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Needs Analysis for the Design of E-LKPD for Dynamic Fluids Based on Inquiry Learning Using Google Sites Integrated with Local Wisdom to Improve Students' Critical Thinking Skills

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ABSTRACT

Google Sites-based digital learning materials (E-LKPD) are an innovative form of digital instructional resources with the potential to support the development of students' critical thinking skills in the subject of dynamic fluids. The novelty of this study lies in the integration of three elements into a single instructional material design: the Inquiry Learning framework, the Google Sites platform, and the context of local wisdom in the city of Bukittinggi—an approach that has not been extensively examined in combination in previous similar studies. This study aims to describe the results of the needs analysis and the initial design of the dynamic fluids E-LKPD. This study employs a descriptive method using both quantitative and qualitative approaches, focusing on the needs analysis phase and the development of the initial product design, without covering the full product development or testing phases. The research subjects in the needs analysis phase consisted of 23 eleventh-grade students in Phase F and two physics teachers at Candung State High School 1. Data were collected through critical thinking skills tests, teacher interviews, analysis of teaching materials, and student characteristic questionnaires, and were then analyzed using quantitative and qualitative descriptive methods. The results of the needs analysis indicate that students' critical thinking skills, overall, fall into the "very low" category, with achievement ranging from 36% to 43% across the five indicators, and the lowest achievement—36%—on the "analyzing evidence" indicator. The instructional materials used by teachers also did not fully implement a learning syntax that encourages active inquiry and were not integrated with local wisdom or interactive digital media. Based on these findings, a dynamic fluid-based E-LKPD (Electronic Worksheet) grounded in Inquiry Learning was designed, comprising six stages: orientation, problem formulation, hypothesis formulation, data collection, hypothesis testing, and conclusion formulation. This E-LKPD integrates the potential of Bukittinggi's local wisdom—such as Jam Gadang, Ngarai Sianok, and the traditional rice field irrigation system, and is presented online via the Google Sites platform. The design produced at this stage has the potential to serve as the basis for testing the validity and practicality of the product in subsequent research phases, while its potential to enhance students' critical thinking skills still needs to be further demonstrated through product development and testing in the next phase.

Keywords :E-LKPD; fluid dynamics; inquiry-based learning; Google Sites; local wisdom; critical thinking skills

I. INTRODUCTION

The development of 21st-century education has brought significant changes to learning objectives and processes. Learning no longer focuses solely on mastering subject matter but also on developing various skills relevant to the needs of the times, so that students are required to possess theoretical knowledge as well as practical skills and strong character [1]. These demands have driven changes in the learning process so that students can face increasingly complex challenges and problems. A number of global educational institutions, as well as Indonesia's Ministry of Education, Culture, Research, and Technology, have identified four core competencies that students must master in this era: critical thinking, creativity, communication, and

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collaboration—collectively known as the “4Cs” [2]. Among these four competencies, critical thinking plays the most fundamental role, as it serves as the foundation for students to analyze information, evaluate arguments, solve problems, and make decisions based on logical evidence [3]. The development of critical thinking skills is a crucial aspect that must be prioritized in the learning process to prepare students to meet the demands of 21st-century education.

Critical thinking is a higher-order cognitive skill that is essential for addressing the complexity of 21st-century challenges, particularly in problem-solving [4]. This process requires the ability to assess evidence, evaluate arguments, and consider various perspectives before making a decision; one of its primary purposes is to help students resolve the problems they face [5]. Each individual’s propensity for critical thinking varies depending on their experiences, cognitive abilities, and learning environment; therefore, educators must continuously analyze, train, and develop this skill throughout the learning process [6]. Thus, critical thinking can be defined as the ability to think logically by systematically gathering, analyzing, and evaluating information to gain a deep understanding, make sound decisions, and generate ideas for effectively solving problems [7].

Various studies indicate that students’ critical thinking skills in physics learning remain relatively low. Students generally struggle to analyze information, evaluate evidence, provide logical reasoning, and draw conclusions based on the data obtained [6], [8]. This situation suggests that students are not yet accustomed to using the scientific thinking process when facing contextual physics problems [5]. Low critical thinking skills also indicate that current instruction has not fully provided students with opportunities to develop higher-order thinking skills through inquiry and analysis activities [3], [9].

The development of critical thinking skills requires a learning process that provides students with opportunities to actively engage in constructing their own knowledge [10]. Students need to be involved in activities such as observing, formulating problems, gathering information, analyzing data, and drawing conclusions based on the evidence obtained [3]. Through these activities, students not only understand physics concepts but also develop the ability to think logically, systematically, and reflectively [11]. Instruction must be designed to encourage students to conduct investigations and evaluate information independently [8]. This indicates that selecting the appropriate instructional model is a key factor in developing students’ critical thinking skills.

One learning model that exhibits these characteristics is Inquiry Learning. This model places students at the center of the learning process through a series of investigative activities, ranging from identifying problems, formulating hypotheses, collecting and analyzing data, to drawing conclusions based on the evidence obtained [2]. This process provides students with the opportunity to develop the ability to analyze information, evaluate evidence, and construct logical reasoning to solve problems [5]. In physics education, the application of Inquiry Learning also encourages students to build conceptual understanding through active and systematic learning experiences. With these characteristics, Inquiry Learning is considered relevant for supporting the development of critical thinking skills in physics education [12].

In addition to selecting the appropriate instructional model, the use of digital technology is also a key aspect in supporting 21st-century learning. Digital technology enables the presentation of content, learning activities, and learning resources in a more interactive, flexible, and easily accessible manner for students [13]. The use of digital technology can also support student-centered learning by providing various media, simulations, and activities that encourage the inquiry process [14]. In physics education, the use of digital technology has the potential to help students understand abstract concepts through visualization and more meaningful interactions [15]. The use of digital platforms is one alternative for supporting the implementation of learning models oriented toward the development of critical thinking skills.

One digital platform that can be utilized to support learning is Google Sites. This platform enables teachers to develop digital worksheets (E-LKPD) that integrate various learning resources—such as text, images, videos, simulations, and learning links—into a single medium that is easily accessible via various devices [16]. The integrated presentation of learning materials and activities provides students with the opportunity to learn more independently, interactively, and flexibly according to their learning needs [17]. Additionally, Google Sites can support the implementation of the Inquiry Learning framework by presenting systematically organized inquiry activities within a digital learning environment [18]. However, digital worksheets (E-LKPD) should not only be supported by digital technology but also provide learning experiences that are relevant to students’ daily lives.

One way to create meaningful learning experiences is by integrating local wisdom into physics instruction. Local wisdom can serve as a learning context, making it easier for students to connect physics concepts with phenomena encountered in daily life [19]. The use of local contexts also helps students understand concepts more tangibly while fostering a sense of care for their surrounding environment and culture [20]. In physics instruction, various phenomena occurring within the community can be utilized as learning resources that support students' inquiry processes [21]. Therefore, integrating local wisdom into E-LKPDs has the potential to create more contextual learning experiences and support the development of students' critical thinking skills.

Various studies have developed E-LKPDs based on Inquiry Learning, utilizing Google Sites, or integrating local wisdom into physics instruction. However, most of these studies have focused primarily on the development process and on testing the feasibility and effectiveness of the products, while studies that specifically analyze needs as the foundation for E-LKPD development remain relatively limited. In fact, needs analysis is a crucial step for identifying learning conditions, student characteristics, and teacher needs so that the instructional materials developed are better aligned with real-world problems and needs in the field [17]. Based on this description, this study aims to analyze the needs for developing E-LKPD on dynamic fluid materials based on Inquiry Learning using Google Sites, integrated with local wisdom as the basis for designing instructional materials that support the development of students' critical thinking skills.

II. METHOD

This study employs a descriptive method with both quantitative and qualitative approaches, aiming to analyze the needs for developing dynamic fluid E-LKPDs based on inquiry learning using Google Sites, integrated with local wisdom. The use of this approach is based on the research objectives, namely to identify the conditions of physics learning in schools, student characteristics, teachers' needs for digital teaching materials, and the potential for utilizing local wisdom to support learning that can enhance students' critical thinking skills [18]. Quantitative data were obtained through the distribution of questionnaires and the administration of critical thinking skill tests, while qualitative data were collected through interviews, observations, and the review of learning documents. The combination of these two types of data provides more comprehensive information regarding actual conditions in the field, thereby serving as a basis for designing E-LKPD specifications that align with user needs. This type of needs analysis approach has been widely applied in instructional material development research because it provides information on student characteristics, learning needs, and the challenges faced by teachers before a product is developed. In addition, various studies on the development of E-LKPDs based on innovative learning models also utilize needs analysis as an initial stage to produce products relevant to student characteristics, learning materials, and curriculum requirements, ensuring that the developed instructional materials have higher levels of usefulness and feasibility.

The population in this study consists of all 11th-grade students in Class F1 at SMAN 1 Candung, along with the physics teacher who instructs that class. The research sample was determined using purposive sampling, specifically Class XI F1, which consists of 23 students, because this class exhibits characteristics representative of physics learning conditions at the school based on subject teachers' recommendations—particularly in terms of learning outcomes, diversity of academic abilities, and the implementation of the dynamic fluids curriculum, which is the focus of this study. These considerations were used to ensure that the sample class could represent the general conditions of physics learning at the school. The respondents in this study consisted of two physics teachers who served as interview informants as well as sources of data for document analysis and observations of instructional implementation, and 23 students in Class XI F1 who served as respondents for the characteristics questionnaire, critical thinking skills test, and as subjects for observations of instructional implementation. All students and teachers involved were provided with an explanation of the research objectives and voluntarily gave their informed consent before data collection took place, while maintaining the confidentiality of the respondents' identities in accordance with the principles of educational research ethics.

A needs analysis was conducted as the initial phase of the study to obtain an overview of the state of physics instruction and to identify various issues that formed the basis for the development of the E-LKPD. This study was conducted at SMAN 1 Candung, involving two physics teachers and 23 students from Class XI F1 as research subjects. Information from the teachers was obtained through interviews focused on the implementation of instruction, the use of instructional materials and media, and the instructional models employed during the dynamic fluids learning process. Meanwhile, data from the students were collected using a student characteristics questionnaire and a critical thinking skills test to determine student characteristics and assess their level of critical thinking skills. In addition to this data collection, the researcher also observed classroom instruction to assess the alignment of the teacher's application of the instructional model's syntax with the appropriate learning stages. All data obtained were then comprehensively analyzed to serve as the basis for formulating development needs and designing specifications for an Inquiry Learning-based E-LKPD using Google Sites integrated with local wisdom.

The instruments used in this study consisted of a teacher interview instrument, a student characteristics instrument, a critical thinking skills test sheet, a lesson implementation observation sheet, and a document analysis instrument in the form of an analysis sheet for the worksheets used by teachers. The teacher interview instrument was designed as a semi-structured interview guide to elicit information regarding the learning process, instructional models, and teaching materials used by physics teachers. The student characteristics instrument took the form of a questionnaire using a Likert scale covering eight indicators, including interest, attitude, motivation, learning style, digital habits, learning facilities, group learning habits, and students' learning difficulties. The critical thinking skills test consists of essay questions based on critical thinking skill indicators. The lesson implementation observation sheet is used to assess the alignment of lesson delivery with the syntax of the applied instructional model, covering introductory activities, core activities, and closing activities. The document analysis instrument, in the form of a checklist, is used to review the student worksheets (LKPD) used by teachers based on criteria of alignment with the learning model's syntax, the relevance of the material to real-world contexts, and the availability of activities that develop students' critical thinking skills.

The results of the critical thinking skills test were analyzed to determine students' achievement on each established critical thinking skills indicator. The percentage of students' critical thinking skills per indicator was calculated using the following equation..

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

Explanation:

NP= expected percentage score
R= student's raw score
SM= ideal maximum score
100= constant

Table 1. Criteria for Critical Thinking Skills

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

(Source: Ref[22])

The survey data on student characteristics were analyzed by calculating the percentage score for each indicator using the following equation:

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

Explanation:

P = Percentage
X = Score obtained for each indicator
Xi = Number of respondents

Table 2. Criteria for Analyzing Student Needs

Score (%)	Category
81-100	Very High
61-80	High
41-60	Moderate
21-40	Low
0-20	Very Low

(Source: Ref[23])

To obtain an overview of the compliance level of the analyzed LKPD documents, the scores for each indicator were converted into percentages. These percentages were calculated using the following equation.

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

Explanation:

P = Percentage
X = Total number of respondent answers for a single item
Xi = Maximum possible score for a single item

Table 3. Criteria for Interpreting the Percentage of LKPD Document Alignment

No	Achievement Level	Qualification	Remarks
1	81–100%	Very Good	Highly Acceptable/Highly Valid/No Revision Needed
2	61–80%	Good	Acceptable/Valid/No Revision Needed
3	41–60%	Fair	Insufficient/Invalid/Needs Revision
4	21–40%	Not Good	Unacceptable/Invalid/Needs Revision
5	>20%	Very Poor	Very Unacceptable/Very Invalid/Needs Revision

(Source : Ref[24])

III. RESULTS AND DISCUSSION

Results

A preliminary study was conducted to identify the baseline conditions of physics learning and students' critical thinking skills at Candung State High School 1. Research data were obtained through several data collection techniques, namely a pre-test of critical thinking skills, interviews with physics teachers, observations of classroom instruction, analysis of student characteristics, and analysis of instructional materials. The critical thinking skills test was administered to students in Class XI Phase F to obtain an overview of their initial critical thinking abilities. The test results were used as one of the bases for identifying the students' critical thinking skills prior to the development of instructional materials. Based on the results, the students' critical thinking skills were still classified as very low. This finding indicates that further analysis of the learning process and the instructional materials used is necessary, as shown in Figure 1, which presents the results of the critical thinking skills test.

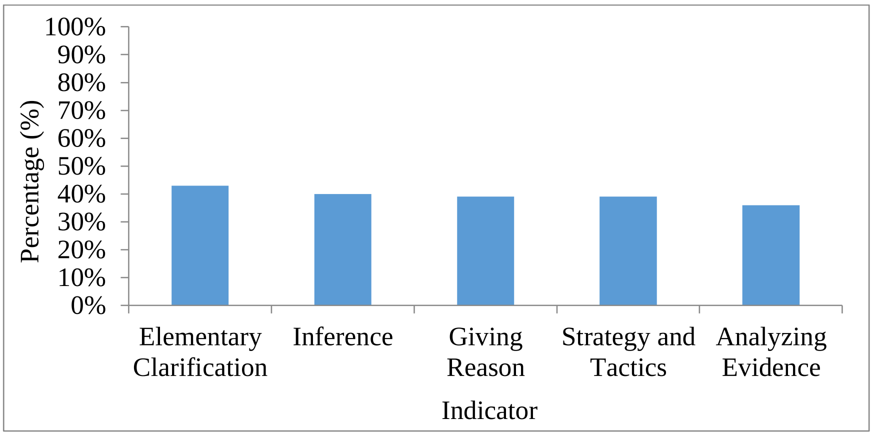

Fig. 1. Graph of Students' Critical Thinking Skills Results

The analysis results in Figure 1 show that students' achievement on the five critical thinking skill indicators ranged from 36% to 43%. These achievement levels include elementary clarification at 43%, inference at 40%, giving reasons at 39%, strategy and tactics at 39%, and analyzing evidence at 36%. Based on the critical thinking skill criteria in Table 1, all of these indicators fall within a score range below 54%. Thus, the critical thinking skills of students at Candung State High School 1 are, overall, classified as very low, with the lowest achievement found in the "analyzing evidence" indicator. The low achievement on this indicator suggests that students still struggle to relate data to concepts, evaluate the validity of information, and draw logical conclusions based on available facts. This situation highlights the need for instructional materials that explicitly train students to analyze evidence and develop critical thinking skills through the learning process. The low achievement on the “analyzing evidence” indicator compared to the other four indicators is likely related to the nature of the questions on this indicator, which require students to relate quantitative data to the concept of fluid dynamics and to assess the sufficiency and relevance of evidence before drawing conclusions—a more complex thought process than simply providing clarification or simple reasoning. Until now, students have been more accustomed to solving procedural problems and have rarely been trained to explicitly evaluate the sufficiency of evidence, resulting in the lowest achievement on this indicator.

The results of the instructional implementation analysis were obtained to provide an overview of the physics learning process taking place at Candung State High School 1. The analysis of instructional implementation was conducted by observing the learning process during teaching and learning activities. These observations covered three main stages of the learning process: introductory activities, core activities, and concluding activities. Each stage was observed to gain an understanding of how physics learning activities were carried out in the classroom. The results of the observations on the implementation of learning were then used to determine the state of the physics learning process at Candung State High School 1. The results of the analysis of learning implementation are presented in Figure 2.

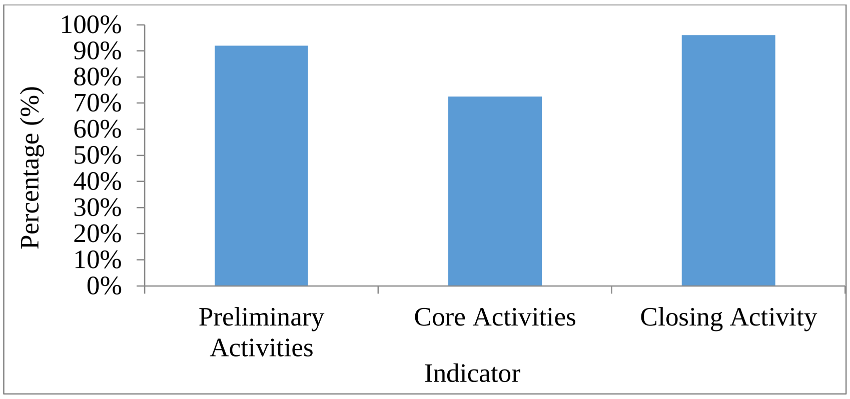

Fig. 2. Graph of the Percentage of Learning Implementation

Based on Figure 2, the analysis of physics learning implementation at Candung State High School 1 shows that introductory activities had a 92% implementation rate, core activities 73%, and concluding activities 96**%.** Closing activities achieved the highest percentage, while core activities showed the lowest implementation percentage. This indicates that the learning process, in general, was carried out well, particularly during the introductory and closing stages. However, in the core activities, there were still some aspects of learning that were not optimally implemented; therefore, efforts are needed to increase students’ active engagement during the learning process. This situation underscores the need to develop more interactive instructional materials that can facilitate students’ active participation in learning activities. The findings from the analysis of learning implementation were further explored through interviews with physics teachers to obtain more comprehensive information regarding learning conditions, the use of instructional materials, and student engagement throughout the learning process.

Interviews with two physics teachers at Candung State High School No. 1 revealed that the learning process generally followed the introductory, core, and concluding stages, but was still dominated by teacher-led instruction, resulting in suboptimal active student participation. The teachers stated that the worksheets used do not explicitly follow the learning model syntax that encourages students to formulate their own problems and hypotheses, nor are they integrated with local wisdom or interactive digital media. Teachers also believe that the use of Google Sites-based digital worksheets has the potential to increase student activity and engagement in physics learning, particularly in the topic of fluid dynamics, which is closely related to everyday phenomena. In addition to gathering information through interviews with teachers, the learning conditions and instructional materials used were also analyzed by reviewing the learning documents available at the school. This document analysis was conducted to gain an understanding of the alignment of instructional materials with learning needs, as well as the extent to which the materials used supported students’ active engagement and connected physics concepts to real-life contexts. The results of the document analysis of the worksheets used by teachers for the fluid dynamics material are presented in Table 4 below, which shows the percentage of achievement for each document suitability indicator based on the interpretation criteria in Table 4.

Table 4. Results of the Document Analysis of the Worksheets

Indicator	Percentage	Category
Alignment of Worksheets with Student Characteristics	50%	Fairly Good
Alignment of Worksheets with Learning Outcomes and Learning Objectives	75%	Good
Alignment of Worksheet Content with Real-Life Contexts	25%	Not Very Good
Alignment of the Worksheets with the Instructional Model	25%	Not Good
Support of the LKPD for Critical Thinking Skills	50%	Fairly Good
Alignment of Worksheets with Learning Assessment	50%	Fairly Good
Overall Average	**45.83%**	**Fairly Good**

The data in Table 4 show that the results of the document analysis of the LKPDs used at Candung State High School 1 yielded an average percentage of 45.83%, falling into the "fairly good" category. The indicator with the highest percentage was the alignment of the LKPDs with learning outcomes and learning objectives at 75% (the "good" category), indicating that the content and tasks in the LKPDs were aligned with the expected learning outcomes. Meanwhile, the indicators regarding the alignment of LKPD content with real-life contexts and the alignment of the LKPD with learning models each achieved a percentage of 25% (in the "less than good" category). These results indicate that the LKPDs used have not linked the material to phenomena relevant to students' daily lives and have not implemented the stages of a learning model capable of encouraging students to engage in active inquiry. Additionally, the indicators of the worksheets' alignment with student characteristics, their support for critical thinking skills, and their alignment with learning assessments each scored 50% (in the "fair" category), therefore, further refinement is still needed so that the worksheets can better support students' active engagement, develop critical thinking skills, and provide a more contextual and meaningful learning experience.

In addition to analyzing the learning process, teacher interviews, and instructional materials used at the school, an analysis of student characteristics was also conducted to gain an understanding of the conditions, needs, and factors influencing the physics learning process. This analysis is essential as a foundation for identifying student characteristics and issues that need to be addressed in the development of instructional materials tailored to their needs. The results of the analysis of student characteristics can be seen in Figure 3.

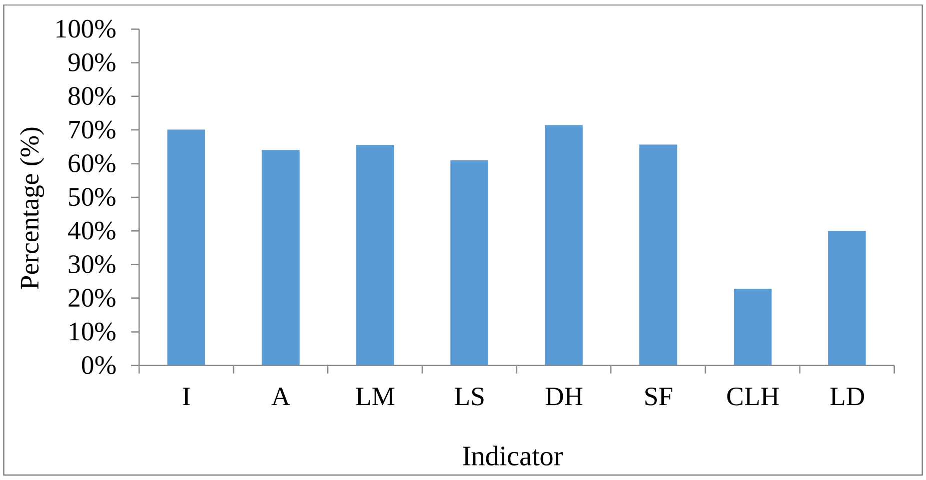

Fig. 3. Graph of Student Characteristic Assessment Results

Based on Figure 3, which presents the results of the student characteristic analysis, it is evident that student interest stands at approximately 64%, attitude at 70%, learning motivation at 66%, learning style at 61%, digital habits at 71%, and learning facilities at 66%. Meanwhile, group learning habits showed the lowest percentage, at around 23%, indicating that students still have a low tendency to engage in group learning activities. Learning difficulties stood at approximately 40%, suggesting that some students still face obstacles in participating in the learning process. The high percentage of digital habits (71%)—which is not matched by adequate group learning habits (23%)—indicates that students tend to use digital devices for individual and passive purposes, such as searching for information or accessing social media, and are not yet accustomed to using digital technology collaboratively to discuss, analyze, or evaluate issues with their peers. In other words, high levels of digital habits do not automatically lead to critical or collaborative thinking habits; therefore, digital instructional materials are needed that are specifically designed to direct the use of such technology toward inquiry-based activities and group discussions that develop critical thinking skills. This situation highlights the need for learning approaches that can increase students' active engagement—both individually and in groups—and provide learning experiences tailored to their characteristics and needs. Therefore, the results of the analysis of student characteristics serve as a key consideration in designing interactive E-LKPDs that facilitate students' ability to learn both independently and collaboratively.

Discussion

The results of the needs analysis show that the critical thinking skills of 11th-grade students in Phase F at Candung State High School 1 remain in the "very low" category across all analyzed indicators. This situation indicates that students' critical thinking abilities have not yet developed optimally at every stage of the thinking process, ranging from understanding and clarifying information, drawing inferences, providing logical reasoning, determining problem-solving strategies, to evaluating the evidence obtained. The low achievement on the "analyzing evidence" indicator suggests that students still struggle to connect observational data with relevant physics concepts, distinguish valid information from inaccurate information, and use evidence as a basis for drawing scientific conclusions. These skills are an essential part of physics learning because physics concepts are not merely understood through memorization but also through the processes of observation, data analysis, reasoning, and verification of phenomena. Therefore, the low proficiency in these indicators suggests that the current learning process has not fully provided learning experiences capable of training students to think scientifically and systematically.

This situation is believed to be related to the nature of physics instruction, which remains teacher-centered, thereby limiting students' opportunities to construct knowledge through inquiry-based activities. In such situations, students tend to receive information directly without going through the process of identifying problems, formulating hypotheses, gathering evidence, or evaluating their own findings. As a result, students are not accustomed to using evidence-based reasoning when faced with a physics problem or phenomenon. In fact, critical thinking skills develop when students are actively involved in every stage of learning, especially when they are given the opportunity to observe phenomena, process information, discuss their observations, and justify their conclusions based on available evidence. This finding is consistent with previous research indicating that students' critical thinking skills need to be developed through learning that involves active and systematic thinking processes [3], [5].

The low level of critical thinking skills is also related to the conditions of the learning process identified through teacher observations and interviews. The results of the analysis of instructional implementation indicate that the physics learning process at Candung State High School 1 has generally followed the stages of instruction, which include introductory activities, core activities, and concluding activities. However, the implementation of instruction has not yet fully succeeded in creating a student-centered learning environment, particularly during the core activities, which constitute the primary stage in the knowledge-construction process. At this stage, students should have the opportunity to observe phenomena, ask questions, gather information, analyze data, and communicate their findings. However, the observation results indicate that these activities have not been carried out optimally because the learning process is still dominated by teacher explanations and problem-solving exercises, thereby limiting students' involvement in constructing their own knowledge.

This situation indicates that the current learning process has not fully provided learning experiences capable of developing students' critical thinking skills. In physics education, core activities play a crucial role because it is at this stage that students are trained to connect concepts with phenomena, conduct simple investigations, interpret data, and draw conclusions based on the evidence obtained. If opportunities to engage in these activities remain limited, students tend to merely receive information without undergoing a systematic scientific thinking process. Consequently, their abilities to analyze information, evaluate evidence, and solve problems remain underdeveloped. This situation aligns with the results of critical thinking skills tests, which indicate that students' abilities across all indicators remain in the low category; therefore, instruction is needed that more effectively engages students actively in the process of discovering concepts. This finding is further supported by interviews with physics teachers, who stated that instruction is still largely teacher-directed, while the worksheets used have not been designed based on a learning model syntax that encourages students to conduct independent investigations. Learning activities remain focused on completing assignments and exercises, so students are not yet significantly involved in formulating problems, developing hypotheses, collecting data, testing investigation results, and drawing conclusions independently. In fact, these activities are an important part of developing critical thinking skills and scientific process skills. Therefore, instructional materials are needed that can facilitate each stage of the inquiry process so that students gain a more active, systematic, and meaningful learning experience [16], [17].

The results of the document analysis of the worksheets used in schools further reinforce the findings from the needs analysis phase. In general, the worksheets contain content and tasks that align with the established learning outcomes and learning objectives. However, the content of the worksheets still focuses on presenting material and solving problems, and thus fails to facilitate students in constructing knowledge through the inquiry process. The learning stages that guide students to identify problems, formulate hypotheses, collect and analyze data, test hypotheses, and draw conclusions independently have not yet been systematically structured [20]. This situation indicates that the worksheets currently in use do not fully support the implementation of a student-centered learning model; consequently, students' opportunities to develop critical thinking skills remain limited. Furthermore, the analysis results also indicate that the material presented in the worksheets has not been linked to phenomena relevant to students' daily lives or to the potential for local wisdom in their surrounding environment. In fact, linking the material to real-world contexts can help students understand physics concepts more meaningfully because they can connect the knowledge they learn to their everyday experiences. In the topic of fluid dynamics, various local phenomena—such as water flow in traditional rice paddy irrigation systems, river flow in the Sianok Gorge area, and other phenomena found in the surrounding environment—can be utilized as learning contexts to help students understand concepts through more tangible experiences. The absence of such contexts tends to make learning abstract, resulting in students being less motivated to analyze the phenomena they encounter in their daily lives.

From the perspective of developing critical thinking skills, the worksheets used also do not provide sufficient opportunities for students to evaluate information, provide evidence-based reasoning, or reflect on the results of their investigations. The available activities are still dominated by solving problems with predetermined answers, so students' thinking processes are more oriented toward finding answers rather than discovering concepts through inquiry. Furthermore, the assessments included in the worksheets still place greater emphasis on final learning outcomes and do not fully accommodate the evaluation of students' thinking processes during learning activities. In fact, worksheets designed with systematic thinking steps can help students construct knowledge independently and develop the ability to analyze, evaluate, and draw conclusions based on evidence [20].

An analysis of student characteristics indicates that students' learning conditions should be a key consideration in the development of instructional materials. In general, students possess the interest, attitudes, motivation to learn, digital habits, and learning resources that support technology-based learning. These conditions suggest that students are prepared to utilize digital instructional materials as a more flexible and interactive learning medium [19]. However, the still-low prevalence of group learning habits indicates that students are not yet accustomed to collaborating to solve problems or engaging in active discussions during the learning process. On the other hand, the fact that some students still experience learning difficulties suggests that they require more structured learning support to gain a deeper understanding of physics concepts.

Therefore, the instructional materials developed must not only present content in an engaging manner but also accommodate students' diverse learning styles. The e-LKPDs developed should be designed to facilitate self-directed learning while providing opportunities for students to interact, discuss, and collaborate in solving the problems presented [17]. The systematic presentation of learning activities through the stages of Inquiry Learning can help students build conceptual understanding step by step, starting from identifying problems, formulating tentative hypotheses, gathering information, to drawing conclusions based on the evidence obtained. Thus, students do not merely act as recipients of information but are also actively involved in the process of constructing knowledge through investigative activities.The characteristics of students who are accustomed to using digital devices also present an opportunity to develop technology-based instructional materials that are better suited to current learning needs. The use of the Google Sites platform allows various learning resources—such as text, images, videos, simulations, and interactive worksheets—to be presented in a single medium that is easily accessible anytime and anywhere. This flexibility helps students learn at their own pace while providing opportunities to review material if they encounter difficulties. These findings align with research indicating that the use of digital platforms in learning can increase student engagement, provide a more interactive learning experience, and support more independent learning [15][18].

Based on the overall results of the needs analysis, this study provides an empirical basis for the development of Inquiry Learning-based E-LKPDs as a relevant solution to the learning problems identified at Candung State High School 1. The Inquiry Learning model provides students with the opportunity to engage in the inquiry process through the stages of orientation, problem formulation, hypothesis formulation, data collection, hypothesis testing, and drawing conclusions [25]. These stages are closely related to critical thinking skill indicators because students are guided to identify problems, process information, use evidence, evaluate investigation results, and draw conclusions. Thus, the application of the Inquiry Learning framework in the E-LKPD is expected to provide a more structured learning activity to facilitate the development of critical thinking skills, particularly regarding the indicator of analyzing evidence—which showed the lowest achievement in the pre-test results.

The integration of local wisdom into the E-LKPD is also a crucial component in addressing the instructional material issues identified during the needs analysis phase. The subject matter of dynamic fluids is closely related to various phenomena in the surrounding environment, such as water flow in rice field irrigation channels, water flow in rivers, and air flow phenomena. Local contexts closely related to students' daily lives can serve as a starting point for observing phenomena, formulating problems, and analyzing the underlying physics concepts. In the previous E-LKPD design, local wisdom was integrated through the phenomena of Jam Gadang, the Sianok Gorge, and traditional rice field irrigation systems, which were linked to fluid dynamics concepts and Bernoulli's Principle. This approach allows students to learn physics concepts through more familiar phenomena, making learning more contextual and meaningful. This aligns with previous research showing that worksheets based on local wisdom can support the development of students' critical thinking skills [26].

The use of Google Sites as an E-LKPD platform is also well-suited to students who are relatively digitally savvy. Google Sites allows for the presentation of instructional materials in a more flexible format through the integration of text, images, videos, and links to learning activities. The use of these digital media can provide a more interactive learning experience compared to conventional worksheets and enables students to access instructional materials using available digital devices. Previous research has shown that discovery-based E-LKPDs using Google Sites have high levels of validity and effectiveness in supporting students' reasoning skills, although that research focused on mathematics learning and did not integrate local wisdom [27]. Thus, the use of Google Sites in this study is intended not merely as a medium for presenting material, but as a platform that integrates inquiry activities, multimedia, local wisdom contexts, and critical thinking skill exercises within a single digital learning environment.

The findings of this study are also related to previous development research that created discovery-based E-LKPDs to improve students' critical thinking skills. That study showed improvements in several indicators of critical thinking skills, but it did not integrate local wisdom and did not utilize a specific web-based platform [28]. Another study on inquiry-based worksheets on dynamic fluid mechanics demonstrated that the instructional materials were appropriate and effective in improving students' learning outcomes, but it did not specifically focus on critical thinking skills or the integration of local wisdom [29]. Based on this comparison, the E-LKPD design in this study is more integrated because it combines dynamic fluid mechanics content, the Inquiry Learning framework, the Google Sites platform, local wisdom, and critical thinking skill indicators into a single digital instructional material.

Based on the overall results of the needs analysis, this study provides an empirical basis for the development of Inquiry Learning-based dynamic fluid E-LKPD using Google Sites integrated with local wisdom. However, this study has several limitations. The research was conducted only up to the needs analysis stage as the initial phase of E-LKPD development; thus, it did not include the product development process, expert validation, practicality testing, or effectiveness testing. Therefore, the proposed E-LKPD cannot yet be declared effective in improving students' critical thinking skills; rather, it remains a design based on the identified learning needs. Further research is needed to continue the stages of development, validation, implementation, and effectiveness testing to obtain empirical evidence regarding the feasibility and effectiveness of the E-LKPD in improving students' critical thinking skills.

IV. CONCLUSION

The results of the needs analysis indicate that the critical thinking skills of 11th-grade students in Phase F at Candung State High School 1 are still relatively low, particularly regarding the "analyzing evidence" indicator.

The instructional materials used in the learning process do not yet fully incorporate learning stages that encourage students' active engagement in the inquiry process, nor are they integrated with local wisdom and interactive digital media. These findings serve as a crucial foundation for designing an E-LKPD on dynamic fluids based on Inquiry Learning using Google Sites that integrates local wisdom, with product specifications that include the six stages of Inquiry Learning: orientation, problem formulation, hypothesis formulation, data collection, hypothesis testing, and conclusion formulation, and integrating the context of local wisdom. The main contribution of this study lies in the results of the needs analysis, which empirically identified the gap between current learning conditions and students' needs, as well as the initial product design developed based on that gap. The resulting product has the potential to serve as a more interactive and contextual teaching- t to support students' active engagement in dynamic fluid learning, while its potential to tangibly enhance students' critical thinking skills still needs to be demonstrated through product development and testing in future research, given that this study is descriptive in nature and covers only the needs analysis and preliminary product design stages, and involves subjects from a single school with a relatively limited number of respondents. The next steps that need to be taken are the development and validation of the product design by experts, as well as practical testing with teachers and students, to ensure the product's suitability before it is used more widely.

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