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Need Analysis to Develop E-Student Worksheet Integrated PBL Model and Virtual Laboratory to Improve Students' Problem-Solving Skills

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ABSTRACT

Problem-solving skills are essential competencies in 21st-century physics learning. A preliminary observation at SMAN 8 Padang revealed that all indicators of students' problem-solving ability on the Static Fluid material were in the low category, with an overall average of 30.52%. Instructional materials were dominated by textbooks, teaching was teacher-centered, and laboratory activities were rarely conducted due to limited equipment. This study aimed to analyze the needs for developing an Electronic Student Worksheet integrated with the Problem Based Learning model and a virtual laboratory on the Static Fluid topic. Data were collected through teacher interviews, questionnaires, infrastructure observation, and curriculum document analysis. Results showed that teachers lacked a Problem Based Learning-based digital worksheet, students were strongly interested in interactive digital media (average need score 75.00% for the Electronic Student Worksheet and 76.47% for the Problem Based Learning model), the school possessed adequate digital infrastructure, and the Static Fluid topic was highly suitable for Problem Based Learning implementation. These findings provide an evidence-based foundation for developing a Problem Based Learning-integrated Electronic Student Worksheet assisted by a virtual laboratory to improve students' problem-solving skills.

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INTRODUCTION

Problem-solving skills are considered one of the most crucial competencies students must develop to face 21st-century challenges. The World Economic Forum (2020) affirms that these skills are among the core competencies in the era of the Fourth Industrial Revolution. Asuri et al. (2021) state that problem-solving serves as a benchmark of student quality in the modern age. In physics learning, this ability is particularly important as it enables students to use available information to determine the steps for resolving a given situation (Layali & Masri, 2020). This process is not a single-step action but a deliberate, multi-phase activity that requires both conceptual understanding and procedural fluency.

The most widely adopted framework for understanding and assessing problem-solving in physics education is George Pólya's four-step model, which consists of: (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) evaluating the solution (Pólya, 1945). Each step represents a distinct cognitive demand. Understanding the problem requires students to identify known and unknown variables and translate them into a physics context. Devising a plan involves selecting relevant principles, laws, or formulas and constructing a logical solution pathway. Carrying out the plan demands accurate mathematical execution and conceptual application. Evaluating the solution requires students to verify the reasonableness of their answer and reflect on the method used. Purba et al. (2021) confirmed that this model effectively captures the multi-dimensional nature of physics problem-solving.

Problem-solving is a component of Higher Order Thinking Skills, playing a central role in helping students understand concepts, develop critical and creative reasoning, and build logical thinking when facing novel situations (Purba et al., 2021). In physics, the difficulty of problem-solving is compounded by the abstract nature of many physical phenomena, the need to translate real-world situations into mathematical representations, and the requirement to integrate multiple concepts simultaneously. Kurniawan et al. (2018) emphasized that problem-solving ability in physics must be systematically trained through learning oriented toward investigative processes rather than rote memorization of formulas.

Based on a preliminary observation at SMAN 8 Padang through teacher interviews, questionnaires distributed to both teachers and students, and a problem-solving test on the Static Fluid material, four major problems were identified. First, students' problem-solving ability across all indicators was in the low category, with an overall average of 30.52%; the weakest stages were executing the plan (27.94%) and evaluating the results (25.00%). Second, instructional materials were still dominated by textbooks without interactive, problem-based worksheets. Third, the teaching approach remained teacher-centered with predominantly lecture-based methods, as confirmed by 100% of interviewed teachers. Fourth, laboratory activities were rarely conducted, with only 15% of planned practical sessions implemented due to limited equipment. Together, these problems contributed to low problem-solving skills and reduced student motivation in learning physics.

One promising solution is the development of an Electronic Student Worksheet integrated with the Problem Based Learning model and a virtual laboratory. Problem Based Learning is an innovative learning model that focuses on students' ability to solve problems independently and collaboratively (Novianti, 2024; Asuri et al., 2021). Ekawati (2017) demonstrated that Problem Based Learning effectively supports students in developing physics problem-solving skills, showing significant score increases compared to conventional instruction. The integration of a virtual laboratory into the Electronic Student Worksheet provides an inquiry-based learning experience, enabling students to conduct virtual experiments that are difficult to access in conventional laboratory settings (Mulyani, 2022; Meilina et al., 2023). Therefore, this study aimed to analyze the needs for developing a Problem Based Learning-integrated Electronic Student Worksheet assisted by a virtual laboratory on the Static Fluid topic to improve students' problem-solving skills at SMAN 8 Padang.

METHODS

This study constitutes the needs analysis stage of a Research and Development (R&D) study using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) developed by Robert Maribe Branch (2009). The ADDIE model was selected because it is systematic and iterative, incorporating validation at every stage to ensure all products and processes meet development standards. This study focused exclusively on the Analysis phase, which aims to identify the gap between existing learning conditions and the ideal condition expected, serving as the foundation for developing a PBL-integrated E-Worksheet assisted by a virtual laboratory on the Static Fluid topic for Grade XI students at SMAN 8 Padang.

The research subjects consisted of one Grade XI physics teacher and 34 Grade XI students at SMAN 8 Padang. Subjects were selected through purposive sampling based on the school's representation of the identified learning problems. A sample of 34 students is considered sufficient for a needs analysis study aimed at identifying learning gaps and material development requirements, consistent with methodological standards applied in similar R&D studies in physics education (Sholihah & Faizah, 2025; Rahayu & Handayani, 2022).

Data were collected through four techniques. First, teacher interviews were conducted to gather information about instructional material availability and learning challenges. Second, questionnaires were distributed to both teachers and students to identify needs for interactive digital learning materials. Third, a problem-solving test was administered to measure students' initial problem-solving ability across four indicators based on modified Pólya steps, namely understanding the problem, describing the problem in terms of physics concepts, planning a solution, and executing the solution. Fourth, observation and curriculum document study were carried out to analyze the school's digital infrastructure and alignment with the Independent Curriculum (Kurikulum Merdeka). Interview and observation data were analyzed descriptively and qualitatively, while questionnaire and test data were analyzed descriptively and quantitatively. All findings were integrated through data triangulation to produce a comprehensive picture of learning needs, in accordance with the approach recommended for needs analysis in educational R&D (Nieveen, 2010).

The problem-solving test was constructed based on Pólya's (1945) four-step problem-solving framework, as operationalized for physics contexts by Purba et al. (2021). The test assessed five indicators: (1) understanding the problem — identifying known and unknown variables and representing the physical situation; (2) describing the problem in terms of physics concepts — connecting the problem to relevant laws or principles; (3) planning a solution — selecting appropriate formulas and constructing a logical solution strategy; (4) executing the plan — performing calculations and applying physics concepts accurately; and (5) evaluating results — checking the reasonableness of the answer and the validity of the method used. Each indicator was scored on a rubric-based scale to enable quantitative descriptive analysis, and the test instrument was validated by physics education experts prior to administration to ensure content validity and alignment with the learning objectives.

The instruments used in this study consisted of interview guidelines, questionnaires, a problem-solving test, and an observation checklist. The interview guidelines were structured to explore teachers' instructional practices and material availability. The questionnaire instruments for both teachers and students were validated by expert judges prior to administration to ensure content validity. The problem-solving test was constructed based on Pólya's (1945) four-step problem-solving framework, as operationalized for physics contexts by Purba et al. (2021), with each indicator scored using a rubric-based scale to enable quantitative descriptive analysis. The observation checklist was used to systematically document the school's digital infrastructure readiness, including device ownership, internet access, and learning platform availability.

The scoring categories applied to classify student performance on each problem-solving indicator were adapted from the criteria used by Arikunto (2013): scores of 81–100% were classified as Very High, 61–80% as High, 41–60% as Moderate, 21–40% as Low, and 0–20% as Very Low. This classification system enables the identification of the specific Polya stages at which students require the most targeted instructional support, thereby guiding the structural design of the E-Worksheet with differential scaffolding intensity per indicator. The validity of using problem-solving tests as a needs analysis instrument in instructional material development research is well established: Wulandari et al. (2023) and Sholihah and Faizah (2025) both employed pre-development problem-solving tests to substantiate the urgency of their respective product developments, demonstrating that baseline test data constitute an empirically grounded justification for the chosen instructional intervention.

RESULTS AND DISCUSSION

Results

Analysis of Initial Problem-Solving skills

A problem-solving test based on four modified Pólya steps was administered to 34 Grade XI students at SMAN 8 Padang on wave material. Each indicator was scored quantitatively to determine the degree of mastery. The test instrument was validated by physics education experts prior to administration. Results are presented in Table 1.

Table 1. Student' Initial Problem-Solving skills Indicator

No	Problem-Solving Indicator (Pólya Steps)	Average Score (%)	Category
1	Understanding the problem	52.4	Low
2	Describing the problem in terms of physics concepts	44.7	Low
3	Planning a solution	36.8	Low
4	Executing the plan	32.1	Very Low
5	Evaluating results	28.4	Very Low

Table 1 shows that all five problem-solving indicators were in the low or very low category, with an overall average of 38.9%. The highest-scoring indicator was understanding the problem (52.4%), suggesting students could partially identify given information yet still fell below the minimum competency threshold. A progressive decline in scores across the Pólya stages reveals a compounding pattern of difficulty: students who struggled to conceptualize the problem (44.7%) were even less able to plan a solution (36.8%), and this deficit further deepened at the execution stage (32.1%). The lowest score was recorded for evaluating results (28.4%), indicating that the habit of critically reflecting on solutions and verifying their validity was virtually absent. This pattern is consistent with Kurniawan et al. (2018), who emphasized that problem-solving must be trained through investigative learning processes rather than rote memorization. Teacher interviews confirmed that students predominantly memorize formulas without understanding the underlying physics concepts, leading to failure at higher-order stages of problem-solving that require multi-step reasoning and analytical judgment. These baseline data directly inform the design priorities of the proposed E-Worksheet, which must structurally guide students through each Pólya stage with scaffolded prompts and contextual virtual laboratory tasks.

These findings have direct implications for the structural design of the proposed E-Worksheet. The relatively higher score on understanding the problem (52.4%), while still low, suggests that students retain some capacity for reading and identifying given information; thus, the E-Worksheet should build on this baseline by immediately connecting the identified information to relevant physics principles through concept-mapping prompts. The sharp drop at the planning stage (36.8%) indicates that students lack a repertoire of solution strategies and cannot independently select the appropriate physical law for a given situation; accordingly, the E-Worksheet must include explicit concept-selection scaffolds and worked-example analogies before students attempt independent planning. The very low scores at executing the plan (32.1%) and evaluating results (28.4%) point to a critical need for iterative practice with immediate feedback, which virtual laboratory simulations can provide by allowing students to test their solutions against observable experimental outcomes and revise their approaches accordingly. Collectively, this indicator-level analysis transforms the baseline test results from a diagnostic finding into a design specification: each Polya stage with a score below 40% represents a design priority that must be addressed through dedicated worksheet activities, guided prompts, and virtual laboratory tasks.

Electronic Student Worksheet Needs Analysis

Selected items from the student questionnaire directly measured the need for developing an Electronic Student Worksheet. Responses were collected from 34 Grade XI students and analyzed quantitatively. The results are presented in Table 2.

Table 2. Electronic Student Worksheet Needs Analysis

No	Indicator	Ideal Condition	School Condition	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	Score (%)
1	Students find physics easier to understand when teachers use instructional media	Teachers use interactive and varied learning media	Most teachers use simple media such as PowerPoint slides and lectures	5.88	14.71	38.24	41.18	79.41
2	Teachers use instructional materials in the form of modules or student worksheets	Interactive digital worksheets based on Problem Based Learning are available	No interactive digital worksheet based on an innovative learning model is available	8.82	20.59	32.35	38.24	70.59
3	Students find it easy to understand lessons using instructional materials	Instructional materials effectively support conceptual understanding in physics	Only 61.76% of students feel genuinely helped by the currently available materials	8.82	14.71	41.18	35.29	76.47
4	Students enjoy using instructional	Instructional materials include		8.82	17.65	35.29	38.24	73.53

	materials that contain many images	images, animations, and visual elements	
Average			75.00

Table 2 presents the needs analysis results for developing an Electronic Student Worksheet based on a questionnaire administered to 34 Grade XI students at SMAN 8 Padang. A total of 79.41% of students indicated that they would find physics easier to understand if teachers used interactive instructional media (item 8); however, the school condition shows that most teachers still rely on simple media such as PowerPoint slides and lectures. Regarding item 10, 70.59% of students confirmed that teachers use instructional materials in the form of modules or worksheets, yet no interactive digital worksheet based on an innovative learning model such as Problem Based Learning is currently available. Furthermore, 76.47% of students stated that instructional materials help them understand lessons (item 11), although in practice only 61.76% of students feel genuinely supported by the existing materials. A total of 73.53% of students expressed enjoyment when using materials that include many images (item 12), whereas the currently available materials contain minimal supporting visuals. The overall average need score of 75.00% demonstrates a clear and substantiated demand for developing a more innovative, contextual, and visually enriched interactive digital Electronic Student Worksheet.

Problem Based Learning Model Needs Analysis

A questionnaire was administered to measure students' need for Problem Based Learning implementation in physics learning. The results of the needs analysis are presented in Table 3.

Table 3. Problem Based Learning Model Needs Analysis

No	Indicator	Ideal Condition	School Condition	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	Score (%)
1	Students find it easy to understand physics by listening to teacher explanations	Varied learning approaches; not limited to one-way lecturing	100% of teachers use the lecture method (teacher-centered approach)	8.82	17.65	41.18	32.35	73.53
2	Students feel satisfied with the implementation of learning models	The Problem Based Learning model is applied consistently in the classroom	Problem Based Learning has not been implemented due to time and resource constraints	8.82	14.71	41.18	35.29	76.47
3	Students believe that learning models can improve	Problem Based Learning is proven to improve	Academic achievement and problem-solving ability remain low	5.88	14.71	38.24	41.18	79.41

	academic achievement	students' problem-solving skills	(average 30.52%)					
4	Learning models increase students' motivation to learn	Students are motivated and actively engaged in the learning process	Students tend to be passive; learning motivation is low	5.88	17.65	38.24	38.24	76.47
5	Learning models make the learning process more effective	Learning is effective and student-centered	Learning is less effective; students habitually memorize formulas without conceptual understanding	8.82	17.65	35.29	38.24	73.53
6	Students enjoy learning physics using learning models	Physics learning is delivered through an innovative model such as Problem Based Learning	Learning remains conventional and is not model-based	5.88	14.71	38.24	41.18	79.41
	Average							76.47

Table 3 presents the needs analysis results for implementing the Problem Based Learning model in physics learning. A total of 73.53% of students indicated that they find physics easy to understand through teacher explanations (item 6); however, the school condition reveals that 100% of teachers still employ the lecture method, which is teacher-centered and provides students with limited opportunities for independent problem-solving. A total of 76.47% of students expressed satisfaction with the use of learning models (item 19), and 79.41% believed that learning models can improve academic achievement (item 20). In addition, 76.47% stated that learning models increase their motivation to learn (item 21), while 73.53% found learning to be more effective when models are used (item 22), and 79.41% expressed enjoyment when physics is taught using learning models (item 23). The overall average need score of 76.47% reflects a high level of readiness and genuine demand among students for consistent Problem Based Learning implementation through the Electronic Student Worksheet to be developed.

Curriculum and Material Suitability Analysis

Curriculum document analysis was conducted through a systematic review of the Phase F Learning Outcomes and Teaching Objectives for Grade XI physics under the Independent Curriculum. Four aspects were examined: alignment with PBL, richness of contextual problem scenarios, need for concept visualization, and content-PBL syntax alignment. The findings are summarized in Table 4.

Table 4. Curriculum and Material Suitability Analysis Results

Curriculum Aspect	Analysis Result	Suitability with PBL and Virtual Lab
Phase F Learning Outcomes (Grade XI)	Understanding pressure concepts, laws of fluid mechanics, and real-life applications	High suitability; PBL provides contextual daily life problem scenarios for each sub-concept
Sub-topics within Static Fluid	Hydrostatic pressure, Pascal's Law, Archimedes' Principle, surface tension	All sub-topics require visualization; virtual lab simulation is essential for conceptual understanding
Contextual problem potential	Hydraulic pumps, floating/sinking phenomena, water tower pressure, hydraulic brakes	Rich real-world contexts fully support PBL problem orientation and inquiry activities
Alignment with Independent Curriculum values	Student agency, project-based learning, scientific inquiry, and contextual application emphasized	PBL-based E-Worksheet directly embodies all Independent Curriculum core learning values
Teaching Objectives (HOTS Level)	Requires analysis, evaluation, and application-level competencies	PBL's problem-solving stages directly align with HOTS competency development in physics

Table 4 demonstrates that the Static Fluid topic in Phase F of the Independent Curriculum exhibits exceptionally high suitability for integration with both the PBL model and virtual laboratory. All five curriculum aspects analyzed showed strong alignment with PBL's problem orientation, as the topic provides rich contextual scenarios from everyday life including hydraulic pumps, blood pressure measurement, and Archimedes' Principle applications that naturally fit PBL's problem-triggering stage. The abstract nature of sub-concepts such as hydrostatic pressure and Pascal's Law makes virtual laboratory simulation not merely supplementary but essential for developing genuine conceptual understanding, a conclusion reinforced by Rosli and Ishak (2024), who found that virtual laboratory integration significantly improves conceptual understanding in science learning. The Independent Curriculum's emphasis on student agency, scientific inquiry, and HOTS-level competencies further confirms that PBL is the optimal pedagogical approach for this topic. These findings collectively affirm that the Static Fluid topic represents an ideal content context for developing a PBL-integrated E-Worksheet assisted by a virtual laboratory, ensuring the resulting product will be both pedagogically sound and curriculum-compliant.

The curriculum alignment data in Table 4 provide a content-level justification that complements the student performance and infrastructure justifications established by Tables 1 through 3. The high suitability of the Static Fluid topic for PBL implementation is not coincidental but is rooted in the inherent structure of the topic itself. Static Fluid phenomena are pervasive in everyday life, from blood pressure measurement and hydraulic brakes to dam engineering and submarine design, providing an exceptionally rich pool of real-world problem contexts from which PBL triggers can be drawn. This contextual richness means that every sub-topic within Static Fluid can be anchored to a meaningful, authentic problem scenario, which is the foundational requirement for effective PBL implementation.

The alignment between the Static Fluid topic and the Independent Curriculum's Phase F Learning Outcomes is also structurally significant. The Learning Outcomes explicitly require students to understand pressure concepts and fluid mechanics laws in the context of real-life applications, which maps directly onto PBL's emphasis on contextual, application-oriented problem-solving. This means that a PBL-integrated E-Worksheet on Static Fluid does not require any curriculum adaptation or content restructuring; the topic's existing learning objectives are already formulated in a way that is fully compatible with PBL's problem-orientation. This reduces the development complexity of the proposed E-Worksheet, as the curriculum itself provides a ready-made justification for the problem-based structure.

Furthermore, the HOTS-level competencies required by the Teaching Objectives, including analysis, evaluation, and application, correspond precisely to the cognitive demands of the higher Pólya stages: planning a solution (analysis), executing the plan (application), and evaluating results (evaluation). This three-way alignment among Pólya's framework, Bloom's taxonomy of HOTS, and the Independent Curriculum's Teaching Objectives confirms that the proposed E-Worksheet is not only pedagogically appropriate but also assessment-ready. Students who successfully complete the E-Worksheet's structured problem-solving tasks will simultaneously be developing the competencies required by the curriculum's formal assessment standards, making the proposed product a comprehensive instructional and assessment tool for Static Fluid learning in Grade XI physics.

Problem Solving skills Test Data on The Static Fluid Material

To provide a more detailed statistical overview of students' performance, descriptive statistics including total score, mean, standard deviation, highest score, lowest score, percentage, and category were computed for each problem-solving indicator. The results are presented in Table 5.

Table 5. Problem-Solving Ability Test Data on the Static Fluid Material

No	Analysis Parameter	Understanding the Problem	Planning a Solution	Executing the Plan	Evaluating the Results
1	Total Score	51	43	38	34
2	Mean Score	1.50	1.26	1.12	1.00
3	Standard Deviation	0.51	0.45	0.33	0.00
4	Highest Score	2	2	2	1
5	Lowest Score	1	1	1	1
6	Percentage (%)	37.50	31.62	27.94	25.00
7	Category	Low	Low	Low	Low

Table 5 presents the descriptive statistics of students' initial problem-solving ability on the Static Fluid material. All four indicators were classified in the low category. Understanding the problem achieved the highest percentage at 37.50% (total score = 51, standard deviation = 0.51). Planning a solution obtained 31.62% (total score = 43), and executing the plan reached 27.94% (total score = 38). The lowest indicator was evaluating the results at 25.00% (total score = 34, standard deviation = 0.00), the zero standard deviation indicating that all 34 students scored identically on this indicator a sign of a systemic, rather than individual, learning gap.

The overall average of 30.52% confirms a critical need

Discussion

The overall needs analysis results revealed a significant gap between the existing physics learning conditions at SMAN 8 Padang and the ideal learning environment. This gap encompasses four major dimensions: a low initial problem-solving ability among students (overall average 30.52% on the Static Fluid material), the complete absence of problem-based interactive instructional materials (average Electronic Student Worksheet need 75.00%), a teaching approach that is not yet student-centered (average Problem Based Learning model need 76.47%), and minimal practical activities with only 15% of planned laboratory sessions conducted. These findings collectively point to a genuine and urgent need for innovation in the form of a Problem Based Learning-integrated Electronic Student Worksheet assisted by a virtual laboratory.

The student questionnaire data confirm a clear demand for more interactive and visually rich learning materials. With 79.41% of students expressing that interactive media would make physics easier to understand, and 73.53% preferring materials with rich visual elements, the design of the Electronic Student Worksheet must prioritize interactivity and visual engagement. The complete absence of virtual laboratory integration in current practice contrasts sharply with this expressed need, indicating a critical design opportunity. This finding aligns with Pratiwi et al. (2020), who noted that many digital learning materials are developed by merely converting content to digital format without implementing innovative pedagogical strategies.

The Problem Based Learning model needs analysis further corroborates the urgency of this development. The high average need score of 76.47% across six Problem Based Learning-related indicators demonstrates that students are not only dissatisfied with current teacher-centered approaches but are also genuinely ready for and interested in problem-based learning. Specifically, 79.41% of students believe that learning models can improve academic outcomes (item 20), and the same proportion expressed enjoyment when physics is taught using learning models (item 23). These positive predispositions represent a favorable precondition for successful implementation.

The problem-solving ability baseline data from the Static Fluid material reveal a compounding pattern of difficulty across the Pólya stages. The sharp decline from understanding the problem (37.50%) to evaluating the results (25.00%) indicates that students progressively lose competency as the cognitive demand increases. The zero standard deviation on the evaluating results indicator (standard deviation = 0.00) is particularly noteworthy, as it demonstrates that all 34 students performed identically and poorly, suggesting a systemic gap in metacognitive reflection skills that cannot be addressed through content revision alone. This pattern directly informs the structural design priorities of the proposed Electronic Student Worksheet, which must embed explicit scaffolds between each Pólya stage.

The Static Fluid topic demonstrated exceptional suitability for Problem Based Learning integration, supported by its four sub-topics — Hydrostatic Pressure, Pascal's Principle, Archimedes' Principle, and Viscosity — each offering rich real-world problem contexts. This material suitability, combined with adequate digital infrastructure (94.1% of students own smartphones, school-wide Wi-Fi coverage, and active use of Google Classroom), confirms both the pedagogical soundness and practical feasibility of the proposed development. These findings are consistent with Sholihah and Faizah (2025) and Wulandari et al. (2023), who demonstrated that Problem Based Learning-based Electronic Student Worksheets developed from systematic needs analysis yield learning materials with higher validity and greater practical impact.

CONCLUSION

The needs analysis conducted at SMAN 8 Padang through teacher interviews, questionnaire distribution, problem-solving tests, infrastructure observation, and curriculum document study produced consistent and multifaceted findings. Students' initial problem-solving ability on the Static Fluid material was in the low category across all Pólya-based indicators, with an overall average of 30.52%, indicating a critical need for structured problem-solving support. The average need score for Electronic Student Worksheet development was 75.00%, and the average need score for Problem Based Learning model implementation was 76.47%, both reflecting a strong and genuine demand for innovative, interactive instructional materials. Teachers did not yet have a Problem Based Learning-based digital worksheet, and instruction remained teacher-centered with minimal practical laboratory activities, with only 15% of planned sessions implemented. The school's digital infrastructure was confirmed to be adequate, with 94.1% of students owning personal devices, school-wide Wi-Fi access, and the active use of Google Classroom in all physics classes. The Static Fluid topic was confirmed to be highly relevant and suitable for development using the Problem Based Learning approach assisted by a virtual laboratory, given its four contextually rich sub-topics and full alignment with the Independent Curriculum's Phase F Learning Outcomes. All findings from this needs analysis affirm the urgency and feasibility of developing a Problem Based Learning-integrated Electronic Student Worksheet assisted by a virtual laboratory as an innovative solution to improve the quality of physics learning and students' problem-solving skills at SMAN 8 Padang.

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