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Needs Analysis of Problem-Based Learning and Local Wisdom-Based E-Student Worksheet to Facilitate Students' Critical Thinking Skills in Kinematics Learning

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ABSTRACT

Twenty-first-century education requires students to develop critical thinking skills to analyze and solve complex problems, particularly in physics learning. However, students' critical thinking skills in kinematics remain low because existing teaching materials, conceptual representations, and learning activities have not effectively supported problem-solving processes. This study aimed to analyze students' needs as the basis for developing a Problem-Based Learning (PBL)-based E-Student Worksheet integrated with local wisdom to facilitate critical thinking skills in kinematics learning. The study employed a Research and Development (R&D) approach using the define stage of the 4D model. The participants were 25 students at SMAN 1 Sungai Geringging. Data were collected through teaching material analysis, student characteristics analysis, concept analysis, task analysis, learning objective analysis, critical thinking tests, questionnaires, and teacher interviews. The findings showed that students' average critical thinking skills reached only 37%, categorized as low, with self-regulation as the lowest indicator (25%). Teaching material analysis revealed limited multimedia integration, adaptive characteristics, and contextual learning support, while concept analysis indicated inadequate alignment between existing materials and ideal kinematics concepts, particularly in projectile motion. These findings conclude that developing a PBL-based E-Student Worksheet integrated with local wisdom is necessary to provide contextual, interactive, and meaningful learning that improves students' critical thinking skills.

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INTRODUCTION

Twenty first century learning is directed toward preparing future generations to possess various skills needed to face present and future challenges (Aviana et al., 2024). Twenty first century learning focuses on student-centered learning aimed at improving four learning competencies, namely critical thinking, collaboration, communication, and creativity (4C skills) (Prihandono et al., 2023). Twenty first century learning requires instructional approaches that promote critical thinking, creativity, collaboration, and problem-solving skills to prepare students for future challenges (Nawawi et al., 2024). Critical thinking skills are highly needed in both academic settings and daily life, as they play an essential role in identifying and solving problems more effectively and efficiently (Mahmudah et al., 2024). Critical thinking skills involve the ability to analyze, evaluate, and synthesize information, as well as make decisions based on evidence and logic. In the learning process, critical thinking skills hold a very important role, especially in physics learning, because students are not only required to understand concepts but also to analyze problems based on real phenomena.

Physics is one of the branches of natural science that studies natural phenomena and relates them to real-life situations. It investigates natural phenomena systematically through observation, measurement, and experimentation to formulate concepts, principles, laws, and theories that are universally applicable. Physics is an empirical science, meaning that all knowledge in physics is based on observations of natural phenomena (Hasepen & Syafriani, 2022). Physics can be defined as a scientific discipline that examines natural phenomena using the scientific method and expresses the findings in the form of concepts, principles, and theories (Qomariyah et al., 2024). A learning paradigm refers to a plan or model used as a guideline for designing and implementing classroom instruction or learning guidance, as well as for identifying various instructional components (Junaidin, 2022). This requires the implementation of an appropriate learning paradigm that supports active student participation and meaningful learning experiences.

Physics learning is a thinking process aimed at developing the ability to understand concepts, principles, and laws of physics, the learning process requires the selection of effective learning strategies (Depany, 2023). In physics learning, critical thinking skills are very important because physics requires a deep understanding of concepts and is closely related to natural phenomena in everyday life (Amelia & Chusni, 2024). One way to integrate such knowledge and skills into real-life contexts is by incorporating local wisdom into the learning process. Local wisdom provides contextual learning experiences by connecting physics concepts with students' cultural backgrounds and everyday experiences, thereby making learning more meaningful and relevant.

Local wisdom refers to a set of knowledge, values, behaviors, and attitudes toward particular objects and events within a community's environment that are recognized as being beneficial and valid (Satriawan & Rosmiati, 2016). According to Wiyono (2025) local wisdom can be integrated into physics learning. Learning based on local wisdom is part of the efforts teachers can make to create contextual learning through real-life experiences while simultaneously preserving the noble values of regional local wisdom that should be recognized by younger generations (Anzelina, 2023). Local wisdom can foster and enhance students' thinking skills by supporting problem-based learning through collaborative problem-solving activities. Such an approach encourages students to think critically about issues related to local wisdom and to work together in identifying appropriate solutions to problems encountered within their local communities (Putri et al., 2023). The integration of local wisdom into physics learning needs to be supported by a learning model capable of accommodating contextual problems and encouraging active student involvement. One learning model that can be applied is the Problem Based Learning (PBL)

The PBL model is an approach that presents direct or real-life problems from everyday situations to be analyzed in order to find solutions to those problems (Rosmasari & Supardi, 2021). PBL is a model that provides authentic real-world problems, where the problems given to students can be solved with the teacher's guidance in seeking information as a solution to the assigned problems (Tanjung & Emiliannur, 2024). Recognized as a highly effective strategy, the PBL model has the capacity to develop students' critical thinking skills and effectively overcome limitations in these skills during the learning process. In the PBL model, problems are used as a starting point that stimulates students to think critically (Anggraini et al., 2025). The integration of PBL with local wisdom has the potential to improve students' critical thinking skills. One way to connect PBL and local wisdom with physics learning is through teaching materials.

Teaching materials are learning resources arranged systematically and comprehensively based on learning principles for use by teachers and students in the learning process (Magdalena et al., 2020). Along with technological developments, teaching materials are no longer presented only in printed form, but can also take the form of audiovisual and computer-based media. One type of teaching material that can be used is the student worksheet. Student worksheet is a form of teaching material that functions as a learning guide for students in carrying out structured and systematic learning activities. student worksheet consists of worksheets used as guidelines in learning activities and contains tasks that students must complete within a particular subject area (Melenia, 2024). The findings of the students' needs analysis provided essential information for designing the E- student worksheet, ensuring that the developed product was aligned with students' learning needs, learning characteristics, and the objectives of physics instruction.

METHODS

This study is a type of Research and Development (R&D) study. The research design employed the 4D development model (Define, Design, Development, and Disseminate). The 4D development model is a model for developing learning tools. This model was developed by (Thiagarajan et al., 1974). The 4D model is systematic and based on the theoretical foundations of educational product design, enabling the resulting products to meet feasibility standards. The 4D model has clear procedures that facilitate researchers in developing a product. The 4D development model consists of four main stages: Define, Design, Develop, and Disseminate, this study was limited only to the Develop stage.

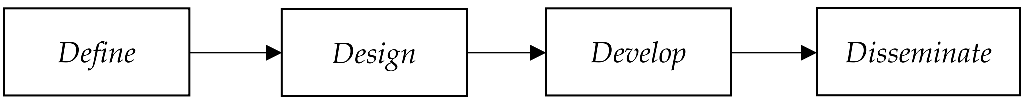

Figure 1. Stages of the 4D Development Model

The Define stage is the initial step, often referred to as the needs analysis stage, conducted at SMAN 1 Sungai Geringging. The purpose of this stage is to determine and describe the requirements needed in product development according to user needs. This stage was carried out through front-end analysis, student analysis, material analysis, task analysis, and specification of learning objectives (Thiagarajan et al., 1974). The results of the needs analysis provide a comprehensive overview of the existing learning conditions, the characteristics of students, and the problems encountered during the learning process. These findings serve as the foundation for designing an E-student worksheet that is aligned with curriculum requirements, student characteristics, and the objectives of physics learning.

Front-end analysis involves identifying the fundamental problems faced in physics learning and aligning them with the curriculum and learning theories. The initial analysis was conducted through interviews with physics teachers at SMAN 1 Sungai Geringging. Student analysis is related to students' characteristics, such as background experiences, learning motivation, attitudes during the learning process, and other related aspects. This stage was conducted by distributing questionnaires to students. Task analysis aims to identify the main tasks to be performed by students. Material analysis concerns facts, concepts, principles, and procedures, while learning objectives analysis is conducted to determine the objectives to be achieved in the learning process.

Data on students' critical thinking skills were obtained through a test developed by Nisa (2024), which had been declared valid and reliable, making it appropriate for use. The test was administered on February 5, 2026, at SMAN 1 Sungai Geringging with a total of 25 students participating. The critical thinking skills test was designed in the form of essay questions given to Grade X Phase E senior high school students. The questions were developed based on critical thinking skill indicators according to Peter A. Facione, which include interpretation, analysis, evaluation, inference, explanation, and self-regulation skills (Facione, 2023). The findings from this analysis served as one of the primary considerations in designing learning activities and assessment tasks support the improvement of students' critical thinking skills.

The data obtained from the students' needs analysis were analyzed using descriptive analysis. The analysis was conducted to identify students' learning needs, characteristics, and the problems encountered during the physics learning process. The results were interpreted based on the criteria proposed by Riduwan (2012), which classify the findings into five categories: very high (81–100), high (61–80), moderate (41–60), low (21–40), and very low (0–20). The findings from the needs analysis provided a comprehensive description of the existing learning conditions and the aspects that required improvement. These results served as the basis for designing and developing the E-student worksheet in accordance with students' needs and the objectives of physics learning.

RESULTS AND DISCUSSION

Results

Analysis of Learning Problems

The first research result in the define stage was the analysis of learning problems. This analysis aimed to identify the problems encountered in physics learning, particularly those related to the characteristics of the teaching materials used in school. The analysis was conducted by comparing the characteristics of ideal teaching materials with the teaching materials used at SMAN 1 Sungai Geringging. The aspects analyzed included self-instructional (SI), self-contained (SC), stand-alone (SA), user friendly (UF), visual and multimedia (VM), adaptive (AD), and contextual (CT). The results of this analysis served as the basis for determining the need to develop an E-student worksheet based on PBL integrated with local wisdom. The results of the learning problem analysis are presented in Figure 2.

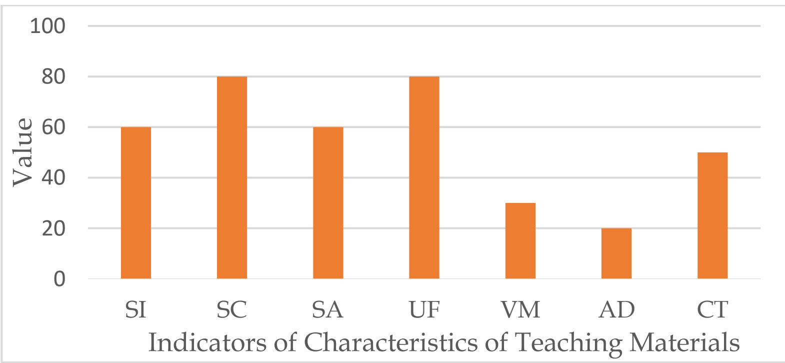

Figure 2. Result of the Context Analysis of Teaching Material

Based on Figure 2, the results of the teaching material context analysis indicate that the self-contained and user-friendly indicators obtained the highest score, namely 80. These results indicate that the textbook used contains relatively complete material in accordance with the learning outcomes and is presented using language that is easy to understand and a clear systematic structure, thereby facilitating students in learning the material. The self-instructional and stand-alone indicators each obtained a score of 60, indicating that the teaching materials provide learning materials and exercises; however, they have to some extent not fully facilitated students to learn independently without teacher assistance or additional learning resources.

Meanwhile, the contextual indicator obtained a score of 50, indicating that the textbook has related some physics concepts to everyday life phenomena; however, the presentation of contextual problems that encourage students to conduct investigations and solve problems is still limited. On the other hand, the visual and multimedia indicator obtained a score of 30, while the adaptive indicator obtained the lowest score, namely 20. These results indicate that the teaching materials used are still dominated by static text and images and have not integrated interactive multimedia, such as videos, animations, simulations, or digital technology that can enhance learning interactivity. In addition, the teaching materials do not yet fully support flexible learning and cannot be optimally accessed through various digital devices. These findings indicate that the major challenges in physics learning extend beyond the delivery of instructional content to include the limited capacity of the existing teaching materials to integrate technology, provide contextual learning experiences, and support students' independent learning. Based on these findings, there is a need to develop an E-Student Worksheet based on PBL integrated with local wisdom to provide a more interactive, contextual, and technology-enhanced learning experience while fostering students' critical thinking skills.

Analysis of Student Characteristics

The student characteristics analysis was conducted to identify students’ learning characteristics, needs, and initial abilities as the basis for developing a Problem-Based Learning (PBL)-based E-student worksheet on Kinematics to facilitate students’ critical thinking skills. This stage involved a preliminary study consisting of school observations, the administration of needs analysis questionnaires to students, and interviews with physics teachers. The findings identified the major learning problems that formed the foundation for the development of the E-student worksheet. The analysis results showed that the average level of students’ critical thinking skills was 37, which falls into the low category. The results of the critical thinking skills analysis for each indicator are presented in Table 1 below:

Table 1. Score of Critical Thinking Skills of Students at SMAN 1 Sungai Geringging

Indicator	Score	Category
Interpretation	25.83	Low
Analysis	42.5	Moderate
Evaluation	38.33	Low
Inference	47.06	Moderate
Explanation	41.2	Moderate
Self-Regulation	25	Low
Average	37	Low

Based on Table 1, each indicator showed varying results in the critical thinking skills test. The lowest critical thinking indicator was self-regulation. The self-regulation indicator was measured by presenting a discourse about two Indonesian Army soldiers participating in shooting practice. Both soldiers fired bullets at different elevation angles, students were asked to evaluate the problem regarding the comparison of the maximum heights reached by the two bullets. One student’s test result on the self-regulation indicator is shown below. The low achievement on this indicator indicates that many students experienced difficulties in monitoring and evaluating their own reasoning when solving physics problems.

Analysis of Conceptual Problems

Concept analysis was conducted to compare the alignment between the ideal concepts of kinematics, as outlined in the curriculum, textbooks, and scientific references, and the learning materials used in schools. This analysis aimed to identify the extent to which the school materials corresponded to the ideal concepts in terms of content alignment, completeness, and depth. The findings of the concept analysis served as one of the primary foundations for developing the E-student worksheet, ensuring that the learning materials were aligned with curriculum requirements and students' learning needs. The results of the concept analysis for each kinematics topic are presented in Figure 3.

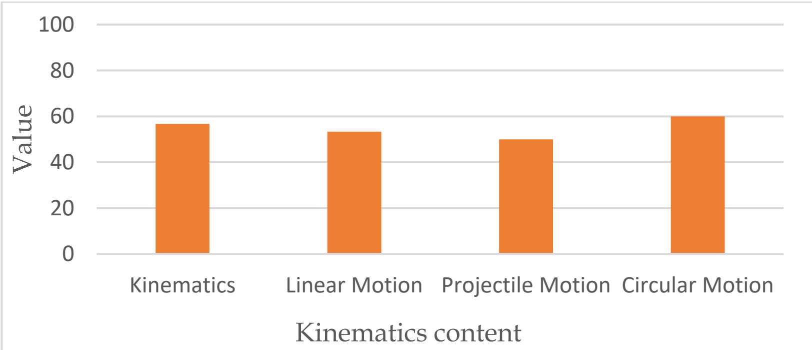

Figure 3. Result Analysis of Conceptual

Based on Figure 3, the results of the concept analysis indicate that the level of alignment between the learning materials used in schools and the ideal concepts varies across the different kinematics topics. Circular motion obtained the highest concept alignment score of 60, indicating that the learning materials used in schools cover most of the essential concepts that students are expected to learn. In contrast, projectile motion received the lowest score of 50, suggesting that several important concepts have not yet been presented optimally in the instructional materials. For the kinematics and linear motion topics, the concept analysis scores were 57 and 53, respectively. These findings indicate that although most of the essential concepts have been introduced during instruction, several concept indicators have not been addressed comprehensively in terms of content coverage, depth of explanation, and the presentation of concepts that support students' understanding. This condition suggests that the learning materials currently used in schools do not yet fully reflect the ideal concepts expected by the curriculum and relevant scientific references.

The differences in concept alignment across the four topics indicate variations in the quality of concept presentation within the learning materials used in schools. Topics with lower concept alignment scores highlight the need for the development of more comprehensive instructional materials to ensure that all concept indicators are presented thoroughly. Such development should focus not only on improving the completeness of the content but also on presenting concepts in a systematic, contextual, and student-friendly manner to facilitate a deeper understanding of the subject matter. Ultimately, improving the alignment between the ideal concepts and the learning materials is expected to enhance students' conceptual understanding and better support the achievement of the intended learning outcomes.

Analysis of Task-Related Problems

The analysis of students' task performance was conducted to evaluate their ability to complete the learning tasks assigned after participating in the instructional activities. The task performance data were analyzed using descriptive statistics, including the number of students, average score, median, mode, highest score, lowest score, and range. This analysis aimed to provide an overview of students' task achievement and the variation in their performance on tasks designed to align with the learning objectives. The results of the descriptive statistical analysis are presented in Table 2.

Table 2. Results of Material Mastery Analysis

No.	Statistical Parameter	Value	Description
1	Number of Students	25	The number of students who participated as the research sample was 25.
2	Average Score	51.28	The average material mastery score was 51.28, indicating a moderate level of mastery.
3	Median	47	Fifty percent of the students obtained scores of 47 or below, while the remaining 50% obtained scores of 47 or above.
4	Mode	58	The most frequently obtained score was 58, indicating that this was the score achieved by the largest number of students.
5	Highest Score	69	The highest score obtained by the students was 69; however, it still did not reach the maximum possible score.
6	Lowest Score	29	The lowest score obtained by the students was 29, indicating that some students still demonstrated a low level of material mastery.
7	Range	40	The difference between the highest and lowest scores was 40, indicating variation in students' levels of material mastery.

As shown in Table 2, a total of 25 students participated in the task assessment. The analysis revealed that the average task score was 51.28, indicating that, overall, students' performance in completing the assigned tasks was at a moderate level. This average score represents approximately 51% of the maximum possible score, suggesting that there is still considerable room for improvement in students' ability to understand the learning material and apply their knowledge when completing the tasks. These findings also indicate that although most students were able to complete the assigned tasks, their level of achievement had not yet reached an optimal level.

In terms of the measures of central tendency, the median score of 47 indicates that 50% of the students obtained scores of 47 or below, while the remaining 50% scored 47 or above. Meanwhile, the mode score was 58, indicating that this was the score obtained by the largest number of students. The relatively close values of the mean, median, and mode suggest that the distribution of students' task scores was fairly balanced, although some variation in students' task performance remained evident. This finding indicates that most students demonstrated a relatively similar level of performance in completing the assigned tasks, despite differences in individual achievement levels.

Based on the measures of data dispersion, the highest score obtained by the students was 69, whereas the lowest score was 29, resulting in a range of 40. This score range indicates a moderate variation in students' ability to complete the assigned tasks. While some students demonstrated good performance, others still experienced difficulties in understanding the concepts and applying them to complete the tasks successfully. Therefore, more effective instructional strategies are needed to enhance student engagement and provide all students with greater opportunities to develop their conceptual understanding and problem-solving skills, thereby improving task performance more consistently across the class.

Analysis of Learning Objectives

The next result obtained during the define stage was the analysis of learning objectives. This analysis was conducted to evaluate the alignment of the learning objectives for the kinematics topic with the ABCD framework (Audience, Behavior, Condition, and Degree). The analysis aimed to determine the completeness of the learning objective statements as a basis for developing an E-Student Worksheet based on Problem-Based Learning (PBL) integrated with local wisdom. The results of the learning objective analysis based on the ABCD components are presented in Figure 4.

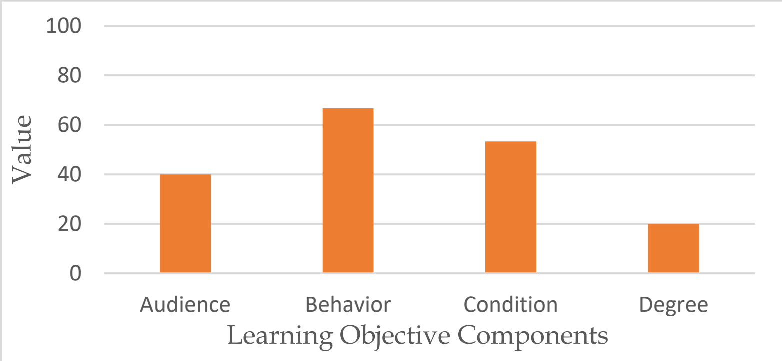

Figure 4. Result Analysis of Learning Objective

Based on Figure 4, the results of the learning objective analysis indicate that the Behaviour component obtained the highest score, 66.67. This result indicates that the learning objectives have clearly and measurably specified the competencies or behaviours expected to be achieved by students. The Condition component obtained a score of 53.33, indicating that the learning objectives have included the conditions or learning situations that support competency achievement, although these conditions have not been consistently incorporated into all learning objectives. Meanwhile, the Audience component obtained a score of 40, indicating that the target learners have been identified but have not been explicitly specified in every learning objective. The Degree component received the lowest score, 20, indicating that most learning objectives do not clearly specify measurable performance criteria or the expected level of achievement as indicators of students' learning success.

These findings indicate that the existing learning objectives primarily emphasize the competencies to be achieved by students but do not fully incorporate all components of the ABCD framework, particularly the Degree component, which serves as the criterion for measuring learning achievement. As a result, the learning objectives are not yet sufficiently specific and measurable to effectively guide both the learning process and student assessment. Based on these findings, there is a need to develop an E-Student Worksheet based on Problem-Based Learning (PBL) integrated with local wisdom and designed according to the ABCD framework. This development is expected to produce more comprehensive learning objectives that effectively support meaningful learning and enhance students' critical thinking skills.

Discussion

The findings of this study identified five important aspects that support the development of a Problem-Based Learning (PBL)-based E-Student Worksheet integrated with local wisdom, namely teaching materials, student characteristics, concept analysis, task performance, and learning objectives. These findings indicate that the existing learning process has not yet fully supported the development of students' conceptual understanding and critical thinking skills in kinematics. Student-centered learning environments are widely recognized as more effective in promoting higher-order thinking skills than conventional teacher-centered instruction (Nicholus et al., 2024). The results of the need analysis also demonstrate that improvements are required in both the quality of instructional materials and the implementation of classroom learning. This condition provides a clear rationale for developing digital teaching materials that are interactive, contextual, and capable of engaging students actively throughout the learning process. The discussion of each finding is presented in the following sections to explain how these results support the development of the proposed E-Student Worksheet.

The first finding indicates that the teaching materials used in schools have not fully met the characteristics of ideal teaching materials, particularly in the aspects of visual communication, software utilization, and contextual learning. The relatively low scores on these aspects suggest that the existing teaching materials are still dominated by text-based explanations and have not optimally integrated interactive digital media into the learning process. Interactive digital teaching materials have been reported to improve students' conceptual understanding and learning engagement by integrating text, images, animations, and videos into a single learning environment (Abdulrahaman et al., 2020). Learning resources that utilize multimedia technology also provide more meaningful learning experiences because students can interact actively with learning content and receive immediate feedback (Bond et al., 2020). In physics education, digital teaching materials designed with contextual and interactive features are more effective in facilitating conceptual understanding than conventional printed materials (Nicholus et al., 2024). These findings indicate that developing a Problem-Based Learning-based E-Student Worksheet integrated with local wisdom is expected to provide interactive, contextual, and meaningful learning experiences for students.

The second finding reveals that students' critical thinking skills remain at a very low level, with an average score of 37 across the six critical thinking indicators. These results indicate that students still experience difficulties in interpreting information, analyzing evidence, making inferences, explaining arguments, evaluating solutions, and regulating their own thinking during physics learning. Critical thinking skills develop more effectively when students are actively engaged in investigating authentic problems rather than passively receiving information (Nicholus et al., 2024). Problem-Based Learning encourages collaborative discussion and inquiry, enabling students to construct scientific knowledge while improving their critical thinking skills (Safanah et al., 2025). The integration of digital teaching materials with Problem-Based Learning has also been reported to enhance students' critical thinking skills and learning engagement in physics education (Islamiyah et al., 2025). These findings indicate that the development of a PBL-based E-Student Worksheet integrated with local wisdom is appropriate to facilitate students in improving their critical thinking skills during physics learning.

The third finding indicates that the concept analysis identified differences in the alignment between the ideal concepts of kinematics and the learning materials currently used in schools. Circular motion achieved the highest concept alignment score, whereas projectile motion obtained the lowest score, indicating that several important concepts have not yet been presented comprehensively. The completeness and accuracy of concept representation in instructional materials are important factors that influence students' conceptual understanding, especially in physics topics involving abstract phenomena and mathematical relationships (Mufit et al., 2022). Digital learning materials that integrate visualization, simulations, and interactive activities can support students in constructing a deeper understanding of physics concepts (Asrizal et al., 2023). Contextual presentation of scientific concepts also helps students connect theoretical knowledge with real-world phenomena, thereby creating meaningful learning experiences (Aini et al., 2022). These findings suggest that the developed E-Student Worksheet should provide systematic, comprehensive, and contextual concept presentations to support students' understanding of kinematics.

The fourth finding shows that students' task performance is still relatively low, with an average score of 51.28, indicating that many students have not yet mastered the learning materials optimally. The differences between students' highest and lowest scores reflect variations in their ability to apply physics concepts when completing learning tasks. Students' performance in physics problem solving is influenced by their conceptual understanding and the learning activities that encourage active knowledge construction (Suhirman et al., 2021). Problem-Based Learning provides opportunities for students to investigate authentic problems, analyze information, and develop solutions through meaningful learning processes (Dolmans et al., 2021). Electronic worksheets integrated with PBL can improve students' critical thinking skills by providing structured activities that guide students in identifying problems and constructing solutions (Rahmatullah, 2024). Therefore, the proposed PBL-based E-Student Worksheet has the potential to improve students' task performance through active participation and meaningful problem-solving activities.

The fifth finding indicates that the learning objectives used in schools have generally followed the expected competencies but have not yet fully accommodated measurable learning outcomes. Several learning objectives describe learning activities but do not clearly specify the expected level of student achievement. Learning objectives that are specific, measurable, and student-oriented are essential for designing appropriate learning activities and assessment strategies (Suskie, 2020). Clear learning objectives also support the implementation of student-centered learning because they provide direction for achieving targeted competencies during the learning process (Kang et al., 2021). In Problem-Based Learning, well-defined objectives help teachers design learning experiences that encourage investigation, reasoning, collaboration, and critical thinking development (Fatmawati et al., 2024). These findings indicate that the learning objectives in the developed E-Student Worksheet should be formulated more specifically and measurably to support students' achievement of kinematics competencies.

Overall, the findings demonstrate that several aspects of physics learning require improvement to support students' critical thinking skills and conceptual understanding. The limitations identified in instructional materials, conceptual coverage, students' task performance, and learning objectives indicate that current learning practices have not fully addressed the demands of 21st-century education. Digital learning materials based on Problem-Based Learning have been shown to improve students' conceptual understanding and higher-order thinking skills through active investigation and problem-solving activities (Armanda & Putra, 2024). Electronic worksheets with interactive features can facilitate independent learning by providing structured activities and digital resources that encourage student engagement (Suryaningsih & Nurlita, 2021). Integrating local wisdom into science learning can provide contextual experiences that help students relate scientific concepts to their surrounding environment (Rosyid et al., 2023). These findings provide a strong rationale for developing a Problem-Based Learning-based E-Student Worksheet integrated with Padang Pariaman local wisdom to facilitate students' critical thinking skills in learning kinematics.

CONCLUSION

This study identified five key findings that support the development of a Problem-Based Learning (PBL)-based E-Student Worksheet integrated with local wisdom for kinematics learning. First, the teaching materials used in schools have not fully supported interactive and contextual learning. Second, students' critical thinking skills were found to be at a very low level. Third, the concept analysis revealed gaps between the ideal kinematics concepts and the learning materials used in schools. Fourth, students' task performance indicated that their mastery of kinematics concepts was still relatively low. Fifth, several learning objectives still require improvement to ensure measurable and student-centered learning outcomes. These findings provide a strong basis for developing a local wisdom-integrated PBL-based E-Student Worksheet to support students' critical thinking skills and conceptual understanding in kinematics learning.

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