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Needs Analysis for the Development of a Discovery Learning-Based Static Fluid E-LKPD Using Google Sites Integrated with Local Wisdom to Enhance Students' Critical Thinking Skills

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ABSTRACT

*A Google Sites-based Electronic Student Worksheet (E-LKPD) represents an innovative digital instructional resource with the potential to foster students' critical thinking skills in physics learning, particularly on the topic of static fluids. Prior to its development, a needs analysis is essential to obtain an objective understanding of the gap between the ideal instructional conditions and the actual practices implemented in the classroom. This study aimed to describe the results of the needs analysis and present the preliminary design of a Discovery Learning-based E-LKPD on static fluids using Google Sites integrated with local wisdom to enhance students' critical thinking skills. A descriptive research design employing both qualitative and quantitative approaches was adopted to obtain a comprehensive understanding of the instructional needs for developing the proposed E-LKPD. The participants consisted of 34 Grade XI (Phase F) students and two physics teachers at SMA Negeri 8 Padang, Indonesia. Data were collected through a critical thinking skills test, a student characteristics questionnaire, classroom observations, teacher interviews, and an analysis of instructional materials. The data were analyzed descriptively by integrating qualitative and quantitative findings to provide a comprehensive understanding of the identified instructional needs. The results revealed that students' critical thinking skills remained at a low level, despite their positive learning characteristics and well-established digital learning habits. Furthermore, classroom instruction had not yet fully engaged students in active learning, while the existing instructional materials did not adequately support concept discovery or the development of critical thinking skills. Based on these findings, a Discovery Learning-based E-LKPD was designed by incorporating the six stages of the Discovery Learning model—*stimulation, problem statement, data collection, data processing, verification, *and* generalization*—and integrating local wisdom through the Google Sites platform. This preliminary design is expected to provide a foundation for subsequent expert validation and practicality testing in future research.*

Keywords : Electronic Student Worksheet (E-LKPD); Google Sites; Discovery Learning; Static Fluids; Local Wisdom; Critical Thinking Skills.

I. INTRODUCTION

The twenty-first century is widely recognized as the era of knowledge, information technology, globalization, and the Fourth Industrial Revolution (Industry 4.0). These developments have imposed new demands on educational systems to produce human resources equipped with twenty-first-century competencies that enable them to adapt to and address increasingly complex global challenges. Within the framework of twenty-first-century skills, four core competencies, commonly referred to as the 4Cs, have been identified: *critical thinking*, *creativity*, *collaboration*, and *communication* [1].

Among the core twenty-first-century competencies, critical thinking is regarded as one of the most essential skills to be developed. It encompasses the ability to comprehend problems in depth, analyze information objectively, evaluate the validity of arguments, and make sound decisions based on logical reasoning [2]. In educational settings, critical thinking plays a pivotal role in enabling students to move beyond the passive acquisition of information by critically processing, evaluating, and applying knowledge in a meaningful and informed manner.

In physics education, critical thinking enables students to relate the concepts they learn to phenomena encountered in everyday life. For example, in the topic of static fluids, students are expected to understand concepts such as pressure, Pascal's law, and Archimedes' principle by observing real-world phenomena in their surrounding environment. This process requires analytical and evaluative skills to explain the relationship between theoretical concepts and observed reality. According to [2] critical thinking encompasses the skills of interpretation, analysis, evaluation, and inference, all of which are fundamental to science education, including physics. Therefore, effective physics instruction should provide students with meaningful and context-based learning experiences that foster the development of these critical thinking skills.

One instructional model with considerable potential to promote the development of critical thinking skills is Discovery Learning. This model provides students with opportunities to construct their understanding through a sequence of learning activities, including stimulation, problem identification, data collection, data processing, verification, and conclusion drawing [3]. These stages are closely aligned with the critical thinking process, as they encourage students to interpret phenomena, analyze information, evaluate evidence, and formulate conclusions based on the findings of their investigations [2]. In the context of static fluids, the implementation of Discovery Learning can facilitate students' understanding of concepts such as hydrostatic pressure, Pascal's law, and Archimedes' principle through direct observation of real-world phenomena as well as the use of digital learning resources.

In addition to instructional models, the availability of teaching materials that align with technological advancements and students' learning needs is a crucial factor in supporting effective physics instruction. One such instructional resource that can be developed is the Electronic Student Worksheet (E-LKPD) [4]**.** An E-LKPD can incorporate a systematic sequence of learning activities, including observing phenomena, formulating problems, collecting information, processing data, and drawing conclusions. Consequently, an E-LKPD serves not only as a practice resource but can also be designed as an instructional medium that facilitates concept discovery and the development of critical thinking skills. Furthermore, the use of digital teaching materials enables the integration of diverse learning resources, such as text, images, videos, and supporting hyperlinks, within a single, cohesive learning environment [5].

In the context of advances in educational technology, Google Sites can be utilized as a platform for organizing and delivering E-LKPD in a digital format. The platform enables the integration of various instructional components into a single web-based environment that is accessible online [6]. The use of Google Sites in E-LKPD development has the potential to provide a more flexible learning experience while facilitating access to a wide range of learning resources. However, the integration of technology into education should extend beyond merely converting printed teaching materials into digital formats. To maximize its educational value, digital teaching materials should be designed based on a well-defined instructional model, incorporate inquiry-based learning activities, and provide students with opportunities to develop higher-order thinking skills. [7] [8].

In addition to the integration of technology and the implementation of appropriate instructional models, incorporating local wisdom can serve as an effective approach to making physics learning more contextual and meaningful. Local wisdom embedded in students' social and cultural environments can provide authentic contexts for connecting physics concepts with real-life experiences. In the topic of static fluids, various phenomena related to the natural environment, local culture, community activities, and regional geographical conditions can be used as starting points for exploring and constructing concepts such as fluid pressure, Pascal's law, and Archimedes' principle. Furthermore, the integration of local wisdom helps students recognize that physics concepts are closely intertwined with their daily lives and the socio-cultural contexts in which they live.

Fundamentally, physics education is not limited to the acquisition of conceptual knowledge and mathematical problem-solving; it also emphasizes scientific processes involving observation, problem formulation, experimental design, data collection, data analysis, and the drawing of conclusions based on empirical evidence [9]. Therefore, physics instruction should provide students with opportunities to experience the process of concept construction through authentic scientific inquiry [10]. When students are actively engaged in these scientific processes, their critical thinking skills, scientific reasoning, and scientific literacy are more likely to develop effectively [11].

Nevertheless, prior to developing instructional materials, a needs analysis is essential to obtain a clear and objective understanding of the actual conditions of the teaching and learning process. A needs analysis is a systematic process for identifying the gap between the desired or ideal conditions and the realities of educational practice, thereby ensuring that the developed product is grounded in actual instructional needs rather than researchers' assumptions [12]. In the development of instructional materials, needs analysis occupies a strategic role as the initial stage that determines the direction, specifications, and characteristics of the product to be designed in subsequent phases [13]. Without a comprehensive needs analysis, the development of instructional materials may fail to address the intended educational needs, as it may overlook the actual characteristics and requirements of students, teachers, and the learning environment for which the product is intended.

A needs analysis is essential for identifying students' characteristics, teachers' and students' needs regarding instructional materials, the availability and utilization of learning resources, the integration of technology into instruction, the implementation of instructional models, students' understanding of static fluid concepts, and the current state of their critical thinking skills. Through a needs analysis, researchers can obtain empirical evidence regarding the extent to which existing instructional practices facilitate the development of critical thinking skills, the degree to which available instructional materials support concept discovery, and students' readiness and characteristics for technology-enhanced learning. Such information is crucial to ensure that the developed product is not merely based on researchers' assumptions but is grounded in the actual needs and challenges encountered in educational practice. Furthermore, the findings provide a foundation for determining the components, structure, and learning activities to be incorporated into the proposed E-LKPD.

Therefore, the needs analysis in this study was conducted comprehensively using multiple data sources, including a critical thinking skills test, a student characteristics questionnaire, classroom observation, interviews with physics teachers, and an analysis of the instructional materials currently in use. The use of multiple data sources was intended to ensure that the findings of the needs analysis were comprehensive, valid, and sufficiently robust to serve as the foundation for developing a Discovery Learning-based E-LKPD on static fluids. This approach is consistent with the concept of front-end analysis, which emphasizes the importance of systematically collecting comprehensive information before instructional materials are designed [14]. Accordingly, the needs analysis was not merely an administrative procedure but a substantive stage that ensured the developed product effectively addressed the instructional challenges encountered by both students and teachers in physics education.

Based on the foregoing, a comprehensive needs analysis was undertaken as the initial stage in the development of a Discovery Learning-based E-LKPD on static fluids using Google Sites integrated with local wisdom to enhance students' critical thinking skills. This needs analysis was expected to provide insights into the current state of physics instruction, users' needs, the characteristics of the instructional materials required, and the potential for integrating digital technology and local wisdom into physics learning. The findings of the analysis were subsequently used as the basis for designing and developing an E-LKPD that is relevant, contextual, and responsive to the needs of physics education while supporting the development of twenty-first-century skills.

II. METHOD

This study employed a descriptive research design using a mixed-methods approach that integrated qualitative and quantitative methods [15]. The quantitative approach was used to analyze data obtained from the critical thinking skills test, the student characteristics questionnaire, and the classroom observation instrument, with the results presented in the form of scores and percentages. Meanwhile, the qualitative approach was employed to describe and interpret data collected through interviews with physics teachers and document analysis. The integration of these two approaches enabled a more comprehensive and in-depth understanding of instructional needs [16]. The study was conducted on January 26, 2026, at SMA Negeri 8 Padang, Indonesia, involving two physics teachers and 34 Grade XI students (Phase F) from the 2025/2026 academic year as the research participants. The study focused on conducting a needs analysis as the preliminary stage in the development of a Discovery Learning-based E-LKPD on static fluids using Google Sites integrated with local wisdom to enhance students' critical thinking skills. Specifically, the needs analysis aimed to identify the instructional challenges, characteristics, and needs of both teachers and students in physics learning. The findings were subsequently used as the basis for formulating the initial specifications and structural design of the proposed E-LKPD.

The study employed several research instruments, including a student characteristics questionnaire to identify students' needs and characteristics in physics learning, a critical thinking skills test to assess students' levels of critical thinking, and a classroom observation sheet to evaluate the extent to which the implementation of instruction was aligned with the syntax of the adopted instructional model, covering the introductory, core, and closing phases of the lesson. In addition, semi-structured interviews were conducted with physics teachers to obtain information regarding instructional practices, teaching materials, instructional models, learning media, and the integration of technology in classroom instruction. Document analysis was also performed using a checklist-based instrument to evaluate the student worksheets (LKPD) used by teachers based on their alignment with the instructional model syntax, the relevance of the learning content to authentic contexts, and the availability of learning activities designed to foster students' critical thinking skills.

This study aimed to examine the extent to which current physics instructional practices align with students' learning needs and expectations as a foundation for developing a Discovery Learning-based Electronic Student Worksheet (E-LKPD) on static fluids using Google Sites integrated with local wisdom. Data from teachers were collected through semi-structured interviews to obtain information regarding instructional practices, teaching materials, learning media, and the instructional models implemented in the classroom. Meanwhile, data from students were collected using a student characteristics questionnaire and a critical thinking skills test to identify their learning characteristics and assess their level of critical thinking skills. Furthermore, classroom observations were conducted to obtain an objective understanding of the extent to which the instructional model implemented by the teachers was carried out in accordance with its prescribed instructional syntax. All data were analyzed using an integrated approach to identify instructional issues that served as the basis for formulating the design specifications of the proposed E-LKPD.

The data collection instruments used in this study consisted of a critical thinking skills test, a student characteristics questionnaire, a classroom observation sheet, a semi-structured interview guide for physics teachers, and a document analysis instrument for evaluating the student worksheets (LKPD). The critical thinking skills test was developed based on Ennis's critical thinking framework, which comprises five core indicators: basic clarification, bases for a decision, inference, advanced clarification, and supposition and integration. Meanwhile, the student characteristics questionnaire was designed to obtain information regarding students' characteristics and learning needs in physics, including their interests, aptitudes, learning motivation, learning preferences, and digital learning habits. The research data were analyzed using descriptive analysis techniques by organizing, summarizing, and presenting the data systematically to facilitate interpretation. Students' critical thinking skills were analyzed by calculating their test scores, which were subsequently interpreted according to the classification of critical thinking skill levels presented in Table 1.

$$NP = \frac{R}{SM} \times 100 \qquad (1)$$

Where:
NP = Expected percentage score
R = Student's raw score
SM = Maximum ideal score
100 = Constant multiplier

Table 1. Criteria for Critical Thinking Skills Percentage

Score (%)	Category
86-100	Very high
76-85	High
60-75	Moderate
55-59	Low
≤ 54	Very low

(Source: Ref[17])

The data obtained from the student characteristics questionnaire were analyzed by calculating the percentage score for each indicator using the following equation:

$$P = \frac{\sum x}{\sum xi} \times 100\% \qquad (2)$$

Where:
P = Expected percentage score
X = Score obtained for each indicator
Xi = Number of respondents

Table 2. Classification Criteria for Students' Needs Analysis Percentages

Score (%)	Category
86-100	Very high
61-80	High
41-60	Moderate
21-40	Low
0-20	Very low

(Source: Ref[18])

The student characteristics questionnaire data were analyzed by calculating the percentage of each indicator using the following equation:

$$P = \frac{\sum x}{\sum xi} \times 100\% \quad (3)$$

Where:
P = Expected percentage score
X = Score obtained for each indicator
Xi = Number of respondents

Table 3. Interpretation Criteria for LKPD Document Alignment Percentages

No	**Level of Achievement**	**Qualification**	**Description**
1.	86-100%	Excellent	Highly Suitable/Highly Valid/No Revision Needed
2.	61-80%	Good	Suitable/Highly Valid/No Revision Needed
3.	41-60%	Fairly Good	Less Suitable/Highly Valid/No Revision Needed
4.	21-40%	Poor	Unsuitable/Highly Valid/No Revision Needed
5.	0-20%	Very Poor	Highly Unsuitable/Highly Valid/No Revision Needed

(Source: Ref[19])

III. RESULTS AND DISCUSSION

Results

The findings of this study are presented descriptively by integrating quantitative and qualitative data. Quantitative data consisted of the results of the critical thinking skills test, the student characteristics questionnaire, and the classroom observation sheet, which were analyzed and presented as scores and percentages. Meanwhile, qualitative data were obtained from interviews with physics teachers and the analysis of instructional materials to complement and provide deeper insights into the quantitative findings. The preliminary findings were obtained from a critical thinking skills test administered at SMA Negeri 8 Padang, Indonesia, on January 26, 2026, involving 34 Grade XI (Phase F) students. The test consisted of essay questions developed based on Ennis's critical thinking framework, which comprises five indicators: basic clarification, bases for a decision, inference, advanced clarification, and supposition and integration. The results indicated that the students' overall critical thinking skills were at a low level. A detailed distribution of the students' critical thinking skills across the five indicators is presented in Figure 1.

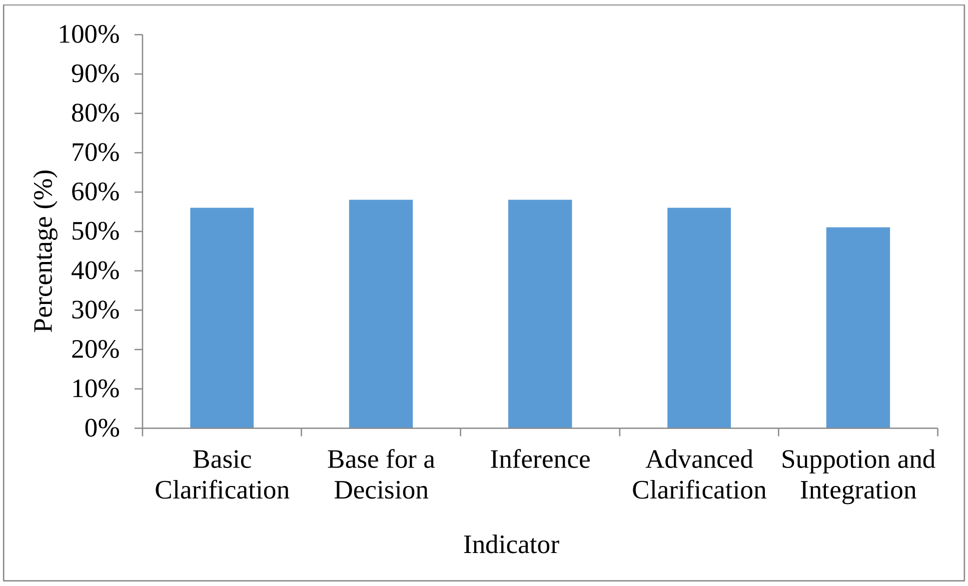

Fig. 1. Result of Students' Critical Thinking Skill Analysis

As shown in Figure 1, the analysis of students' critical thinking skills across the five indicators revealed that all indicators remained at relatively low levels. The highest scores were obtained for the indicators bases for a decision and inference, each achieving 58%, followed by basic clarification and advanced clarification, both with scores of 56%. In contrast, supposition and integration recorded the lowest score at 51%. These findings indicate that students demonstrated relatively stronger abilities in making reasoned decisions and drawing conclusions; however, they still experienced difficulties in integrating assumptions and relevant information to develop a more comprehensive understanding. Overall, the results suggest that students' critical thinking skills require further improvement through instructional practices that provide opportunities to analyze problems, evaluate information, draw evidence-based conclusions, and integrate multiple sources of information more effectively.

Although the test results indicated that students' critical thinking skills were generally at a low level, this condition cannot be attributed solely to a lack of learning interest or motivation. Therefore, a further analysis of students' characteristics was conducted to identify the factors and potential strengths that could support the development of their critical thinking skills. The analysis was carried out using a questionnaire covering students' interests, attitudes, learning motivation, learning preferences, and digital learning habits. The results of this analysis are presented in Figure 2.

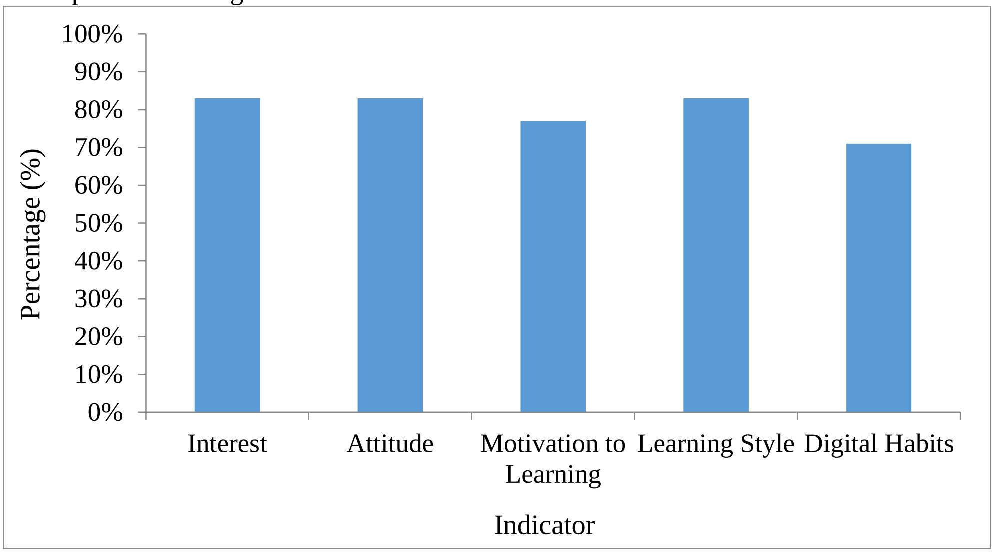

Fig. 2. Result of Students' Characteristic Analysis

The results of the student characteristics questionnaire presented in Figure 2 indicate that, overall, the participants possessed characteristics that were conducive to supporting digital learning and the development of critical thinking skills. The indicators of learning interest, learning attitude, and learning preferences each achieved a score of 83%, indicating a good level. Learning motivation obtained a score of 77%, which also falls within the good category, although it was slightly lower than the other indicators. Meanwhile, students' digital learning habits achieved a score of 71%, suggesting that they were reasonably familiar with the use of digital technology in both their daily activities and learning processes. These findings indicate that the students were generally well prepared to engage in technology-enhanced learning supported by digital instructional materials. However, despite these positive characteristics, their critical thinking skills remained at a relatively low level. This suggests that instructional materials should not only be engaging and technology-based but also be systematically designed to foster students' ability to analyze problems, make reasoned decisions, draw evidence-based conclusions, provide logical explanations, and integrate multiple sources of information through meaningful learning activities.

Although the analysis of students' characteristics demonstrated that they possessed favorable levels of learning interest, attitudes, motivation, learning preferences, and digital learning habits, these positive attributes were not reflected in their critical thinking performance, which remained at a low level. This discrepancy suggests that additional aspects of the instructional process should be examined to obtain a more comprehensive understanding of the challenges in physics learning. Therefore, classroom observations were conducted to examine the implementation of the instructional process, students' level of engagement, and the extent to which learning activities supporting the development of critical thinking skills were incorporated into classroom practice. The findings from the classroom observations were subsequently used to complement the results of the critical thinking skills test and the student characteristics questionnaire in identifying the needs for instructional material development. The results of the classroom observation analysis are presented in Figure 3.

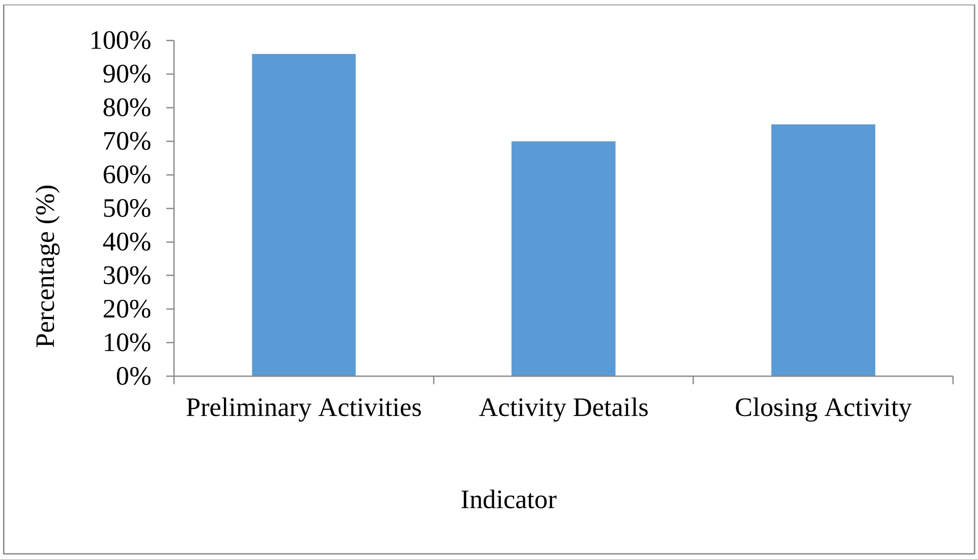

Fig. 3. Result of the Classroom Observation Analysis

As shown in Figure 3, the results of the classroom observation indicated that the introductory phase of the physics lesson achieved the highest level of implementation, with a percentage of 96%, suggesting that the opening activities were conducted very effectively. In contrast, the implementation of the core learning activities reached 70%, while the closing activities achieved 75%. These findings indicate that the overall implementation of instruction had not yet reached an optimal level, particularly during the core learning phase, which recorded the lowest percentage. This result suggests that students' active engagement in the learning process requires further enhancement so that instruction is not solely teacher-centered but also provides opportunities for students to observe, discuss, ask questions, construct concepts, and develop their understanding independently. Therefore, a more student-centered instructional approach is needed, in which the teacher serves primarily as a facilitator and guide throughout the learning process.

The classroom observation findings further revealed that the implementation of the core and closing phases of instruction was not yet optimal, indicating that students' active participation in learning remained limited. To further investigate this issue, interviews were conducted with two physics teachers at SMA Negeri 8 Padang, Indonesia, to identify the instructional models employed, the implementation of their instructional syntax, the teaching materials and learning media used, and the challenges encountered in actively engaging students during classroom instruction. The interviews revealed that physics instruction had adopted both Problem-Based Learning (PBL) and Discovery Learning, complemented by conventional lecture-based instruction. The use of these instructional models reflects the teachers' commitment to promoting greater student engagement. However, the implementation of the instructional syntax was not fully aligned with the intended design of the models.

During the investigation phase, instruction was predominantly focused on the explanation of concepts and theoretical content, while opportunities for students to engage directly in experimental activities were limited. This limitation was primarily attributed to the insufficient availability of laboratory facilities and practical resources, resulting in instruction that emphasized conceptual understanding rather than procedural knowledge. Consequently, the learning process remained largely concept-oriented, with students acting primarily as recipients of information rather than actively constructing knowledge through authentic scientific experiences. As a result, physics instruction has not yet been fully effective in fostering students' critical thinking skills in a comprehensive manner.

Another important finding emerged from the document analysis of the instructional materials used by the teachers. The analysis indicated that, although the existing teaching materials and student worksheets (LKPD) satisfied several fundamental criteria for instructional materials and were adequate to support classroom teaching and learning, they still exhibited several limitations. In particular, the learning activities provided in the LKPDs did not consistently promote active participation among all students, as they tended to be highly structured and offered limited opportunities for independent exploration. Moreover, the learning content was insufficiently connected to authentic real-life contexts, the instructional syntax was not systematically organized, and the assessment instruments were not comprehensive enough to evaluate students' problem-solving abilities or facilitate meaningful reflection on both the learning process and learning outcomes.

Table 4. Interpretation Criteria for LKPD Document Alignment Percentages

Indicator	Persentase	Qualification
Alignment of the Student Worksheet with Student Characteristics	50%	Fairly Good
Alignment of the Student Worksheet with Learning Outcomes and Learning Objectives	75%	Good
Alignment of Student Worksheet Content with Real-Life Contexts	25%	Poor
Alignment of the Student Worksheet with the Learning Model	25%	Poor
Support Provided by the Student Worksheet for Critical Thinking Skills	50%	Fairly Good
Alignment of the Student Worksheet with Learning Assessment	50%	Fairly Good
Overall Average	**45,83%**	**Fairly Good**

The data presented in Table 4 indicate that the indicator assessing the alignment of the student worksheet (LKPD) with the intended learning outcomes and learning objectives achieved the highest percentage 75%, which falls within the *good* category. This finding suggests that the LKPD was generally well aligned with the expected learning outcomes and instructional objectives. Furthermore, the indicators related to the alignment of the LKPD with students' characteristics, its support for the development of critical thinking skills, and its alignment with assessment practices each obtained a score of 50%, which corresponds to the *fair* category. These results indicate that the LKPD has begun to accommodate students' characteristics, support the development of critical thinking skills, and incorporate assessment components; however, these aspects have not yet been implemented optimally. In contrast, the indicators assessing the relevance of the LKPD content to authentic real-life contexts and its alignment with the adopted instructional model each obtained the lowest percentage 25%, which falls within the *poor* category. This finding indicates that the learning materials contained in the LKPD were insufficiently connected to real-world contexts and did not fully adhere to the instructional syntax of the learning model employed. Overall, the LKPD document achieved an average conformity score of 45.83%, corresponding to the *fair* category. However, according to the document feasibility criteria presented in Table 3, the LKPD was still classified as inadequately feasible, indicating that substantial revisions are required to better align it with the intended instructional characteristics and to more effectively support the development of students' critical thinking skills.

Discussion

Based on the findings of this study, one of the major findings is that the critical thinking skills of Grade XI (Phase F) students at SMA Negeri 8 Padang remain at a low level. This finding indicates that students continue to experience difficulties in integrating multiple sources of information and connecting their existing knowledge to develop a comprehensive understanding of a given problem. It also suggests that critical thinking extends beyond the ability to comprehend information; it encompasses the capacity to provide reasoned explanations, make informed decisions, draw evidence-based conclusions, and integrate information through logical reasoning [20].

The low level of critical thinking skills identified in this study may indicate that the current instructional practices have not yet provided sufficient opportunities for students to engage in higher-order thinking activities. In physics education, students should be encouraged to observe phenomena, identify problems, collect and analyze information, evaluate evidence, and draw conclusions based on the findings of scientific investigations. Previous systematic reviews in physics education have demonstrated that active learning, inquiry-based learning, Problem-Based Learning (PBL), and Discovery Learning are among the most widely adopted instructional approaches for fostering critical thinking skills, as they actively engage students in scientific inquiry and problem-solving processes [21]. Therefore, the findings of this study highlight the need for instructional materials that extend beyond the presentation of content and practice exercises by guiding students through the processes of concept discovery, phenomenon analysis, reasoned decision-making, evidence-based conclusion drawing, and the systematic integration of information. These needs provide a strong rationale for the development of a Discovery Learning-based Electronic Student Worksheet (E-LKPD) designed to facilitate the development of students' critical thinking skills in physics learning.

The analysis of students' characteristics revealed that the questionnaire results for learning interest, learning attitudes, learning preferences, learning motivation, and digital learning habits were generally classified as good. These findings indicate that students possess sufficient readiness and potential to engage in technology-enhanced learning supported by digital instructional materials. However, these positive characteristics were not reflected in their critical thinking skills, which remained at a low level. This suggests that the primary challenge does not stem from students' lack of interest, attitudes, motivation, or readiness to use technology, but rather from the limited effectiveness of current instructional practices in leveraging these characteristics to foster the development of critical thinking skills.

Students' characteristics constitute an important consideration in the design of instruction and instructional materials, as learners possess diverse needs, interests, abilities, and prior learning experiences. Instruction that takes these characteristics into account enables teachers to adapt instructional strategies, learning activities, and learning resources to students' needs, thereby enhancing their engagement and learning motivation. In the context of physics education, the integration of technology and digital instructional materials provides an alternative means of creating learning experiences that are more flexible, interactive, and responsive to students' characteristics. Previous studies in physics education have also demonstrated that technology can be used to personalize learning experiences according to students' needs, interests, and characteristics while simultaneously promoting their engagement and motivation in learning [22]. Therefore, the findings of the student characteristics analysis in this study further support the need to develop a digital Electronic Student Worksheet (E-LKPD) that not only capitalizes on students' familiarity with digital technology but also incorporates well-structured learning activities designed to foster critical thinking skills through active learning and the process of discovery.

The analysis of the implementation of physics instruction revealed that the introductory phase of the lesson was conducted effectively, whereas the implementation of the core and closing phases remained suboptimal. These findings suggest that the instructional process has not yet provided sufficient opportunities for students to actively engage in constructing their own knowledge. Active learning emphasizes students' direct involvement in the learning process through activities such as critical thinking, discussion, inquiry, and problem-solving, rather than merely receiving information from the teacher [23]. Therefore, although classroom instruction was implemented, the observation results indicate that it has not yet effectively facilitated students' active engagement in learning. This limitation may have contributed to the low level of students' critical thinking skills, highlighting the need for instructional materials that systematically guide learning activities and actively support students' engagement in discovery and inquiry processes.

The analysis of the instructional documents used in physics learning revealed that the existing instructional materials have not yet fully facilitated students' active engagement in concept construction and the development of critical thinking skills. The learning activities provided in these materials remain primarily oriented toward conceptual understanding and problem-solving exercises, whereas activities that encourage students to observe phenomena, investigate problems, analyze information, draw evidence-based conclusions, and integrate multiple sources of information require further enhancement. These findings indicate a gap between the instructional demands for active student engagement and the capabilities of the currently available instructional materials. Instructional materials designed to incorporate inquiry-based and active learning activities provide students with opportunities to construct knowledge, develop scientific reasoning, and strengthen their critical thinking skills. Previous studies on digital instructional materials in physics education have also demonstrated that Electronic Student Worksheets (E-LKPDs) can facilitate more interactive learning experiences while supporting the development of critical thinking skills [24]. Therefore, the document analysis findings further reinforce the need to develop a Discovery Learning-based E-LKPD that systematically guides students through processes of discovery, inquiry, and problem-solving while integrating digital technology and local wisdom into physics learning.

Overall, the needs analysis revealed a clear gap between students' potential and learning needs and the current instructional practices and instructional materials available. Although students demonstrated positive levels of learning interest, motivation, attitudes, and digital learning habits, their critical thinking skills remained at a low level, and the instructional process had not yet fully engaged them in active learning. These findings were further supported by the classroom observations, teacher interviews, and document analysis, all of which indicated that inquiry-based learning activities and opportunities to develop critical thinking skills require further enhancement. Therefore, there is a clear need to develop a Discovery Learning-based Electronic Student Worksheet (E-LKPD) using Google Sites integrated with local wisdom to provide a more active, contextual, and learner-centered learning experience. The proposed E-LKPD is expected to serve as an alternative digital instructional resource that not only supports students' concept construction through discovery learning but also facilitates the systematic development of critical thinking skills in physics education.

IV. CONCLUSION

This study employed a descriptive research design using qualitative and quantitative approaches to analyze the needs for developing a Discovery Learning-based Electronic Student Worksheet (E-LKPD) on static fluids. The needs analysis revealed that the critical thinking skills of Grade XI (Phase F) students at SMA Negeri 8 Padang were at a low level. Nevertheless, the students demonstrated positive levels of learning interest, attitudes, motivation, learning preferences, and digital learning habits, indicating their readiness to participate in technology-enhanced learning. The findings from classroom observations, teacher interviews, and document analysis further indicated that the existing instructional practices and instructional materials had not yet fully facilitated students' active engagement in inquiry-based learning or supported the development of critical thinking skills. These findings provide a strong foundation for the design and development of a Discovery Learning-based E-LKPD on static fluids using Google Sites integrated with local wisdom. The proposed E-LKPD incorporates the six stages of the Discovery Learning model: *stimulation, problem statement, data collection, data processing, verification,* and *generalization*. The integration of local wisdom is expected to provide authentic and meaningful learning contexts that are closely connected to students' local environment and everyday experiences. The developed E-LKPD is expected to serve as an interactive and contextual digital instructional resource that promotes active student engagement while facilitating the development of critical thinking skills in physics learning. The subsequent phase of this research involves the development of the prototype, followed by expert validation and practicality testing involving both physics teachers and students to ensure the quality, feasibility, and usability of the product before its broader implementation in classroom practice.

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