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Need Analysis to Develop Alternative Energy E-Student Worksheet Integrated Inquiry Learning and Local Wisdom to Facilitate Students' Critical Thinking Skills

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ABSTRACT

This study aims to develop an E-Student Worksheet on alternative energy integrated with Inquiry Based Learning (IBL), local wisdom, and Canva AI to facilitate the critical thinking skills of Phase E senior high school students. This research is motivated by the low level of students' critical thinking skills, limited digital teaching materials, and difficulties in understanding physics concepts. To address these challenges, a digital E-Student Worksheet was developed by integrating inquiry-based activities, local wisdom of West Pasaman, and interactive Canva AI features. This study employed the Research and Development (R&D) method using the 4D model, consisting of Define, Design, Develop, and Disseminate stages. Research data were collected through preliminary studies, student needs questionnaires, teacher interviews, and validity and practicality assessments. The preliminary study showed that students' critical thinking skills were relatively low, with an average achievement of 49.70%. The developed E-Student Worksheet is expected to serve as a valid and practical digital learning resource that facilitates students' critical thinking skills in physics learning.

INTRODUCTION

Education in the 21st century reflects significant changes in educational approaches, technology utilization, goals, and challenges. In the digital era and globalization, education is required to be able to adapt to evolving needs and demands, as well as prepare students to become skilled and competitive individuals in the global market Burnama et al., (2024). This condition demands the competence of graduates from various levels of education who not only master the subject matter, but also include learning skills and innovation in response to modern developments and education (Lutfiadi & Zawawi, 2021). The 21st century skills include four main competencies (4C), namely: 1) critical thinking skills, 2) creative and innovative thinking skills, 3) communication skills, and 4) collaboration skills (Irwan &

Kamarudin, 2021). One of the skills in the 21st century is the ability to think critically, which must be used to improve the quality of education in Indonesia.

Critical thinking skills describe a person's ability to analyze ideas or ideas appropriately according to applicable concepts. This is in agreement with Valengia et al., (2021) which states that the ability to think critically is the ability of everyone to analyze and evaluate information that can be trusted so that it can provide rational and correct conclusions. The aspects of critical thinking skills that will be used are providing simple explanations, building basic skills, concluding, providing further explanations and setting effective strategies, which can be measured by a test of critical thinking skills Denti et al., (2024). The development of critical thinking skills is accompanied by the formation of students' skills and a better attitude to physics learning.

In physics learning that does not only focus on the material but also as an effort to understand various natural phenomena systematically. The focus of students is not only on achieving the final learning results, but also on understanding principles and theories (Sulistiyono, 2020). This understanding allows students to understand concepts in depth, develop critical thinking skills, and practice logical and regular questioning skills. Through the physics learning process, students are trained to have scientific reasoning, problem-solving skills, and critical thinking skills, all in line with efforts to strengthen the Pancasila Student Profile which includes values such as faith and fear of God Almighty, noble character, independence, cooperation, global diversity, critical reasoning, and creative (Sinurat et al., 2025). In physics learning, efforts are needed that can support students in understanding the material as well as practicing their thinking skills, one of which is by teaching materials.

Teaching materials are in the form of learning materials that are systematically prepared based on learning principles to support the achievement of competencies that have been formulated and create a conducive learning atmosphere Zulfi Idayanti et al., (2024). One form of teaching material that can be used in the learning process is the Student Worksheet. Student Worksheet is a form of teaching material used in learning, containing instructions for use, brief materials, and assignments designed to help students understand the subject matter so that competencies and learning indicators can be achieved Denti et al., (2024). Students will learn to understand the material and do assignments independently according to the instructions. Student Worksheet will maximize students to play an active role in learning Nurmasita et al., (2023). Therefore, *E-Student* It was developed to adapt the learning process to the demands of the times while increasing student involvement in learning activities. *E-Student* to increase students' interest in learning and reduce boredom during the learning process. Thus, students' critical thinking skills will increase. In addition, *E-Student* has the advantage of facilitating learning because it can be accessed through various electronic devices such as desktop computers, computers, notebooks, and smart phones Nurmasita et al., (2023). Therefore, a learning approach is needed that is able to encourage students' active involvement in the high-level thinking process, one of which is through the application of the Inquiry Based Learning model in learning.

Inquiry-Based Learning Model Inquiry-based learning is a process in which students actively build knowledge through questioning, formulating hypotheses, conducting investigations, and drawing conclusions based on data Pedaste et al., (2015). Student-centered learning models direct students to actively engage in learning through questioning, conducting investigations, and finding answers to realize learning that is more contextual and closer to students' lives, the IBL model needs to be integrated with local wisdom values that develop in the community. The development of *E-Student Worksheet* in this study utilizes Canva AI as a platform for developing digital teaching materials. Canva AI provides various artificial intelligence-based features, such as Magic Write and Magic Design, as well as the integration of illustrations, videos, and infographics, helping teachers develop learning

materials more quickly, engagingly, and interactively. Furthermore, Canva for Education also provides thousands of learning templates, ready-to-use learning resources, and AI features designed to enhance students' creativity, engagement, and critical thinking skills in the learning process.

The use of Canva AI in developing open-source materials is also supported by research by (Ni Putu Widya Purnamawati et al., 2024), which showed that Canva-based e-modules effectively improve students' critical thinking skills because they present material through a combination of visuals, interactive activities, and engaging evaluations. Furthermore, the integration of *E-Student Worksheet*, the Inquiry-Based Learning model, and local wisdom from West Pasaman (such as the use of palm oil waste biomass, biogas from cow dung, and Kincia Aia) is expected to produce valid, practical, and effective teaching materials for developing students' critical thinking skills in alternative energy. This is reinforced by research by (Hermita et al., 2025), which concluded that e-modules based on Inquiry-Based Learning integrated with local wisdom significantly improve critical thinking skills by encouraging students to conduct scientific investigations and teaching science concepts within the context of their environment. Local wisdom is the culture of a region that contains moral values, knowledge, and can be a source of knowledge Siti Dwi Cahira, (2024). The use of local wisdom is not only used to regulate the order of people's lives, but also to be able to form a distinctive character that distinguishes one region from another Suherman et al., (2024). Thus, local wisdom has great potential to be implemented in the learning process. So, learning based on local wisdom plays a role in developing students' critical thinking skills so that they are able to find new knowledge.

METHODS

The type of research used in this study is the Research and Development (R&D) method. Research and Development (R&D) methods were chosen in this study as a framework to produce new products and test their success. In this study, the Research and Development (R&D) approach was chosen. As explained by research Gustina et al., (2024)., R&D is a research method used to produce a particular product and test the effectiveness of that product. To produce certain products, research is used that is a needs analysis and to test the effectiveness of the product so that it can function in the wider community, research is needed to test the effectiveness of the product so that the final result of this research will produce a product.

The research model used in this study is 4D. The 4-D development research model is a model that involves stages (Define, Design, Development, Disseminate) proposed by Thiagarajan, 1976). The selection of this model is based on the consideration that the research design of the 4-D model is systematic and based on the theoretical foundation of educational product design, so that the products produced have feasibility standards. The 4-D model has a clear procedure that will make it easier for researchers to produce a product.

The research instrument consists of a critical thinking ability test, a teaching material analysis sheet, a questionnaire of student needs, and a physics teacher interview guide. The critical thinking ability test was developed based on five critical thinking indicators proposed by Ennis, (2016), namely *basic clarification, bases for a decision, inference, advance clarification* and *additional*. The student needs questionnaire is used to obtain information about learning characteristics, learning styles, and students' needs for digital teaching materials. Meanwhile, the teaching material analysis sheet and interview guide are used to obtain information about the learning conditions of physics and the needs of teaching material development.

The research data was analyzed using descriptive statistical techniques. Student needs are assessed using a five-point Likert scale from Riduwan, (2012). The scale is used to measure

the level of approval of respondents to each statement in the questionnaire. The scoring criteria for the five-point Likert scale are presented in Table 1.

Table 1. Percentage of Critical Thinking Ability Initial Test Score

Total score range (%)	Rating
81-100	Very Powerful
61-80	Strong
41-60	Enough
21-40	Weak
0-20	Very weak

Source: (Riduwan, 2012)

Based on the Likert scale in Table 1, the index of 81-100 is considered very strong, 61-80 is considered strong, 41-60 is considered sufficient, 21-40 is considered weak, and the index 0-20 is considered very low. Quantitatively, test instruments are used to determine the percentage of critical thinking students.

$$p = \frac{a}{b}\ x\ 100\%$$

P = Percentage of critical thinking skills
a = Number of correct answers to critical thinking skills questions
b = Total number of critical thinking skills questions

RESULTS AND DISCUSSION

Results

The results of this study can be seen from the test of students' critical thinking ability conducted at SMAN 1 Kinali. Data was obtained through critical thinking ability essay tests by distributing questionnaires to students and interviews with physics subject teachers. The results of the preliminary study can be summarized as follows. Based on the results of the students' critical thinking ability test, in the form of an essay test conducted at SMAN 1 Kinali. This test was held on February 6, 2026 and was attended by 33 students of class X Phase E. This instrument was developed by Nurifa (2025) which has been validated using the critical thinking ability indicator by Ennis, (2016). This research uses a 4D development model, which includes four stages, namely define, design, develop, and disseminate. However, in this study, the development process is limited to the develop stage. The following is an explanation of the development of *E-Student* alternative energy integrated with IBL and Local Wisdom to facilitate students' critical thinking skills.

Front-End Analytics

The front analysis aims to identify the initial conditions of physics learning and the problems faced by teachers in the learning process. The analysis was carried out through interviews with physics teachers at SMAN 1 Kinali, learning has used the Independent Curriculum, but its implementation still faces several obstacles, such as students' difficulties in understanding physics concepts, low learning activity, and limited learning time. In addition, digital learning support facilities are still inadequate, such as limited use of projectors and internet access. The teaching materials used are also still dominated by package books and simple Student Worksheet that do not fully contain contextual problems to train students' critical thinking skills.

The results of the interviews also show that teachers have used digital media such as PowerPoint and learning videos, but the use of *E-Student* is still limited. Teachers consider

that *Inquiry-Based* Learning (IBL)-based E-Student is very necessary because it can increase students' interest in learning, activeness, and critical thinking skills. Although teachers have implemented IBL through practicum and group discussions, the implementation has not been optimal because students are not used to independent learning, it takes longer, and the limitations of inquiry-based teaching materials. Therefore, it is necessary to develop *E-Student* based on Inquiry-Based Learning integrated with local wisdom on Alternative Energy materials to support more interactive, contextual, and in accordance with the demands of the Independent Curriculum.

Learning Analysis

Student analysis was carried out systematically through the provision of critical thinking ability tests to class X students at SMA Negeri 1 Kinali. This activity aims to obtain an overview of the level of students' critical thinking skills as a basis for designing learning that suits their learning characteristics and needs. The test instrument was prepared referring to the indicators of critical thinking ability put forward by Ennis (2016), namely Basic Clarification, Bases for a Decision (basis for decision-making), Inference (drawing conclusions), Advanced Clarification (further clarification), and Additional Considerations (additional considerations). Each question item is designed to measure students' ability to understand the problem, identify relevant information, evaluate evidence, draw logical conclusions, and consider various alternative solutions based on rational reasons.

Based on the results of the critical thinking ability test that has been carried out, data was obtained that the level of students' critical thinking ability is still quite sufficient, with an average achievement of 49.70%. The following description of the average achievement in each critical thinking ability indicator can be seen more fully in Table 2 below.

Table 2. Percentage of Critical Thinking Ability Initial Test Score

No.	Critical Thinking Indicators	Percentage	Categories
1	Basic clarification	54.55%	Enough
2	Bases for a Decision	34.85%	Weak
3	Inference	53.03%	Enough
4	Advance clarification	52.27%	Enough
5	Additional	53.79%	Enough
	Average	49.70%	Enough

Based on Table 2, it can be seen that the fundamentals of decision-making indicator obtained an achievement percentage of 34.85% and is included in the sufficient category. These indicators reflect the student's ability to utilize relevant information, evidence, and concepts to support the decisions or answers given. Low achievement on this indicator indicates that students still struggle in formulating logical reasons and connecting the available data with proper physics concepts. In addition, students are not used to evaluating the information obtained before making a decision or drawing conclusions. This condition shows that the learning that takes place has not fully provided students with the experience to develop evidence-based thinking skills and scientific reasoning. Therefore, learning activities that emphasize more on the process of investigation, data analysis, and problem solving are needed so that students' ability to make decisions based on scientific facts and concepts can develop better.

The analysis of student needs was carried out to obtain an overview of the characteristics and learning needs of students in alternative energy materials. The aspects analyzed include learning interests, attitudes, learning motivation, learning styles, critical

thinking skills, and students' experiences in digital learning. The results of the analysis of student needs based on these aspects at SMA Negeri 1 Kinali are presented in Table 3 below.

Table 3. Student Needs Analysis

No.	Indicator	Percentage	Categories
1	Interest	65%	Strong
2	Attitude	64.50%	Strong
3	Learning Motivation	60%	Strong
4	Learning Style	59%	Enough
5	Critical Thinking Skills	62%	Strong
6	Digital Learning	66%	Strong
7	External Energy Material	62%	Strong

Based on the results of the analysis of student characteristics, information was obtained that students' learning interest in physics learning was in the strong category with a percentage of 65%. The learning attitude of students is also in the strong category with a percentage of 64.50%, which indicates a readiness and positive response to the learning activities carried out. Students' learning motivation is in the strong category with a percentage of 60%. In the aspect of critical thinking skills, students obtained a percentage of 62% which is included in the strong category. This condition shows that students have good enough abilities to analyze information, evaluate problems, and draw conclusions based on the facts obtained. Meanwhile, the learning style of students is in the category of sufficient with a percentage of 59%. These results show that there is a variation in learning preferences that students have, so that learning strategies and media that are able to accommodate these various learning characteristics are needed. In the aspect of digital learning, students obtained a percentage of 66% with a strong category and students' initial understanding of alternative energy materials was in the strong category with a percentage of 62%. These findings show that students already have a fairly good basic knowledge regarding the material to be studied.

Task Analysis

Based on the results of interviews with physics teachers at school, it is known that. The teaching material used in Physics learning class X is the book Ni Ketut Lasmi and published by Erlangga in 2021. This book does not contain a discussion related to Local Wisdom on the topic of renewable energy. In addition, the critical thinking skills developed in the book do not fully reflect the indicators put forward by Ennis (2016).

Task analysis is carried out to identify competencies, activities, and skills that students need to master during the learning process on alternative energy materials. In addition, this analysis aims to find out the initial picture of students' critical thinking skills through descriptive statistical analysis of the test results that have been given. The information obtained is the basis for determining the order of learning activities, the preparation of materials, and the development of inquiry activities that are in accordance with the characteristics of students. The results of the analysis also provide an overview of the level of achievement, dissemination of abilities, and variations in students' learning outcomes as the basis for the development of E-Student Worksheet. The data from the results of the task analysis carried out at SMA Negeri 1 Kinali is presented in Table 4 below.

Table 4. Task Analysis

No.	Descriptive Parameters	Value	Remarks
1	Amount of Data	33	Number of students taking the test
2	Total score	314	The sum of all scores obtained by students
3	Red	9.52	Average score of students

4	Minimum Score	6	Lowest score obtained
5	Maximum Score	13	Highest score obtained
6	Range	7	Maximum and minimum score difference
7	Standard deviation	1.77	Rate of spread of the score against the average
8	Variance	3.13	Square of standard deviation

Based on the results of descriptive statistical analysis, it is known that the critical thinking ability test was followed by 33 students. The total score obtained by all students was 314 with a mean score of 9.52. These results show that students' critical thinking skills are still at a moderate level and have not reached the maximum score that can be obtained. The lowest score obtained by students is 6, while the highest score is 13, so a score range of 7 is obtained. This range shows that there is a difference in critical thinking skills among students, although the difference is not too large. A standard deviation value of 1.77 indicates that the spread of the data is relatively low. This means that most of the students' scores are around the average and there are no very noticeable differences between students. This is reinforced by a variance value of 3.13, which indicates a relatively small level of data diversity. If it is related to the results of the percentage of critical thinking skills obtained in the research, which is 49.70%, then it can be concluded that students' critical thinking skills are still in the sufficient category. This condition shows that students already have basic skills in identifying information, providing reasons, and drawing conclusions, but still need strengthening, especially in the aspects of analysis, evaluation, and decision-making that require high-level thinking skills. Therefore, a more innovative and student-centered learning strategy is needed to improve critical thinking skills optimally.

Concept Analysis

The concept analysis aims to identify and determine the main concepts of alternative energy materials in the IBL-based *E-Student design*. Concept analysis is used as a means of achieving certain competencies, by identifying and systematically arranging the main parts of the learning material. Alternative Energy material consists of 3 sub-materials, namely energy and the law of energy conservation, energy sources and energy potential, and energy impact and utilization strategies. The results of concept analysis are used as a basis for compiling learning materials in a systematic, orderly, and in accordance with the level of understanding of students. To find out the results of the concept analysis carried out at SMA Negeri 1 Kinali, the information is presented in Table 5 below.

Table 5. Analysis of Alternative Energy Concepts and Integration of Local Wisdom

No.	Alternative Energy Sub-Material	Integrated Local Wisdom	Conformity with Local Inquiry and Wisdom
1	Energy and the Law of Energy Conservation	Utilization of Palm Oil Waste (empty bunches, shells, fibers) as Biomass	High suitability provides real and contextual scenarios for students to investigate how energy moves and deforms from biological waste to factory operational energy or regional electricity.
2	Energy Sources and Energy Potential	Processing of Cow Manure into Biogas in the Kinali Area	An ideal context for modeling the analysis of regional energy potential; Triggering self-investigation regarding the mathematical calculation of the availability of local resources and

			Alternative Energy Efficiency of the Livestock Sector
3	Energy Utilization Impacts and Strategies	Utilization of River Water Flow Through Watermills (AIA Wheels) in Kinali	Rich real-world cultural context; fully support field observation activities, understanding of traditional technologies, and the formulation of sustainable energy utilization strategies without harming the environment.

Based on the table, it integrates the main material of Alternative Energy into three physics sub-materials that are contextually aligned with the local potential in the West Pasaman region. In the first sub-material, the concept of Energy and the Law of Energy Conservation is associated with the process of converting chemical energy into thermal and electrical energy in the utilization of palm oil waste. Furthermore, the sub-material Energy Sources and Energy Potential is focused on capacity analysis and mathematical calculations of the availability of cow manure as biogas in the Kinali area. The third sub-material discusses the Impact and Strategy of Energy Utilization through direct observation of the efficiency of environmentally friendly technology in the form of water wheels by the local community. Overall, these three forms of local wisdom have a very high suitability to support ethnoscience-based scientific investigation and field observation methods for students.

Specifying Instructional Objectives

The learning analysis stage is carried out to formulate goals to be achieved through the development of *E-Students*. Based on the results of the analysis, learning objectives were obtained that focused on improving students' critical thinking skills through the use of *digital-based E-Student* that integrated IBL models and local wisdom. The analysis of learning objectives is carried out to determine the learning outcomes that must be achieved by students after participating in the learning process on alternative energy materials. The learning objectives formulated are adjusted to learning outcomes, student characteristics, and learning needs that have been identified beforehand. To find out the results of the analysis of learning objectives carried out at SMA Negeri 1 Kinali, the data is presented in Figure 1 below.

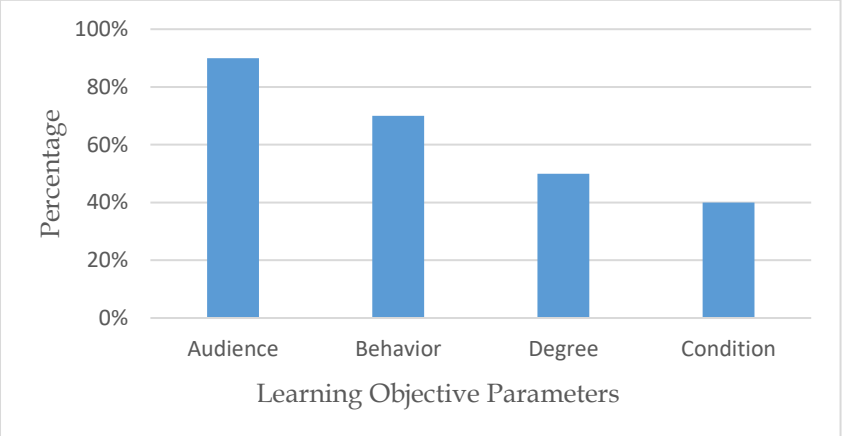

Figure 1. Analysis of Learning Objectives

Based on the graph of the results of the analysis of learning objectives, the level of fulfillment of the ABCD (Audience, Behavior, Condition, Degree) component shows a

significant variation in achievement in each of its parameters. The Audience component (A) occupies the highest percentage of 90%, which indicates that the subject or educational objectives have been defined very clearly and consistently in almost all learning objective formulations. Meanwhile, the Behavior (B) component reached 70%, which shows that the use of Operational Verbs (KKO) has mostly been measured, although some of them still need to be streamlined to focus more on one main competence. On the other hand, the Degree (D) component has only touched 50%, reflecting that the minimum standard or the level of success of students in achieving competencies is still often overlooked. Finally, the Condition (C) component is the parameter with the lowest achievement, at only 40%, which indicates that most of the learning objectives that are prepared do not include specific stimuli, media, methods, or activities that underlie the student's learning process. Overall, the formulation of existing learning objectives still tends to jump directly to the final competency without describing the conditions of the learning process and clear success criteria.

Discussion

Based on the results of a preliminary study conducted at SMAN 1 Kinali through critical thinking tests, student needs questionnaires, and interviews with physics teachers, three key findings were obtained that formed the basis for the development of an Alternative Energy Worksheet that was integrated with Inquiry-Based Learning (IBL) and local wisdom assisted by Canva AI. The three findings include students' low critical thinking skills, limitations of teaching materials used in physics learning, and characteristics of students who show readiness to use digital teaching materials. These findings show that there is a gap between the demands of 21st century learning and the learning conditions that occur in schools, a need for teaching material innovations that are able to answer these needs.

The results of the preliminary study showed that the critical thinking ability of students in class X of SMAN 1 Kinali was still in the sufficient category with an average of 49.70%, while the bases for a decision indicator obtained the lowest percentage of 34.85%. These findings show that students still have difficulty evaluating information and using scientific evidence as a basis for decision-making. This condition indicates that the learning process that takes place has not fully trained students to investigate, analyze data, and draw logical conclusions. The results of this study are in line with the research Ridho et al., (2021) which explains that the use of active learning-based digital teaching materials is able to improve critical thinking skills because students are directly involved in the process of building knowledge through contextual learning activities.

The results of interviews with teachers also showed that the teaching materials used were still dominated by package books and conventional Student Worksheet, so they were not able to facilitate high-level thinking skills. Therefore, the development of *E-Student* It is a suitable solution because it is able to present learning activities that are more interactive, flexible, and student-centered. These findings are supported by research Nasir et al., (2024) which states that the development of Student Worksheet based on local wisdom has proven to be feasible to use and is able to improve the science process skills and critical thinking skills of students through more contextual learning.

The analysis of student needs shows that the digital learning aspect has a strong category with a percentage of 66%, which shows that students have the readiness to utilize technology in learning. This is an excellent opportunity to develop Canva AI-based *E-Student* as an interactive learning medium. The use of interesting digital media allows students to be more active in exploring physics concepts independently so that the learning process becomes more meaningful. In line with these results, the research of Fadila and Festiyed (2025) shows

that Guided Inquiry-based *E-Student* has a very high level of validity and practicality and is effective in improving students' critical thinking skills in physics learning.

This research also integrates the local wisdom of West Pasaman Regency, such as the use of palm oil waste as biomass, the processing of cow dung into biogas, and the use of waterwheels as an alternative energy source. The integration of local wisdom makes learning more contextual because students learn physics concepts through phenomena they encounter in their daily lives. This approach can improve understanding of concepts as well as train critical thinking skills through observation and investigation processes. These results are supported by research Rahmawati et al., (2025) which states that *E-Student* Based on local wisdom significantly improves students' critical thinking skills because the learning materials become closer to their environment and culture.

In addition, the application of the Inquiry Based Learning model combined with digital teaching materials based on local wisdom is in line with the demands of the Independent Curriculum which emphasizes student-centered learning. In this model, students are encouraged to identify problems, formulate hypotheses, conduct investigations, and draw conclusions based on the evidence found. This process is able to train critical thinking skills more optimally than conventional learning. This is reinforced by the research of Hermita et al., (2025) which shows that the implementation of Inquiry Based Learning-based e-modules that integrate local wisdom provides a significant improvement in students' critical thinking skills on all measured indicators.

Overall, the results of the preliminary study show that the low critical thinking skills of students, the limitations of digital teaching materials that support active learning, and the high readiness of students to utilize technology are a strong basis for the development of *Alternative Energy E-Students* integrated with Inquiry Based Learning, local wisdom, and Canva AI. The development of these teaching materials is expected to be able to create physics learning that is more interactive, contextual, and meaningful so that it can facilitate the improvement of students' critical thinking skills in accordance with the demands of 21st century learning.

CONCLUSION

Based on empirical findings and the results of the needs analysis carried out at the definition stage, it can be concluded that the critical thinking skills of class X Phase E students at SMAN 1 Kinali are still in the sufficient category with an average achievement of 49.70%, while the bases for a decision indicator shows the lowest achievement of 34.85%. These results indicate that students still have difficulty in evaluating information, using scientific evidence as a basis for decision-making, and connecting physics concepts with contextual problems. This condition is influenced by the learning process which is still dominated by the use of package books and conventional that have not fully facilitated investigation activities, problem solving, and the development of high-level thinking skills. On the other hand, the results of the needs analysis show that students have a good readiness for digital learning, which is shown by high interest in the use of digital media (66%), interest in learning (65%), learning motivation (60%), and critical thinking skills based on self-perception (62%). In addition, teachers also identify the need for digital teaching materials that are able to integrate the Inquiry Based Learning model with real-life contexts so that physics learning becomes more active, contextual, and meaningful. Therefore, the development of E-Student Worksheets on alternative energy materials that integrate Inquiry Based Learning (IBL), West Pasaman local wisdom (the use of palm oil waste as biomass, biogas from cow dung, and AI-Wheels), and supported by Canva AI is very relevant and urgent to do. The development of these teaching materials is expected to be able to overcome the limitations of existing teaching

materials, increase student involvement in the learning process, facilitate the development of critical thinking skills through scientific investigation activities, and support the implementation of the Independent Curriculum which emphasizes student-centered, contextual, and competency-oriented learning in the 21st century.

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