index. The validation test results showed that the learning tool had an average validation score in the "very valid" category, with a validity index > 0.8. The practicality test results included an average student response of 96.39% in the "practical" category, a teacher response of 92.95% in the "practical" category, and the feasibility of the learning process had an average percentage of 88.88% across three learning activities. Therefore, it can be concluded that the problem-based Physics learning tool is valid and practical.

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INTRODUCTION

Education is of paramount importance in every individual's life and in the development of nations worldwide. It is a fundamental necessity for every human being, as education enables individuals to continuously learn and comprehend various issues, ultimately achieving personal goals and well-being (Triwiyanto, 2021). The curriculum serves as the "soul" of education, which must be evaluated innovatively, dynamically, and periodically following the advancements in science and technology, as well as the competencies required by society and the users of graduates (Wati et al., 2023). From a learning perspective, the curriculum is a set of plans that include objectives, content, instructional materials, and methods used as guidelines for organizing learning activities to achieve specific educational goals. In the Merdeka Curriculum, there exists the character of the Pancasila Student Profile, which aims to instill values in the current generation, such as faith and devotion to God Almighty, noble character, global diversity, cooperation, independence, creativity, and critical thinking. These six profiles embody the values of Pancasila, which is the foundation of the Indonesian state (Triwiyanto, 2021).

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However, physics education in Indonesia continues to face various challenges. One of the primary challenges is the low level of scientific process skills and learning outcomes among students. Scientific process skills refer to students' abilities to conduct scientific investigations, such as formulating problems, designing experiments, collecting and analyzing data, and drawing conclusions (Putri, 2024). According to Rahman (2022), these skills are crucial as they train students to think critically, creatively, and independently. The low levels of scientific process skills and learning outcomes in physics education can be attributed to several factors: (1) Traditional teacher-centered approaches still dominate physics instruction. Teachers tend to deliver material in a one-way manner, while students merely act as passive recipients of information. This results in students being less active in the learning process and inadequately trained to develop scientific process skills. (2) There is a lack of innovative and engaging learning media. The media used is often limited to textbooks and student worksheets (Prasetyo & Nurhadi, 2020), rendering physics education less engaging and monotonous for students (Sari, 2021). Consequently, students are less motivated and less involved in the learning process. (3) There is a scarcity of quality learning resources. Textbooks and other learning materials often do not align with the latest developments in science and technology (Permendikbud, 2020). Furthermore, the available learning resources frequently lack relevance to students' life contexts (Permendikbud, 2020), making it difficult for students to understand and apply physics concepts in everyday life. (4) There is a lack of professionalism among physics teachers. Teachers often do not possess adequate knowledge and skills in teaching physics, which hampers their ability to design effective and engaging learning experiences. Additionally, teachers may struggle to provide constructive feedback to students (Susanti, 2023).

Based on interviews with a physics teacher at a school in the Pringgabaya district, it was found that students tend to be passive during lessons, often not responding when the teacher asks questions or explains material. Furthermore, the teacher rarely implements the Problem-Based Learning (PBL) model and does not assess students' psychomotor skills. Instead, the teaching model employed is conventional, primarily consisting of lectures, discussions, and note-taking of material read by the teacher. The teacher also indicated an imbalance in physics education regarding achieving cognitive goals and students' scientific process skills. This imbalance contributes to suboptimal learning outcomes and scientific process skills among students. Additionally, teachers have not fully grasped the preparation of teaching modules for the Merdeka Curriculum, leading the majority to download teaching modules from the internet, the accuracy of which is uncertain.

To address these issues, efforts are needed to enhance the quality of physics education. One effective approach is to develop problem-based physics learning devices. Problem-Based Learning (PBL) is a student-centered instructional approach (Hidayat, 2023). In PBL, students learn by solving authentic problems relevant to their contexts. PBL can enhance students' scientific process skills as they are required to engage in learning actively. Students must formulate problems, design experiments, collect and analyze data, and draw conclusions (Hidayat, 2023). Moreover, PBL can also increase students' motivation to learn, as they feel involved in the learning process and perceive physics education as relevant (Dwiyanti & Rosana, 2020).

One of the essential learning devices needed in schools today is a Teaching Module or lesson plan based on the curriculum aimed at achieving the established competency standards (Maylitha et al., 2023). Teaching modules are crucial in supporting teachers in designing lessons (Maylitha et al., 2023). Teachers play a vital role in preparing learning devices, as they are encouraged to enhance their thinking skills to innovate in teaching modules. Therefore, creating teaching modules is a pedagogical competency that teachers must develop, ensuring that their teaching techniques in the classroom are more effective, efficient, and aligned with achievement indicators.

Ideally, teachers should prepare teaching modules to the fullest extent; however, in reality, many teachers do not fully understand the techniques for preparing and developing teaching modules, especially within the context of the Merdeka Curriculum. The learning process that does not adequately plan teaching modules will likely result in a non-systematic delivery of content to students, leading to an imbalance in the learning experience between teachers and students. It can be expected that only the teacher is active, or conversely, the learning may seem less engaging due to the teacher's inadequate preparation of teaching modules (Maulida, 2022). This teaching module can be combined with one of the active learning models, namely Problem-Based Learning (PBL).

The learning process in PBL focuses on students' active investigation of the problems presented. This allows them to develop critical, analytical, and collaborative thinking skills as they seek solutions to their challenges. During the investigation, the teacher is a facilitator, providing guidance and support to students while supplying the necessary resources to enhance their learning (Rizaldi & Syahwin, 2023). Students are expected to collaborate in groups, share ideas, and support one another in solving complex physics problems (Astutik, 2021). PBL also emphasizes the importance of reflection and evaluation. Students are encouraged to reflect on their learning processes, identify their strengths and weaknesses in problem-solving, and evaluate the solutions they propose (Ridwan et al., 2021). Evaluation is conducted through various methods, including tests, projects, presentations, and formative assessments. The results of these evaluations provide insights into students' achievements and form the basis for providing constructive feedback to enhance future learning (Fitriyani & Suparwoto, 2021).

Revising and continuously improving teaching modules is essential to ensure alignment with student's needs and the advancements in curriculum and learning technology. This involves updating learning materials, integrating relevant technology, and adjusting teaching strategies based on student feedback and evaluation results (Penyangga & Student, 2022). Thus, developing physics teaching modules using the PBL model aims to improve students' cognitive learning outcomes, cultivate relevant skills, and prepare them to face future challenges holistically and sustainably. This research aims to develop a valid and practical problem-based physics teaching module. The development of the physics teaching module using the PBL approach responds to the demands of a curriculum that increasingly emphasizes the development of process skills and the application of concepts in real-world contexts. Learning that adopts the PBL approach can provide a more comprehensive and contextual learning experience for students, thereby fostering a more profound understanding and the development of relevant skills. Consequently, developing physics teaching modules using the PBL approach is an essential solution and an urgent necessity to enhance the quality of physics education in senior high schools (SMA/MA) to prepare students for future challenges.

RESEARCH METHOD

The type of research employed in this study is Research and Development (R&D). The research procedure follows the 4D development model, which consists of four main stages: define, design, develop, and disseminate. The development stage analyzes the developed product through validity and practicality testing.

The validity test, or expert assessment, aims to produce a valid product based on expert evaluations before conducting field trials. This validity test is carried out using the assessment results from validators to determine the validity of the learning devices, which include the teaching module, student worksheets (LKPD), learning outcome test instruments, and the KPS questionnaire that have been developed. Data collection techniques utilize validation questionnaires. The analysis process employs Aiken's V formula. Validity is determined based on Table 1:

Table 1. Validity Levels of the Teaching Module

Value Range	Validity Level
$V \geq 0.4$	Less valid
$0.4 > V < 0.8$	Valid
$V \geq 0.8$	Very valid

(Source: Aiken, 1997)

The practicality test aims to obtain direct feedback in the form of responses from both students and teachers regarding the developed learning devices. The subjects for the practicality test are 18 students from class XI at a school in the Pringgabaya district. The data collection techniques include observation sheets for implementing learning, teacher response questionnaires, and student response questionnaires. The observation sheets for implementing learning, teacher responses, and student responses are analyzed using percentage methods. The criteria for practicality are presented in Table 2:

Table 2. Practicality Criteria

Practicality Percentage	Practicality Level
75.01 – 100	Practical
50.01 – 75.00	Fairly practical
25.01 – 50.00	Less practical
≤ 25.00	Impractical

(Source: Marisa et al., 2020)

RESULT AND DISCUSSION

This research produced a physics learning device, including a teaching module, student worksheets (LKPD), learning outcome test instruments, and a KPS questionnaire. These learning devices have been developed, implemented, and trialed with students.

Results of the Validity Test

The validity test aims to obtain expert feedback regarding the developed product's quality. The critiques and suggestions provided by the experts regarding the weaknesses and shortcomings of the teaching module will serve as a basis for further refinement, ensuring its validity for use in education. Below is a summary of the validity results for the learning devices:

Table 3. Results of the ATP Validity Test

No	Component	Aiken's V Index	Description
1	Content Feasibility	0.824	Very Valid
2	Presentation Feasibility	0.806	Very Valid
3	Language Feasibility	0.833	Very Valid

Table 3 indicates that the content feasibility aspect received an index of 0.824, the presentation feasibility was 0.806, and the language feasibility reached 0.833. All components fall within the Very Valid category, indicating that the ATP has substantially met the validity criteria. These values suggest that the ATP is systematically presented with clear and easily understandable language.

Table 4. Results of the Teaching Module Validity Test

No	Component	Aiken's V Index	Description
1	Content Feasibility	0.844	Very Valid
2	Presentation Feasibility	0.847	Very Valid
3	Language Feasibility	1.000	Very Valid

Table 4 presents the detailed results of the validity analysis conducted on the Teaching Module. The analysis covers three key aspects: content feasibility, presentation feasibility, and language feasibility. The content feasibility aspect demonstrates a strong validity level with an Aiken's V index of 0.844, indicating that the instructional material is well-structured and aligned with the intended learning objectives. Similarly, the presentation feasibility aspect achieves an Aiken's V index of 0.847, suggesting that the module is effectively organized, visually coherent, and pedagogically suitable for learners. Notably, the language feasibility aspect attains a perfect score of 1.000, signifying that the instructional language used in the module is entirely clear, unambiguous, and comprehensible for the target audience. Based on these findings, all assessed components fall into the category of very valid, which strongly supports the conclusion that the teaching module successfully meets the established validity criteria, making it a reliable and high-quality educational resource.

Table 5. Results of the LKPD Validity Test

No	Component	Aiken's V Index	Description
1	Content Feasibility	0.839	Very Valid
2	Presentation Feasibility	0.792	Valid
3	Language Feasibility	0.792	Valid

Table 5 shows the validity analysis results for the LKPD. The content feasibility aspect received an Aiken's V index of 0.839 and is categorized as Very Valid. Meanwhile, the presentation and language feasibility aspects received a score of 0.792, which falls into the Valid category. This indicates that the LKPD possesses good content, presentation, and language quality. Although overall valid, further improvements in the presentation and language aspects could be made to achieve optimal results.

Table 6. Results of the KPS Instrument Validity Test

No	Component	Aiken's V Index	Description
1	Prediction	0.854	Very Valid
2	Inference	0.854	Very Valid
3	Variable Identification	0.792	Valid
4	Hypothesis Formulation	0.792	Valid
5	Data Interpretation	0.813	Very Valid
6	Experiment Design	0.792	Valid

The analysis results indicate that the prediction and inference aspects have an Aiken's V index of 0.854, while data interpretation reaches 0.813, all categorized as Very Valid. Meanwhile, the variable identification, hypothesis formulation, and experiment design aspects received scores of 0.792, placing them in the Valid category. This suggests that the KPS instrument has good overall validity, with several aspects strongly supporting the assessment of scientific process skills. However, improvements in the components of variable identification, hypothesis formulation, and experiment design could further enhance this instrument.

Table 7. Results of the Learning Outcome Test Instrument Validity Test

No	Component	Aiken's V Index	Description
1	Content	0.896	Very Valid
2	Construction	0.861	Very Valid
3	Aspect	0.833	Very Valid
4	Language	0.833	Very Valid

Based on the validity analysis results of the learning outcome test instrument, the content component received an Aiken's V index of 0.896; construction reached 0.861. In contrast, the specific aspect and language each received a score of 0.833. All components are categorized as Very Valid, indicating that the instrument has met high validity standards. Thus, the learning outcome test instrument can be used to evaluate learning outcomes with a high level of validity.

Results of the Practicality Test

The practicality test was conducted after the developed learning devices were deemed valid. This test aims to obtain direct feedback from students and teachers regarding the practicality of the learning devices. The practicality criteria are based on percentages, with practicality levels grouped into four categories: practical, fairly practical, less practical, and impractical.

Results of Student Responses

Student responses assess the practicality from several aspects. These aspects include learning activities, materials, and LKPD facilitated to enhance learning outcomes and scientific process skills. The results of student responses are presented in Figure 1:

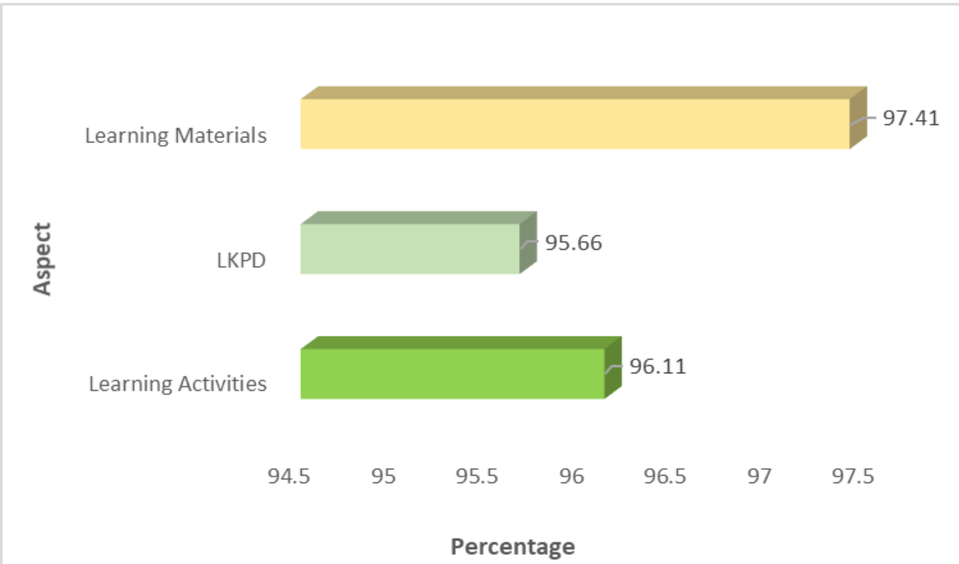

Figure 1: Student Response

Figure 1 shows the results of students' responses to three aspects: learning activities, LKPD, and learning materials. The learning materials obtained the highest score of 97.41%, indicating that this aspect is considered the best or most practical. Furthermore, learning activities have a percentage of 96.11%, which is also very high, reflecting the practical implementation of learning. The LKPD has a slightly lower percentage of 95.66% but is still in the practical assessment category. Overall, these three aspects showed very positive assessment results, with insignificant percentage differences, indicating that all aspects have been designed and implemented well.

Teacher Response Results

The teacher's response assessed the practicality of several aspects. These aspects include initial activities, teaching modules, learning materials, LKPD, learning outcomes, and KPS instruments. Teacher response results are presented in Figure 2:

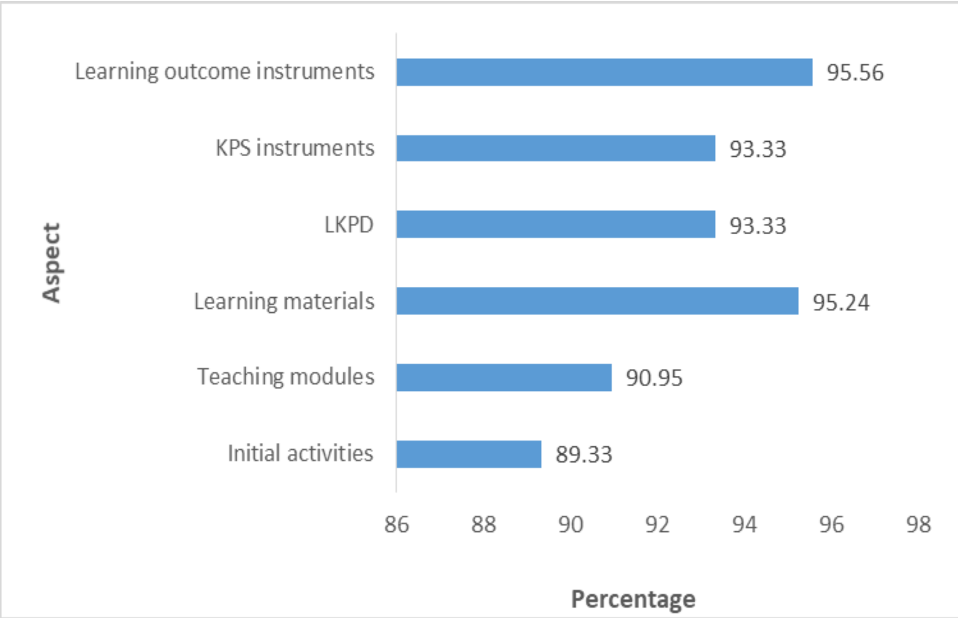

Figure 2: Teacher Response Results

Figure 2 shows the results of teacher responses to the six aspects of the assessment. The initial activity received the lowest rating of 89.33%, indicating the need for improvement in designing opening activities that are more effective and attract attention. The Teaching Module was rated quite well, with a percentage of 90.95%, but it can still be improved to support students' understanding. Meanwhile, the Learning Materials received a high rating of 95.24%, followed by the Learning Outcomes Instrument with the highest score of 95.56%, which reflects its good quality in achieving learning objectives. The LKPD and KPS Instrument scored 93.33%, indicating their effectiveness is already quite optimal, although further evaluation can be done for improvement.

Learning Implementation Results

The observations of learning implementation in three learning activities showed varying results. In Lesson I, the learning implementation was 83.34%, while 16.64% was not implemented. This was due to the student council election activities that disrupted the learning schedule. In Learning II, the learning implementation rate reached 94.44%, with only 5.56% not implemented. Meanwhile, Learning III showed similar results to Learning II, with 88.88% of lessons implemented and 11.12% not implemented (Figure 3). Despite some obstacles, most of the lessons could be implemented well.

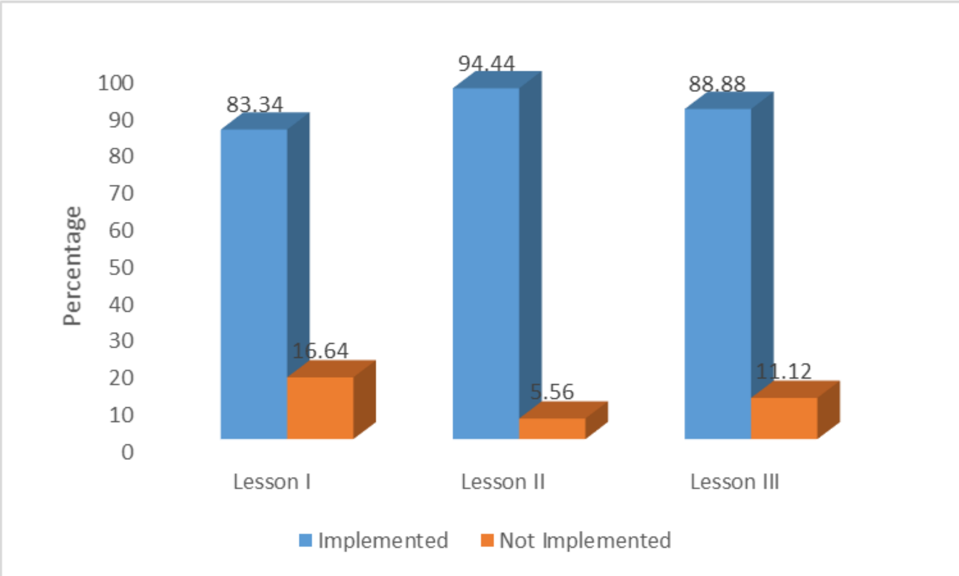

Figure 3. Learning Implementation Results

Discussion

The validity test or expert appraisal aims to produce valid products based on expert assessments. The validation test evaluates content validity and construct validity. Content validity measures the extent to which an instrument accurately encompasses all aspects of the concept to be measured (Nengsih et al., 2019). The content validity assessed in this study includes the alignment of the teaching module and the developed learning devices with the syntax of the problem-based learning model and their conformity with the scientific process skills (KPS) indicators and learning outcomes.

Construct validity reflects the construction of structure, framework, language, and graphics (Nengsih et al., 2019). The structure and framework of the developed instrument must be logically and systematically organized, ensuring that each part is interconnected in supporting the measurement of the intended concept. The use of clear, precise language appropriate to the developmental stage of the learners is crucial to avoid ambiguity and misunderstandings in interpreting items. Additionally, graphical aspects such as images, diagrams, and layouts must support understanding concepts and not distract from the primary measurement objectives (Flake et al., 2017).

Based on the validity test results using Aiken's V index, the learning objectives flow demonstrates very high validity across three components: content feasibility (0.824), presentation feasibility (0.806), and language feasibility (0.833). All three components fall within the very valid category, affirming that the learning objectives have been structured according to pedagogical standards and are relevant to learning needs. The clarity of language and systematic presentation further enhance users' acceptance of this flow, particularly educators in the learning process. These results are consistent with previous research indicating that high content, presentation, and language validity are essential for enhancing learning effectiveness (Dzikro & Dwiningsih, 2021). The validity of the teaching module shows excellent results, with Aiken's V index for content feasibility at 0.844, presentation feasibility at

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0.847, and language feasibility achieving a perfect score of 1. This indicates that the teaching module meets the Very Valid criteria across all aspects. High validity in the language aspect is a significant indicator, as modules that utilize clear and communicative language can optimally support learners' understanding (Maulida, 2022). Thus, this teaching module is highly suitable for use in education to support the achievement of educational objectives.

The teaching module within the Merdeka Curriculum allows teachers to design adaptive learning according to students' needs, including in Physics. In this study, the development of problem-based physics teaching modules has great potential to enhance scientific process skills (KPS) and learning outcomes. The problem-based approach in the teaching module supports critical thinking skills, problem-solving, and the practical application of scientific concepts, aligning with the Merdeka Curriculum's goal of producing relevant and contextual learning (Maulida, 2022).

Emphasizing KPS through problem-based teaching modules aligns with research indicating that problem-based approaches can enhance students' abilities to observe, analyze data, and communicate results scientifically (Fauziah, 2022). This is crucial for Physics, where experimentation and hypothesis testing are core learning components. The application of problem-based modules can be accompanied by formative assessments designed to periodically evaluate the development of students' KPS. Thus, the teaching module in this study not only supports the improvement of learning outcomes but also equips students with the scientific skills necessary for everyday life (Salsabilla et al., 2023).

The Student Worksheets (LKPD) validation results indicate an Aiken's V index of 0.839 for content feasibility, categorized as Very Valid. In contrast, presentation and language feasibility received scores of 0.792, categorized as Valid. Although the overall validity is considered good, there is room for improvement, particularly in presentation and language, to maximize the usefulness of the LKPD in enhancing scientific process skills and learning outcomes. This aligns with Rohmah et al. (2021), who states that the presentation of material and clarity of language are crucial factors in improving the effectiveness of LKPD-based learning.

The KPS instrument is highly valid in prediction and inference (index 0.854) and data interpretation (index 0.813). However, validity in variable identification, hypothesis formulation, and experiment design remains in the Valid category (index 0.792). These results indicate that the KPS instrument can be effectively utilized overall. However, improvements are needed in aspects still categorized as Valid to support a more comprehensive measurement of scientific process skills. Previous research has also shown that instrument validity is a critical factor in ensuring the reliability of data collected to support valid and reliable scientific process skills, such as prediction, inference, and experimental design (Ramadani et al., 2017).

The validation results for the learning outcome test instruments indicate that all components—content (index 0.896), construction (index 0.861), and language (index 0.833)—fall within the Very Valid category. This demonstrates that the instruments possess good quality for measuring learning outcomes. High content validity emphasizes the test content's relevance to learning objectives, while valid construction and language provide clarity and ease of use for learners. Previous research has also indicated that high validity in learning outcome test instruments is crucial in ensuring that evaluation tools accurately reflect students' competency achievements (Sukmawati & Irwandi, 2020).

Practicality of Problem-Based Physics Learning Devices

The practicality test is conducted to obtain direct feedback from students and teachers regarding the practicality level of the problem-based physics teaching module in enhancing

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scientific process skills and learning outcomes. Practicality refers to the ease of use of the problem-based physics teaching module in the learning process. In this study, the practicality of the problem-based physics teaching module is assessed based on the responses from students and teachers collected through questionnaires distributed after the learning process.

(1) Results of Student Responses

Students filled out response questionnaires based on their opinions and experiences using the problem-based physics e-module during the learning activities. The problem-based physics teaching module enhances scientific process skills and learning outcomes. Therefore, student responses reflect the extent to which the problem-based physics teaching module can facilitate scientific process skills and learning outcomes during the learning process.

The analysis of student responses across three aspects—learning activities, LKPD, and learning materials—indicates a very high level of practicality. The learning material received the highest score (97.41%), indicating the effectiveness of the material design in stimulating motivation and supporting scientific process skills. Indicators such as material supporting process skills and stimulating curiosity achieved very high scores, reaching 98.89%. This aligns with Sukmawati & Irwandi (2020) and Arifin et al. (2024a), who assert that materials designed to engage curiosity and conceptual exploration can enhance students' scientific thinking skills and learning outcomes.

The aspect of learning activities scored 96.11%, indicating that the learning process has been effectively designed to support active student engagement. Motivation to participate in learning and problem-based activities received a perfect score (100%). This indicator aligns with Problem-Based Learning (PBL) principles, which create a contextual learning environment, encourage exploration, and provide meaningful learning experiences (Ayu et al., 2024). However, indicators such as active collaboration in groups received slightly lower scores (91.11%), indicating that enhancing student collaboration during learning activities remains an area for improvement.

The response aspect to the LKPD received a practicality score of 95.66%, with the highest indicator being the attractiveness of the LKPD (100%). Other indicators, such as ease during experiments (96.67%) and the ability to enhance experimental tool skills (97.78%) indicate that the LKPD effectively facilitates scientific process skills. According to Rohmah et al. (2021) and Arifin (2024b), engaging LKPD helps guide students to understand concepts through experiment-based activities. However, the clarity of activity steps received the lowest score (91.11%), suggesting that instructional aspects of the LKPD require slight improvements to enhance clarity.

These student response data are relevant to developing PBL-based teaching modules to support scientific process skills (KPS) and learning outcomes. Designing engaging and contextual learning materials, attractive LKPD, and problem-based learning activities significantly contribute to students' scientific process skills and learning outcomes. This approach is crucial for connecting theory with laboratory practice in physics learning, such as static fluids. However, several areas require enhancement, such as strengthening collaboration in learning activities and refining the activity steps in the LKPD. Thus, a more integrated teaching module will be able to optimize the objectives of the Merdeka Curriculum, which aims to create adaptive, contextual, and empowering learning for students comprehensively.

(2) Results of Teacher Responses

The analysis of teacher responses to the problem-based physics teaching module indicates that most aspects of learning meet high practicality standards. The average practicality score for the initial activities aspect is 89.33%, with elements such as models and teaching methods supporting skill enhancement receiving perfect scores (100%), while the learning objectives flow recorded the lowest score at 80%. This reflects that the preparation of initial activities is already very good, although there is room for improvement in understanding the objectives more deeply.

Regarding the teaching module, the average practicality score is 90.95%, revealing that the learning steps aligned with the PBL stages, and the planned time allocation received high scores. The success of the teaching module heavily relies on the relevance of the material taught to everyday life contexts, making it easier to understand and motivating students to be more active in learning (Maulida, 2022; Arifin et al., 2022; Arifin, 2023; Arifin et al., 2024c). This success is also driven by teaching strategies encouraging collaboration and group discussions, emphasizing that PBL is an effective method for enhancing scientific process skills and learning outcomes.

The aspect of learning materials recorded a very good score, with an average practicality of 95.24%. Visually appealing materials directly related to everyday life received perfect scores. At the same time, time allocation and the availability of comprehensive teaching materials were also key factors in achieving this success. Regarding the LKPD, the obtained practicality score is 93.33%, indicating that the worksheet has been well-designed to support collaborative learning and is oriented towards scientific process skills and learning outcomes. However, some aspects of using experiments in the LKPD and their suitability with the teaching materials still show slightly lower results, at 86.67%. This may relate to the appropriateness of the experiments conducted within the PBL context, which requires further adaptation to enhance students' learning experiences (Ayu et al., 2024).

Assessment instruments for scientific process skills and learning outcome tests received very high scores of 93.33% and 95.56%, respectively. Assessments that align with the expected competencies and the use of easily understood language ensure that these instruments effectively measure the achievement of learning objectives. These instruments also provide valuable feedback for the overall development of students, both in terms of knowledge and scientific process skills. Thus, the learning devices used in this study are practical for supporting the success of PBL-based learning processes.

(3) Results of Learning Implementation

The observation of learning implementation across three learning activities shows varied outcomes. In Learning I, the implementation of learning was 83.34%, while 16.64% was not implemented. This was due to the occurrence of student council president elections that disrupted the learning schedule. In Learning II, the level of learning implementation reached 94.44%, with only 5.56% not implemented. Meanwhile, Learning III showed results similar to Learning II, with 88.88% of the learning implemented and 11.12% not implemented (Figure 5.3). Despite some obstacles, most of the learning could be carried out effectively.

The obstacles encountered during the learning process, such as time being cut short or interference from other activities, highlight the importance of flexibility in implementing the teaching module. Salsabilla et al. (2023) emphasize that teachers must have adaptive strategies to manage unexpected disruptions, such as prioritizing the most essential material to remain aligned with learning objectives. Furthermore, to enhance the implementation of learning in subsequent sessions, teachers can optimize time management by adjusting the

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learning schedule to the school academic calendar. This observation result also indicates that the problem-based teaching module can provide clear guidance for teachers in directing learning despite the obstacles. Ayu et al. (2024) state that the problem-based approach enhances student engagement in learning and motivates them to understand the material in depth. Thus, implementing the teaching module not only aids in achieving learning objectives but also supports the development of students' skills and learning outcomes.

Based on the observation of learning implementation, the primary factor influencing the implementation of learning is time allocation, as several learning activities were hindered by activities conducted at the school. In line with this, Jariah & Aminatun (2022) note that insufficient time allocation can affect the implementation of learning. Additionally, the problem-based teaching module was applied for the first time at the trial location, requiring students to adjust, which may impact the implementation of activities (Ayu et al., 2024).

CONCLUSION

The developed learning devices exhibit high content, presentation, and language validity, as Aiken's V index indicates, confirming their alignment with pedagogical standards and learning needs. The teaching module and Student Worksheets (LKPD) not only meet the validity criteria but also demonstrate a high level of practicality based on the responses from students and teachers, reflecting the effectiveness of the material design in enhancing scientific process skills and learning outcomes. Although several aspects require improvement, such as collaboration in learning activities and instructional clarity in the LKPD, these learning devices are highly suitable for use.

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