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[Research Article]

A NEEDS ASSESSMENT OF STUDENTS' PROBLEM-SOLVING SKILLS IN PHYSICS EDUCATION

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ABSTRACT

Students' problem-solving skills in physics remain a major concern because many learners still rely on formulas, worked examples, and procedural calculation rather than conceptual reasoning. This study aimed to analyze students' needs in physics problem-solving learning and identify classroom conditions that support or limit the development of these skills. A descriptive needs analysis was conducted with 32 eleventh-grade students at a school in East Jakarta using questionnaires, interviews, and lesson plan document analysis. The findings show that physics learning has incorporated contextual examples, scaffolding, guided practice, group discussion, digital media, and formative feedback. However, these practices have not fully developed students' independent, conceptual, and adaptive problem-solving abilities. Students still experience difficulties in identifying variables, using visual representations, adapting to modified problems, and reflecting on solutions. The study concludes that a more structured, problem-oriented learning model is needed to strengthen students' conceptual, reflective, and flexible reasoning.

Keywords: Problem-Solving Skills, Needs Assessment, Physics Education, Contextual Learning, Scaffolding

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1. INTRODUCTION

Problem-solving ability is a central competence in physics education because it requires students to understand problem situations, connect concepts with mathematical representations, select appropriate strategies, and evaluate the reasonableness of their solutions. The problem solving process is commonly described through the four stages proposed by George Pólya (1945), namely understanding the problem, devising a plan, carrying out the plan, and looking back. However, recent studies show that students still experience difficulties in planning strategies, interpreting results, and connecting conceptual understanding with mathematical procedures (Lapame et al., 2025; Tuveri et al., 2025).The development of problem-solving skills is one of the major goals of 21st-century education, alongside communication, collaboration, and critical thinking (Widiandari & Redhana, 2021). In addition, metacognition and problem-solving are considered essential competencies for enabling students to learn independently and adapt to rapid advances in science and technology (Domokos & Huey, 2023). This aligns with the nature of science, which emphasizes inquiry, discovery, and the application of knowledge to real-life situations (Susilawati et al., 2023; Wahyudi et al., 2023). In physics education, students are expected not only to memorize formulas but also to understand situations, select relevant concepts, construct problem representations, and interpret solutions logically. Consequently, problem-solving skills have been widely recognized as a central focus of physics education research (Nisa et al., 2024).
Problem-solving skills have become a major focus in physics education research, yet students' performance remains relatively low, particularly in non-routine and conceptually demanding problems. Students often apply equations directly without analyzing the physical context, making their problem-solving process procedural rather than conceptual. This difficulty is reinforced by weak mathematical foundations, limited connections between physics concepts and daily phenomena, and insufficient reflection on solutions (Heldalia et al., 2025; Nasir et al., 2025; Nisa et al., 2024). These difficulties are closely related to classroom practices that still emphasize teacher-centered instruction, memorization, and formula application rather than conceptual understanding (Prayogi et al., 2024). Such practices limit students' opportunities to develop independent and systematic problem-solving strategies, whereas effective physics learning requires meaningful cognitive engagement and metacognitive regulation through planning, monitoring, and evaluating thinking processes (Güner & Erbay, 2021; Haerudin et al., 2020; Ssemugenyi, 2023). Therefore, physics learning needs approaches that explicitly support reasoning, metacognition, and reflective thinking in problem-solving activities (Maries & Singh, 2023; Musengimana et al., 2025).

Various studies have improved students' problem-solving skills through innovative learning models, media, and instructional tools. However, these interventions are not always based on students' actual needs and classroom conditions. Since problem-solving performance is influenced by student characteristics, teachers, learning strategies, and school environments, a needs analysis is necessary to identify learning barriers and provide a foundation for designing context-appropriate interventions (Nasir et al., 2025).

Therefore, this study aims to analyze students' problem-solving needs in physics learning by evaluating the extent to which current learning activities support the development of problem-solving abilities. Through identifying strengths and weaknesses in current learning practices, this study is expected to provide baseline data that can serve as an empirical foundation for designing context-appropriate interventions, learning tools, and instructional models to improve students' problem-solving skills in physics.

2. METHOD

A needs analysis was conducted involving 32 eleventh-grade students from a school in East Jakarta to identify learning conditions, students' needs, and challenges in physics learning, particularly related to problem-solving skills.

The needs analysis serves as an initial step to provide empirical data for designing learning interventions aligned with students' characteristics and learning needs. To obtain comprehensive data, this study employed several data collection techniques, including questionnaires, interviews, and a review of lesson plan documents.

Data was collected using questionnaires, interviews, and lesson plan document analysis. The questionnaire was used to identify students' learning experiences, perceptions of current physics learning, difficulties in solving physics problems, and learning needs related to problem-solving skills, as questionnaires are useful for systematically obtaining respondents' opinions, perceptions, and characteristics (Sugiyono, 2022).

Interviews were conducted to obtain deeper information about classroom implementation, students' difficulties in understanding physics material, teachers' instructional strategies, and expectations for more effective learning, since interviews allow researchers to explore participants' experiences and perspectives in greater depth (Creswell & Creswell, 2018).

Lesson plan documents, or RPPs, were analyzed to examine the alignment between learning objectives, instructional activities, teaching methods, assessment forms, and students' problem-solving needs, as documentation can provide written evidence that supports data obtained through other techniques (Moleong, 2021).

Data from questionnaires, interviews, and document analysis were analyzed descriptively to identify learning conditions and students' problem-solving needs as a basis for developing instructional improvements.

3. RESULT AND DISCUSSION

The results and discussion present the identified patterns of students' problem-solving needs in physics learning. The discussion focuses on how current learning practices support or limit students' ability to understand problems, develop solution strategies, apply physics concepts, and reflect on their answers. The findings are organized into four main themes: contextual approach and problem-oriented learning, scaffolding and conceptual understanding, higher-order thinking skills and problem solving, and digital media integration and feedback.

3.1 Contextual Approach and Problem-Oriented Learning

Based on the results of the student questionnaire, several responses were received regarding the Physics learning process. These responses included the frequency with which teachers presented contextual problems before explaining the material, the extent to which students were encouraged to find independent solutions before the teacher provided an answer, and the presence of Physics problems with more than one alternative solution.

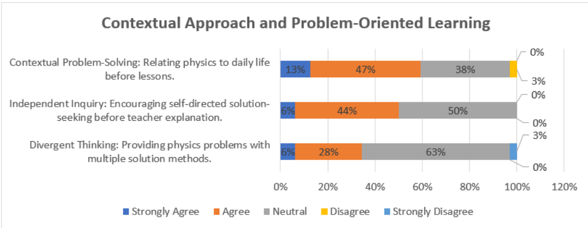

Figure 1. Students' responses to contextual and problem-oriented learning.

Regarding the indicator of contextual problem presentation before the material explanation, the questionnaire data showed predominantly positive responses. 60% of students agreed or strongly agreed that the teacher used everyday life problems as a catalyst for the material. This was reinforced by a review of lesson plans (RPP) documents or teaching modules, which showed that the teacher had designed a real-world orientation for the wave material, such as the process by which sound reaches the ear, how Wi-Fi works, and the use of sonar systems by fishermen.

Time constraints are the main factor that limits the consistent implementation of fundamental problem standards at the beginning of the chapter. This condition is influenced by the dense Phase F curriculum for Graded XI, which requires teachers to cover extensive material within limited instructional time, while the learning model itself demands students’ active involvement in an investigative process.

Consequently, problem orientation is not consistently introduced at the beginning of the lesson. Concrete examples are often presented only after students begin to struggle with abstract concepts, causing real-world phenomena, such as ocean waves, to function as supporting explanations rather than as initial contextual triggers for learning.

These findings align with those of Sasmita et al. (2022) and Wijaya et al. (2025), who emphasize that linking physics to real-world contexts clarifies abstract concepts and improves learning outcomes. However, in the present study, contextual problem orientation was not implemented consistently because limited instructional time and extensive learning materials made it difficult for teachers to apply contextual strategies in every meeting, a constraint also reported by Ahmad et al. (2025).

Meanwhile, regarding the indicator of encouraging students to find independent solutions before providing answers, questionnaire data showed that 50% of students agreed or strongly agreed that they felt encouraged to learn independently. In the lesson plan, this point is addressed through active learning activities that involve students in problem-based scenarios.

Students’ learning habits remain a major barrier to the development of independent problem-solving skills. Students tend to focus directly on mathematical formulas and final numerical answers rather than first understanding the basic concepts underlying the problem. This condition reflects an incomplete conceptual foundation and is reinforced by the assumption that learning physics mainly involves memorizing formulas and solving questions, while the broader practical applications of physics receive less attention.

Independent learning opportunities were provided through practice questions. However, teacher assistance was still given quickly when students began to experience difficulties. In the topic of sound waves, for instance, students were encouraged to find solutions independently, but support was still provided when they struggled to distinguish conceptual differences in the solution process. As a result, students’ independence in problem solving had not fully developed.

This aligns with the findings of Fitriah et al. (2024) that successful physics problem-solving depends on the ability to connect concepts to their mathematical representations. Unfortunately, students often focus more on mathematical manipulation than on understanding the meaning of physics, leading them to immediately search for formulas without conceptual analysis (Bowers et al., 2024) . To address this, Suwasono (2023) emphasized that teacher scaffolding should guide students’ thinking processes, rather than providing answers. Assisting too quickly actually reduces students’ opportunities to learn to solve problems independently.

The indicator regarding providing problems with more than one alternative solution received a neutral response from 63% of students. This indicates tis variations in problem solving are not consistently present across all Physics topics.

Teachers have attempted to train students’ thinking flexibility by providing various types of questions, including analytical and essay-based questions. However, the implementation has not been fully consistent. Case-based evaluation has occasionally been used to assess students’ ability to apply physics concepts, but this approach has not yet become a regular part of classroom assessment.

Field findings indicate a gap between the intended development of thinking flexibility and students’ actual problem-solving practices. Students’ variations in solving problems tend to remain limited to numerical modifications. This condition occurs because learning is often directed toward more efficient methods that produce faster answers, rather than encouraging students to explore alternative solution strategies.

This is in line with Maries and Singh (2023), who showed that problem-solving skills develop more effectively with multiple representations (such as diagrams) rather than by focusing directly on algebra. On the other hand, students often struggle to apply a variety of strategies because they are fixed on a single, rigid procedure (Napis et al., 2023). This obstacle is reinforced by the findings of Gjerde et al. (2022) who found that students tend to imitate steps when solving examples without in-depth reflection. Consequently, providing problems that involve only number manipulation perpetuates mechanical imitation and hinders students' flexibility of thought.

Physics learning has begun to use contextual problems related to daily life, such as sound waves, Wi-Fi, and sonar systems. However, these contexts are not yet consistently used as the starting point for investigation. They are more often used as examples during explanation. Students' independence in solving problems also remains limited because teacher assistance is still given quickly when students face difficulties. Therefore, contextual learning needs to be strengthened so that students can develop more independent and flexible problem-solving strategies.

3.2 Scaffolding & Conceptual Understanding

Five main areas of focus were identified from the questionnaire on student guidance strategies and understanding of physics concepts. These included initial guidance on problem analysis, intensity of basic math practice, step-by-step modeling of problem examples, emphasis on concepts in assignments, and review activities for learning materials.

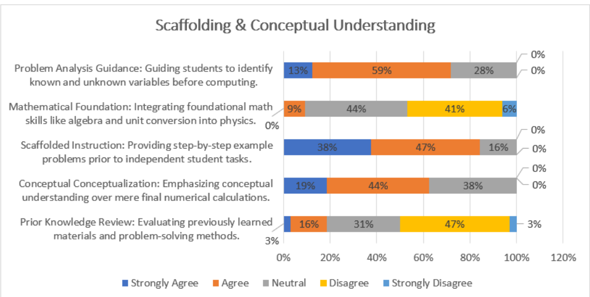

Figure 2. Students' responses to scaffolding and conceptual understanding.

Regarding guidance indicators for understanding problem information, such as writing the "known" and "asked" components, questionnaire data showed a positive response of 72% agreeing and strongly agreeing. This finding aligns with the lesson plan document, which indicates that the learning structure follows Pólya's problem-solving flow, which begins with understanding the real-world problem.

However, differences were found in practical classroom implementation. Although teachers reported that they consistently provided guidance, approximately five to eight students still experienced confusion during problem-solving activities. This condition indicates that teacher guidance had not fully accommodate the varying levels of students' understanding.

In contrast, explicit guidance in writing known and unknown variables on the board was rarely provided. Students tended to solve problems by imitating the teacher's examples rather than following a systematic process of identifying the required variables. This finding suggests that the identification stage had not been consistently emphasized in daily learning sessions.

This finding aligns with Basri et al (2024), Pravidya et al. (2022), and Lapame et al. (2025), who stated that the problem-solving stage in physics requires students to accurately identify known information, questions, and symbols. However, some students still do not do this completely. Furthermore, Riantoni et al. (2023) explained that beginners tend to match variables directly to formulas or previous examples when solving problems, resulting in more procedural than analytical solutions.

In the basic math practice indicator, 47% of students disagreed and 44% were neutral in their responses to negative statements. This indicates that teachers frequently provide mathematical reinforcement in class. This finding is also supported by the lesson plan, which includes algebraic exercises on wave equations and unit conversions for calculating frequency and velocity.

Basic mathematical skills remain a potential barrier in physics learning, although the issue is not dominant when prerequisite material is consistently reviewed. Teachers generally minimize this obstacle by re-explaining basic mathematical operations and unit concepts during instruction. The remaining difficulties tend to occur when students forget to write down or apply these mathematical components properly.

Students also experienced this challenge when working with varied numerical forms. Teachers often modified values from whole numbers into decimals or fractions to improve students' calculation accuracy. This variation required students to be more careful in performing mathematical operations and interpreting numerical information within physics problems.

This finding aligns with Kamil (2023), who showed that mathematical/numerical skills are significantly related to students' success in solving physics problems. Asshagab et al. (2023) also found that weaknesses in fraction operations and linear equations can hinder physics problem solving. Furthermore, Bahrami et al. (2025) showed that unit conversion remains a source of misconceptions. Therefore, exercises in algebra, fractions, decimals, and unit conversion are relevant to reducing students' mathematical barriers.

The indicator regarding the gradual provision of sample questions also received a positive response, with 85% of students agreeing and strongly agreeing, who felt the teacher had provided comprehensive examples before asking them to work independently. A review of the lesson plan confirmed the existence of a gradual practice question plan prepared in the second module meeting.

Teachers' mentoring time is mainly allocated to post-teaching reinforcement to ensure students' readiness after receiving the material. The intensity of guidance is greater after the lesson than before the lesson, indicating that teacher support is more focused on strengthening students' understanding through follow-up practice and clarification.

Although students recognized the importance of sample problems, this strategy was less effective in stimulating deeper reasoning. Independent practice also provided limited challenge because questions often only modified numerical values from previous examples. Simangungsong et al. (2024) showed that example problems, guided practice, and follow-up problems can support students in learning problem-solving steps, while Ayık and Gül (2025) emphasized gradually reducing teacher support to avoid dependency. Thus, scaffolding-fading can gradually shift problem-solving responsibility from the teacher to the students.

Furthermore, regarding the aspect of emphasizing conceptual understanding and not just the final numerical result, the questionnaire results showed 63% positive responses, agreeing and strongly agreeing. The lesson plan document shows that the final assessment instrument is indeed designed to measure the ability to understand and reflect on concepts, not just calculation skills.

Objectivity in classroom assessment is reflected through holistic process-based evaluation rather than reliance on final calculation results alone. Assessment is carried out from the initial stages of learning, allowing each student's progress to be observed and documented through continuous feedback.

This process-oriented evaluation aligns with students' perception of a gradual and coherent instructional sequence. The teacher does not immediately demand final answers, but guides students step by step by considering differences in their levels of understanding. Practical formulas are introduced after students have developed sufficient basic conceptual comprehension.

These findings align with Tanjung et al. (2024), who demonstrated that physics problem-solving skills can be assessed using process indicators such as understanding the problem, planning solutions, implementing strategies, and evaluating results. In addition, Adam (2025) emphasized that effective problem solving in physics involves clearly defined stages of understanding, planning, executing plans, and checking solutions. Furthermore, systematic reviews by Nasir and Kuswanto (2025) confirm that recent research consistently identifies these stages as core components of problem-solving proficiency in physics learning.

In the final indicator regarding reviewing material or completing problems (review), the negative statement about the infrequency of this activity received 47% of students' responses indicating disagreement, suggesting that review activities are carried out quite frequently. This is reinforced by the lesson plan, which includes an agenda for self-reflection and filling out a reflective journal at the end of each meeting.

In practice, teachers use review activities and discussions of current physics phenomena to stimulate students' critical thinking and reinforce their understanding. These activities are commonly carried out at the beginning of the lesson through reading-based reviews or opinion-based questions related to contextual physics issues.

From the students' perspective, review activities are often completed independently or through direct consultation with the teacher when they encounter substantially modified problem types. This occurs because some questions contain tricky elements or differ considerably from previous examples, requiring students to recheck earlier material before determining the appropriate solution.
Siswanto et al. (2025) explain that reading scientific texts and relating them to physics can improve conceptual understanding, argumentation, and critical thinking. This is reinforced by Akinyemi et al. (2025), who emphasize that evaluating solutions in physics is important through checking results, analyzing units, and assessing the reasonableness of answers.

Scaffolding has been provided through step-by-step examples, basic mathematical reinforcement, guided practice, and review activities. These supports help students understand procedures, but they have not fully developed independent conceptual reasoning. Some students still imitate examples and focus mainly on numerical changes. Therefore, scaffolding should be gradually reduced and directed toward helping students identify information, select concepts, and evaluate solutions independently.

3.3 High-Order Thinking Skills & Problem Solving

Based on the survey results regarding high-order thinking and problem-solving strategies, four key dimensions of physics learning were evaluated. The analysis centers on scaffolding students through guided practice, encouraging the use of visual representations, delivering adaptive problem challenges, and fostering conceptual analysis rather than rote formula memorization.

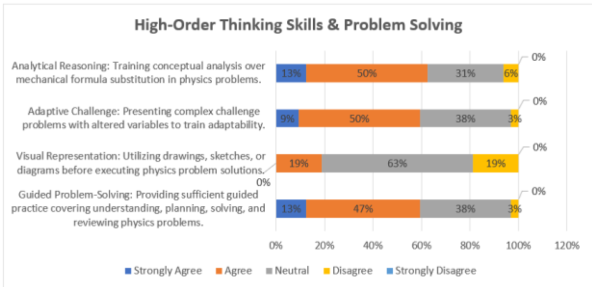

Figure 3. Students' responses to higher-order thinking and problem solving.

Regarding the indicator of problem-solving training based on rather than simply memorizing formulas, the questionnaire data showed a very positive response. 63% of students agreed that they had practiced solving problems that required cognitive analysis rather than simply plugging numbers into formulas. The lesson plan documents support this finding through a final assessment plan that measures the ability to understand, calculate, and reflect on phenomena and aligns with Pólya's problem-solving steps.

Students' reliance on formula memorization remains an obstacle in implementing higher-order thinking assessments. The implementation of HOTS-oriented assessment has not been fully intensive in classroom practice, as students' analytical ability is strongly influenced by the learning model used by the teacher. Interactive media and project-based activities can stimulate critical thinking, while passive lecture-based instruction tends to limit students' ability to solve analytical problems and develop logical reasoning.

The effort to develop students' analytical skills often conflicts with mechanistic evaluation practices. From the students' perspective, post-presentation exercises do not sufficiently challenge higher-level reasoning because the questions tend to follow previously explained patterns. Self-assessment tasks are often limited to numerical modifications, causing students to rely more on memorized calculation procedures than on deeper conceptual analysis. Tanjung et al. (2024) demonstrated that student skills were effectively assessed using Heller's framework (focus, physics description, planning, execution, and evaluation), where guided practice and structured problem sequences were shown to train analytical reasoning aligned with Pólya's steps. Similarly, Adam et al. (2025) found that scaffolding training improved prospective teachers' abilities in the problem-solving stage, although strengthening reflection and interpretation was still needed. Collectively, these studies demonstrate that emphasizing structured steps and conceptual reasoning can enhance higher-order thinking skills while reducing reliance on mechanical calculations.

Meanwhile, regarding the indicator of providing challenging questions with dynamic conditions or variables, 50% of students agreed that teachers often provide challenging questions with variable components to practice adaptive problem-solving. This point is strongly accommodated in the lesson plan documents, for example, through the analysis of medium changes in refraction and frequency variations in the Doppler effect.

Efforts to foster students' cognitive flexibility are implemented through various formal assessment formats. Teachers design varied instruments, including case-based, analytical, multiple-choice, and essay questions. However, classroom practice tends to rely more on descriptive and essay-based questions, as these formats are considered more suitable for assessing students' reasoning processes.

Students perceived that questions involving dynamic variables were sometimes challenging because changes in physical conditions could differ significantly from the initial examples. This situation required students to adapt their conceptual understanding more flexibly, rather than merely applying the same procedure from previous questions.

A study by Saefan, Kurniawan, and Rini (2025) showed that modeling tasks are adaptable to various instructional contexts and can support students' adaptive reasoning. Similarly, Nailunada, Yuliati, and Wisodo (2025) found that PBL supported by PhET simulations improved students' ability to explain phenomena and apply concepts to changing conditions. These findings indicate that adaptable tasks, dynamic contexts, and technology integration can strengthen students' analytical thinking skills.

Suboptimal conditions are evident in the habit of creating drawings, sketches, or diagrams before solving problems. The questionnaire results showed that most students fell into a gray area, choosing the neutral option 63%. This high number of neutral choices indicates that creating graphic visualizations has not yet become a standard habit for students, but is instead used passively or situationally, depending on the difficulty level of the problem. Students tended to seek quick formulas immediately without first conducting qualitative analysis or identifying the position and function of each variable. This tendency shows that students' problem-solving processes were still oriented toward procedural shortcuts rather than conceptual understanding.

Students' reliance on mechanical patterns was reflected in their habit of skipping the stages of qualitative analysis and variable visualization. They tended to imitate examples written on the board because transition exercises toward more applied problems were rarely provided. When modified problems were introduced, students often struggled because the characteristics of the problems differed significantly from the initial examples. This pattern indicates a fundamental weakness in the early stage of problem understanding within the problem-solving framework.

Students who actively draw their own diagrams have better problem-solving skills than those who are given ready-made diagrams (Maries & Singh, 2023). The convenience of ready-made diagrams or instant procedures makes students more likely to simply copy the steps. As a result, they lose sight of the problem's conceptual structure and struggle to develop flexible solution strategies (Norqvist et al., 2025).

Furthermore, regarding the adequacy of guided practice, which includes the stages of understanding, planning, completing, and reviewing, questionnaire data show that 60% of students agreed or strongly agreed that they received sufficient practice before being asked to work independently. The lesson plan document confirms the allocation of structured practice, both controlled and independent, to strengthen students' mathematical procedures. Providing post-material guided assistance is a mitigation strategy used by teachers to support students during learning. However, this intervention has not fully addressed the difficulties experienced by all students. Although sequential work instructions have been provided, several students still consistently require more intensive guidance, indicating that the instructional support has not yet accommodated differences in students' levels of understanding.

Despite the allocated guidance time, students perceived that the material often progressed too quickly before they had fully understood the previous topic. They therefore expected more frequent practice questions to strengthen their conceptual understanding of physics. This condition shows that limited practice opportunities and rapid topic transitions may reduce students' ability to internalize concepts deeply.

Chen et al. (2023) showed that worked examples can reduce cognitive load, lower perceived difficulty, and improve retention and near-transfer outcomes for beginning students. However, their effect on broader transfer remains limited without continued reinforcement through varied practice. Similarly, in the context of physics, Samani and Pan (2021) found that repeated and structured physics problem practice improves memory and students' ability to solve new, more challenging problems.

Students have been introduced to analytical questions and problems with changing variables. However, their problem-solving skills are still dominated by formula memorization and imitation of teacher examples. The use of diagrams, sketches, or visual representations is also not yet a consistent habit. Therefore, HOTS-based physics learning should emphasize conceptual analysis, multiple representations, adaptive reasoning, and reflection on solutions.

3.4 Digital Media Integration & Feedback

Four primary dimensions of instructional strategies and conceptual support were evaluated from the student questionnaire. These core areas encompass the integration of interactive digital media, student opportunities for digital variable manipulation, the frequency of collaborative group problem-solving, and the delivery of constructive teacher feedback on physics assessment errors.

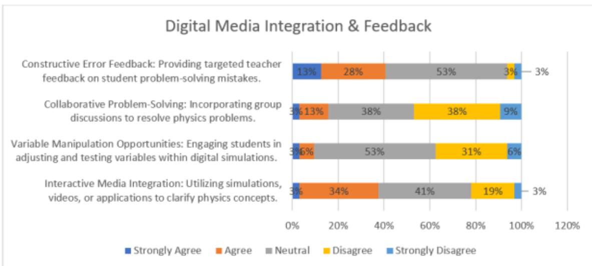

Figure 4. Students' responses to digital media integration and feedback.

Regarding indicators of the use of interactive learning media such as simulations, videos, or applications, questionnaire data show that 41% of students chose neutral. This high neutral number indicates that, although teachers have used interactive media, the intensity or variety is perceived by students as average, so it has not yet had a significant impact on students' understanding of physics concepts in class. This finding is supported by the lesson plan review document, which lists the use of PhET Interactive Simulations, learning videos, and the use of Google Classroom as a distribution center for materials and assignments.

However, classroom implementation faces significant technical obstacles. Although teachers have prepared PowerPoint and other supporting media, the available school facilities, particularly projectors, do not always provide adequate visual quality for learning activities. This limitation is further complicated by the school policy restricting students' device use, which reduces opportunities for teachers to implement interactive digital media spontaneously. As a result, teachers need to adjust their instructional strategies by returning to more conventional methods, such as note-taking, to accommodate limited access to technology during learning.

Interactive simulations such as PhET and digital media have been shown to significantly improve understanding of physics concepts compared to conventional methods because they help visualize difficult material (Rehman et al., 2021). However, their effectiveness is highly dependent on classroom implementation readiness, such as the availability of facilities, time allocation, teacher capabilities, and learning integration strategies. Without adequate technical support, a wide variety of media, and high usage intensity, these digital platforms will not have a significant impact on student understanding (Hussaini et al., 2023).

These barriers to technological access directly affect indicators of opportunities to manipulate variables through digital simulations. As a negative indicator, statements regarding the infrequent opportunities for students to change variable values showed quite a variety of responses, with 53% of students choosing neutral, indicating that opportunities for students to experiment or change variable values through digital simulations have not been routinely facilitated but only periodically or situationally due to limited access to technology. Theoretically, the lesson plan outlines virtual laboratory activities in which students can manipulate variables such as amplitude and wavelength using PhET simulations.

Limited classroom resources often cause digital learning to function as a one-way, technology-assisted lecture rather than as an interactive exploratory activity. The absence of student devices restricts opportunities for learners to manipulate variables independently, making digital simulations less effective in supporting active engagement and scientific reasoning. As a result, technology is used more as a presentation tool than as a medium for two-way conceptual exploration.

On the other hand, social interaction among students showed better conditions in the indicator of opportunities for group discussions. The statement that teachers rarely provide opportunities for discussion was rejected by many students, with 53% of them disagreeing. This response indicates that group discussion activities continue to run at the same rate in class. The lesson plan review also showed strong fulfillment of the collaborative aspect through the design of joint experimental activities and project presentations.

A project-based approach was implemented by requiring students to work in teams and present their results to the class. This approach supported collaborative learning because students could discuss difficult problems, review material together, and clarify their understanding through peer interaction.

Interactive simulations enhance understanding of physics concepts optimally when students are directly involved in independent exploration, in line with the findings of Rehman et al. (2021). However, device and connectivity limitations force the use of simulations to shift from active manipulation to passive demonstration, which hinders the potential for inquiry-based exploration and the development of scientific reasoning (Safaryan, 2023).

Furthermore, the indicator of teacher feedback on problem-solving errors showed an ambiguous tendency, with 53% of students choosing the neutral option. This response suggests that feedback has been provided, but its intensity, clarity, or consistency may not yet have been strongly perceived by students. The lesson plan document shows that teachers had integrated a continuous formative feedback system at the conclusion of each meeting.

The classroom evaluation system is formatively designed to value students' learning progress beyond final calculation results. Teachers provide constructive feedback through qualitative corrections and comments on student assignments or presentations. These after-class reflections function as instruments for reviewing students' understanding and serve as part of the basis for determining final grades.

Qualitative formative feedback personalized to students' cognitive errors has been shown to significantly improve science problem-solving skills, especially for students with low initial abilities (Pals et al., 2023). However, its effectiveness depends heavily on the consistency of its delivery in the classroom. When this substantive feedback is only provided selectively when students encounter significant difficulties, students may perceive teacher guidance as infrequent and not shared equally (Stovner et al., 2021).

Digital media such as PhET, videos, and Google Classroom have been planned, but their use is not yet optimal. Technical limitations, restricted device access, and limited opportunities to manipulate variables reduce students' active exploration. Group discussion has supported learning, but teacher feedback still needs to be clearer and more consistent. Therefore, digital media and feedback should be strengthened to help students understand errors and improve their problem-solving process.

4. CONCLUSION

This needs assessment shows that physics learning has supported students' problem-solving skills through contextual examples, scaffolding, guided practice, group discussion, digital media, and feedback. However, these practices have not yet fully developed students' independent, conceptual, and adaptive problem-solving abilities. Students still tend to rely on formulas, imitate worked examples, rarely use visual representations, and experience difficulties when problem conditions are modified. These findings indicate the need for a more structured and problem-oriented learning model to strengthen students' conceptual reasoning and systematic problem-solving skills.

Therefore, this study provides an empirical basis for further research on the use of more structured problem-based learning models to support the development of students' problem-solving skills. Such models are expected to help students understand problems, develop solution strategies, apply concepts, and evaluate their solutions more systematically. This may help students move beyond procedural calculation toward more conceptual, reflective, and flexible problem-solving.

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