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# Needs Analysis of E-Worksheets Work and Energy Based on Deep Learning and Local Wisdom Assisted by Canva AI to Facilitate Student's Critical Thinking Skills

Agung Tiardi[1], Emiliannur[1*], Yenni Darvina[1], Fuja Novitra[1], Renol Afrizon[1]

[1] *Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia*
*Corresponding author. Email: emiliannur@fmipa.unp.ac.id*

**ABSTRACT**

*This research was driven by the urgent need to integrate deep learning into physics education to support the development of students' critical thinking skills, given that observational findings indicate a low level of student engagement due to the use of conventional teaching materials that do not yet integrate technology, local wisdom, and the pillars of deep learning. In order to solve this problem, this project intends to perform a preliminary analysis as the first step of the Plomp Educational Design Research model in order to create an interactive E-Worksheets on Work and Energy utilizing Canva AI that incorporates the pillars of local wisdom and deep learning. The quantitative results, which were obtained through diagnostic tests, student needs surveys, teacher interviews, and a descriptive analysis of textbooks, show significant gaps across all parameters: learning objective formulations still lack the "condition" aspect (40.0%); existing IT-based media scored 67.0% for accessibility and visual layout but only 53.3% for interactivity and 46.7% for independent learning; and deep learning integration is stuck at surface-level learning, with the "Joyful" pillar reached 67.0% while the "Mindful" and "Meaningful" pillars remained at 46.7%. Furthermore, although 79.0% of students expressed very high expectations for interactive and flexible digital learning media, the integration of contextual material based on local wisdom fell into the "very low" category (33.3%) and students' critical thinking skills remained in the "low to moderate" range. The development of Canva AI-based E-Worksheets that incorporate the pillars of deep learning and local wisdom is a critical strategic solution to close this gap while also supporting students' critical thinking abilities, as these results highlight a significant gap between school learning resources and contemporary pedagogical demands.*

**Keywords :**E-Worksheets, Deep Learning, Local Wisdom, Canva AI, Critical Thinking, Work and Energy



## I. INTRODUCTION

The implementation of Independent Curriculum, which is now based on Ministry of Education, Culture, Research, and Technology Regulation No. 13 of 2025, highlights the importance of mastering 21st-century skills (4Cs) through a flexible learning framework that emphasizes both the holistic development of students' character and essential content [1]. According to [2], this new paradigm radically changes the emphasis of education from purely rote memorizing of procedural knowledge to mastery of competences in critical thinking, teamwork, ICT use, and the ability to handle real-world problems in daily life. This competency is essential for developing a scientific, comprehensive, and relevant conceptual understanding in the field of physics education; it is not just theoretical knowledge that is disconnected from reality [3], [4]. Critical thinking abilities should ideally support higher-order cognitive processes that involve a number of intricate actions, including interpretation, analysis, evaluation, inference, explanation, and self-regulation. This would allow students to make inferences about phenomena as well as offer arguments supported by solid scientific data [5], [6], [7].

However, there is a big disconnect between the curriculum's aspirations and actual practice, according to empirical findings made in the field. Numerous studies attest to the fact that high school students' critical thinking abilities with regard to Work and Energy are still comparatively low, as demonstrated by basic challenges in figuring out the essence of an issue, deciphering graphs or statistical data, and connecting physics

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ideas with actual occurrences in their environment [8]. The findings of a pilot study conducted at SMAN 10 Padang support this imbalance: the distribution by indicator showed a very sharp disparity, even though the cumulative average for critical thinking fell into the "Satisfactory" category (66.92%). In fact, the Self-Regulation indicator, which is an essential component of critical thinking, was in the lowest group (56.66%), with 20% of students scoring at the minimal level and 53.33% only able to write generic reflections without sufficient study of physics concepts. Both the Grade 11 Physics textbook by Ni Ketut Lasmi and the printed worksheets currently in use fail to support metacognitive reflection, according to the findings of in-depth interviews and document analysis. They lack pertinent local context and are stuck in a repetitive pattern of presenting formulas for memorization. The results of a student needs survey, which showed that 79% of students strongly expressed a desire for interactive, multimedia-based e-worksheets and 82% of students expressed a desire for digital teaching materials that are useful, dynamic, and accessible via mobile devices, contrast sharply with the limitations of these traditional, non-adaptive teaching materials [9].

Deep Learning is a solution-focused approach that can improve learning efficiency by fostering student initiative, honing analytical abilities, and bolstering students' capacity to apply theoretical knowledge to novel and challenging circumstances [10], [11]. When incorporated with students' cultural backgrounds and local experiences, this teaching method will become more comprehensive, inclusive, and relevant [12], [13], [14]. The local knowledge of the people of West Sumatra actually provides a highly concrete physical analogy in the topic of Work and Energy, which is frequently viewed as abstract and dull due to its theoretical-deductive presentation [15]. The application of work based on collective pulling forces at an angle in the *Maelo Pukek* tradition along the coast [16], the principle of energy transformation in the traditional *Kincia Aia* technology in Padang City [17], and the principles of mechanics, dynamics, and equilibrium in the traditional game of tug-of-war, which involves the interaction of forces are all concrete examples of this idea.

In the age of technological disruption, students' independent learning is strategically supported by digital transformation through interactive learning materials in addition to a contextual pedagogical approach. By incorporating interactive audiovisual components and automatic feedback mechanisms that assist students in independently identifying and overcoming learning obstacles, E-Worksheets have demonstrated efficacy in promoting student engagement and problem-solving abilities [18], [19]. The incorporation of well-designed visual media can enhance students' cognitive processing of previously abstract material, making it easier to understand, according to the Cognitive Theory of Multimedia Learning. According to [20] and [21], Canva AI is a sophisticated visualization tool that helps instructors create interactive content that is effective, imaginative, visually appealing, and collaborative using mobile devices. Group-based collaborative learning techniques, the utilization of school computer laboratories, or the usage of integrated institutional accounts can all help overcome potential technological issues, such as restricted individual access to AI features [22].

The systematic integration of E-Worksheets, deep learning techniques, and local knowledge, together with the effectiveness of Canva AI-assisted design in the work and energy material, are the research's main innovations and strengths. By offering dynamic visuals, responsive interactive simulations, and reflective exercises that can gradually and sustainably develop students' critical thinking abilities, this synergy is especially intended to solve the shortcomings of traditional print media. Therefore, this research presents a full pedagogical approach to bridge the gap between 21st-century competency needs and the reality of classroom learning, which has not yet been optimized, rather than just creating a digital product innovation.

## II. METHOD

This study employs a research and development approach using Plomp’s three-phase model (preliminary research, development or prototyping, and evaluation). This approach was chosen because it systematically and iteratively integrates the product development process with empirical field studies. The development model used is based on Plomp’s model, which emphasizes an iterative process through the stages of preliminary research, prototype development, and evaluation [23]. This model was chosen because of its suitability for producing learning tools that are not only theoretically sound but can also be applied in real-world learning contexts and effective educational practices.

This study was carried out at SMAN 10 Padang, which offers physics education based on an independent curriculum, during the even semester of the academic year. Utility analysis and product feasibility testing were among the phases of the study timetable that were created in accordance with a development model [24]. The activities were planned in a methodical manner to guarantee that every phase of the study could be completed as effectively as possible and produce reliable data. The subjects of this study were 11th-grade students in Phase F and the physics teachers directly involved in the learning process. Subjects were selected using purposive sampling, taking into account the characteristics of the students in the class and their readiness to engage in technology-based learning. In addition, a panel of validators comprising subject matter experts, media experts, and education practitioners was also involved to assess the quality of the developed products. The involvement of these various parties aims to obtain comprehensive data from multiple perspectives.

The research procedure followed the stages of the Plomp model, beginning with the preliminary research phase. This stage provided the necessary analysis through observation, interviews, and a review of documentation to identify issues in physics learning, particularly those related to critical thinking skills and the use of instructional materials [25]. The results of this stage serve as the basis for designing products that meet the learning needs in the field. The next phase is development or prototyping, which is carried out in stages through product design, evaluation, and revision. A deep learning strategy, local knowledge, and critical thinking skill indicators were included into each learning task to create interactive student worksheets. Experts then evaluated the final prototypes to see whether the content, instructional design, visual presentation, and alignment with the chosen learning approach were appropriate. This procedure was carried out repeatedly until a product that satisfied legitimate requirements and was judged appropriate for real-world application was produced.

After that, a phase of evaluation was carried out using teachers and students as direct users to assess the generated product's usefulness. At this point, the E-Worksheets' usability, interface clarity, and efficacy in promoting learning were noted [26]. researchers to obtain a more thorough understanding of the product's quality across a range of pertinent educational contexts. The data obtained from this stage were used to make final improvements to the product before it was deemed suitable for use in physics studies. The types of data collected in this study consisted of qualitative and quantitative data. Qualitative data were obtained from interview results, validator comments, and feedback from teachers and students regarding the use of the Student Worksheets. Meanwhile, quantitative data were obtained from validity results and practice scores analyzed using a Likert scale. The combination of these two types of data allows researchers to gain a more comprehensive picture of the quality of the product developed across various relevant educational contexts.

A variety of techniques, including surveys, interviews, and observation, were used to gather data. While teachers and students were interviewed to obtain detailed information, observation was employed to directly monitor learning situations. Quantitative information about the assessment of the generated product was obtained using instruments [13]. To guarantee that the information gathered was pertinent to the study's goals, every method of data gathering was used in a methodical manner. Descriptive analysis was used to analyze the data. The results of this analysis were then linked to the research objective of assessing the extent to which student worksheets based on a deep learning approach and local wisdom can stimulate students' critical thinking skills and contribute to improving the quality of physics instruction.

The critical thinking skills test was designed based on Facione's [27] indicators namely, Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-Regulation to measure students' critical thinking skills. All collected data were then analyzed using descriptive statistical techniques to provide a systematic overview of the learning conditions. The analysis of critical thinking skills was conducted by calculating students' achievement scores, which were then interpreted into ability level categories based on the criteria established by [28] in Table 1.

**Table 1**. Categories for Determining Students' Critical Thinking Skill Levels

| Score | Category |
|---|---|
| 0 < Value < 43,75 | Very Low |
| 43,75 < Value < 62,50 | Low |
| 62,50 < Value < 71,50 | Moderate |
| 71,50 < Value < 81,25 | High |
| 81,25 < Value < 100,00 | Very High |

Based on the categories in Table 1, the score of critical thinking skills of 81,25–100 is categorized as Very High, 71,50-81,25 is categorized as High, 62,50-71,50 is categorized as Moderate, 43,75-62,50 is categorized as Low, and ≤43,75 is categorized as Very Low. The score of students' critical thinking skills is calculated using Equation (1).

$$NP = \frac{R}{SM} \times 100\%$$

Description:
NP = Percentage value sought or expected
R = Raw score obtained by the student
SM = Ideal maximum number

As for the categorization in the analysis of ICT-based instructional materials, the analysis of learning objectives, the analysis of deep learning integration, the analysis of local wisdom integration, and the analysis of learning styles, the categorization follows [29] as presented in Table 2.

**Table 2**. Category for Context Analysis

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

Based on the Likert scale in Table 1, an index of 81-100 is considered very high, 61-80 is considered tall, 41-60 is considered sufficient, 21-40 is considered low, and an index of 0-20 is considered very low.

## III. RESULTS AND DISCUSSION

### Results

*Analysis of Critical Thinking Skills*

The capacity to comprehend and assess information objectively and make wise and practical decisions is known as critical thinking skills. Additionally, critical thinking abilities help pupils see issues and find more effective solutions [30]. According to [27], interpretation, analysis, evaluation, inference, explanation, and self-regulation are all signs of critical thinking. Students in the eleventh grade at SMAN 10 Padang were observed in order to conduct this analysis. The examination of students' critical thinking abilities based on the predefined indicators is shown in the following table.

**Table 3**. Critical Thinking Skills Analysis Results

| Indicator | Score | Category |
|---|---|---|
| Interpretation | 80.08 | High |
| Analysis | 64.16 | Moderate |
| Evaluation | 70.83 | Moderate |
| Inference | 64.83 | Moderate |
| Explanation | 65 | Moderate |
| Self-Regulation | 56.66 | Low |

The data in Table 1 show significant variation in proficiency across all indicators, with an average score of 66.94. The highest average score was found in the Interpretation aspect, with a score of 80.08, which falls into the high category, indicating that students are generally able to understand and express the meaning of the data or events presented. Conversely, the lowest average score was found in the Self-Regulation indicator, with a score of 56.66, which falls into the low category. The main reason the Self-Regulation indicator scored the lowest is that the learning process and instructional materials used in schools have not provided space for metacognitive reflection for students. Learning to date has tended to be transactional and procedural, focusing solely on solving calculation problems, without accustoming students to double-check the validity of their reasoning, correct initial claims based on accurate physics concepts, or evaluate their own thinking strategies. As a result, students have become accustomed to being passive consumers of information and do not practice independence or metacognitive control when solving problems involving Work and Energy. Meanwhile, the other four indicators analysis, evaluation, inference, and explanation remain stagnant in the Moderate category. The results at SMAN 10 Padang are consistent with the research by [8], which found that students' average critical thinking skills remained at 33.3%. The fact that the self-regulation indicator remains

*Analysis of the Use of ICT-Based Instructional Materials*

In addition to assessing students' critical thinking skills, this study explores the actual conditions surrounding the use of instructional materials in physics education based on the results of document analysis and interviews with subject teachers. The study shows that worksheets that do not align with learning objectives still dominate the available textbooks, and the use of digital instructional materials has not yet been optimized. Furthermore, abstract concepts still dominate the textbooks. For this investigation, the elements of the student worksheets used by schools were evaluated. The assessment was conducted using a descriptive percentage analysis technique by applying established instructional material evaluation indicators to respondents via a Likert-scale questionnaire. The results of these percentage calculations were then categorized into ranges of criteria for the suitability/availability of teaching materials according to [29] to map the actual quality of the teaching materials used in schools. Table 3 below presents the results of the evaluation of student teaching materials using the established indicators.

**Table 4.** Results of Teacher Interviews on the Analysis of Instructional Materials

| | Indicator | Ideal Conditions | Real Conditions (Teacher Interviews) |
|---|---|---|---|
| 1. | Accessibility & Flexibility | Interactive digital physics learning materials that are easily accessible at any time via mobile devices without any device compatibility issues. | The school already has Wi-Fi facilities and students are allowed to use gadgets. |
| 2. | Multimedia Interactivity | Bahan ajar memuat elemen multimedia interaktif seperti video simulasi fenomena fisis, animasi, dan kuis digital dengan umpan balik langsung. | The use of digital media that once existed was still limited to static presentations such as PowerPoint and evaluation quizzes. |
| 3. | Independent Learning | The structure of the teaching materials is designed to be systematic, adaptive, and complete so that it allows students to learn independently according to their learning speed. | Students still depend completely on the teacher's direction and explanations at the front of the class. |
| 4. | Visual Appearance and Readibility | The layout design, color combination, typography, and navigation of the digital interface are designed proportionally to increase student motivation and readability. | The digital teaching materials that teachers have shown have a fairly neat appearance, but lack variety in terms of visual animation. |
| 5. | Contextual | Teaching materials integrate everyday life phenomena and local wisdom that is relevant to students' environment to strengthen understanding of physics concepts in a concrete manner. | The presentation of material in the teaching materials used is still abstract and theoretical, and does not yet integrate the context of local wisdom |

The availability of technology infrastructure and its use in the physics learning process were found to be significantly out of sync based on interviews with subject teachers about the integration of media and digital teaching materials. The availability of facilities and students' freedom to utilize gadgets actually offer quite acceptable support in digital accessibility and flexibility. However, the availability of methodically and interactively developed electronic instructional materials has not yet equaled the potential provided by these digital tools.

To provide a clear picture of the condition of the instructional materials in terms of accessibility, multimedia interactivity, self-directed learning, visual presentation, and contextual content, the complete results of the analysis are summarized in Table 3.

**Table 5**. Results of the Contextual Analysis of Instructional Materials

| Teaching Materials Analysis Aspect | Score | Category |
|---|---|---|
| Accessibility & Flexibility | 67 | High |
| Multimedia Interactivity | 53 | Enough |
| Independent Learning | 47 | Enough |
| Visual Appearance & Readability | 67 | High |
| Contextual | 53 | Enough |

Based on the Table 5, the Accessibility & Flexibility and Visual Appearance & Readability indicators received the highest score at 67 each, indicating that students are well-supported by adequate personal devices, school network access, and visually neat ICT layouts. Conversely, the Learning Independence indicator stands at only 47, while both Multimedia Interactivity and Contextual indicators are at 53, revealing a gap where existing digital resources lack modular designs, virtual simulations, and real-world problem-solving to support autonomous learning. This disparity aligns with [31], who state that static, one-way school ICT materials fail to foster self-regulated learning in physics, as well as [32], who found that E-Worksheets lacking interactive simulations and contextual problems leave students passive despite using advanced devices. Consequently, there is an urgent need for innovative digital teaching materials that fully integrate multimedia interactivity and contextual problems rather than merely transferring textbook text to digital screens.

*Analysis of Learning Objectives*

Document analysis was then utilized to assess the quality of the learning objectives as specified in the primary textbook that students were using in class. When evaluating this analysis, the completeness of traditional competency factors such as the Audience, Behavior, Condition, and Degree components was taken into account. Each learning target formulation in the textbook's Work and Energy section was scored using a document analysis rubric. Using a standardized rubric scale, each component is evaluated according to availability and formulation accuracy standards. The final score percentage indicates the quality and completeness of the textbook's learning objective formulations, which are then categorized using Riduwan's suggested criteria.

One example of a learning objective from the examined physics textbook was as follows: "*From a physics perspective, describe the idea of work and how it relates to energy and power*." According to the research, this textbook's real LO formulation is still rather abstract and only addresses the behavior component and content domain mapping. Most importantly, this traditional formulation leaves out the "Condition" component as a stimulus or learning medium, fails to define the target audience, and fails to set standards for the level of success. The results of the evaluation of the attainment of Learning Objective indicators in the Work and Energy content are summarized in Figure 1 below.

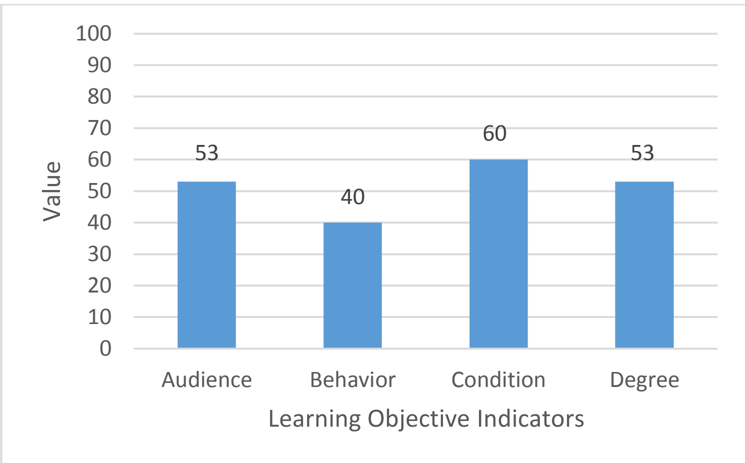


**Fig. 1**. Results of the Analysis of Learning Objectives

Based on the data in Figure 1, the results of the analysis of the Learning Objectives (LO) in physics textbooksas assessed in terms of their adherence to the Audience, Behavior, Condition, and Degree format indicate that the overall achievement falls within the enough category. In the enough category, the Behavior indicator had the highest proportion with 60 score. This shows that real and quantifiable Operational Verbs

(OVs) are already used in the competency statements or scientific behaviors expected of students in the textbook to demonstrate students' physical performance on the topic of Work and Energy. The Audience and Degree indications, which both scored 53 and fell into the enough category, came next. The "Condition" indication, on the other hand, continued to fall into the enough category with the lowest score of 40. The comparatively low proportion for this criterion indicates that the textbook's LO sentences do not fully incorporate stimuli, situational circumstances, or learning activity scenarios. The learning objective statements that are now accessible typically concentrate on the desired learning outcomes without specifically describing the techniques, scientific exercises, or media that students must use to develop the ideas of work and energy during the learning process.

*Analysis of the Integration of Deep Learning*

The third element looked at was how much instructors' teaching paradigms changed from surface learning to deep learning. This assessment concentrated on the three core tenets of the most recent curriculum meaningful, mindful, and joyful while analyzing the ideas of effort and energy. A descriptive percentage analysis based on observations of instructional implementation and an examination of instructional planning materials was used to calculate the scores for each pillar. A standardized measurement instrument scale was used to evaluate each indicator that represented the Mindful, Meaningful, and Joyful pillars. The degree to which the deep learning pillars had been successfully included into the physics learning process was then mapped using these percentage results. The data obtained from the analysis of these indicators is shown in Figure 2 below.

**Table 6.** Results of a Teacher Interview on Deep Learning

| | Indicator | Ideal Conditions | Real Conditions (Teacher Interviews) |
|---|---|---|---|
| 1. | Mindful | Pembelajaran mendorong siswa terlibat penuh secara mental, fokus, memiliki regulasi diri yang baik, dan menyadari esensi serta tujuan dari apa yang sedang mereka pelajari. | Learning encourages students to be fully mentally engaged, focused, well-regulated, and aware of the essence and purpose of what they are learning. |
| 2. | Meaningful | Teachers connect the essential concepts of Work and Energy to real-world challenges so that the material has long-term practical value for students . | The teacher has not yet explicitly integrated the context |
| 3. | Joyful | Proses pembelajaran menciptakan suasana yang aman, inklusif, membangkitkan rasa ingin tahu, dan memicu emosi positif siswa dalam bereksplorasi. | The learning process creates a safe, inclusive environment that sparks curiosity and elicits positive emotions in students as they explore. |

Work and Energy material has gaps in the three pillars of Deep Learning, according to the results of teacher interviews: the curriculum is still theoretical because it has not yet incorporated local wisdom (Meaningful); the use of interactive technology has not been optimized to pique students' curiosity (Joyful); and instruction has not yet provided space for metacognitive reflection to foster students' self-regulation (Mindful). Therefore, in order to bridge these three pillars and simultaneously improve students' critical thinking abilities, interactive, Deep Learning-based E-Worksheets that incorporate local expertise are required.

To provide a quantitative overview of the implementation of the Deep Learning pillar, the achievement percentages for the Meaningful, Mindful, and Joyful indicators are presented in Figure 1 below.

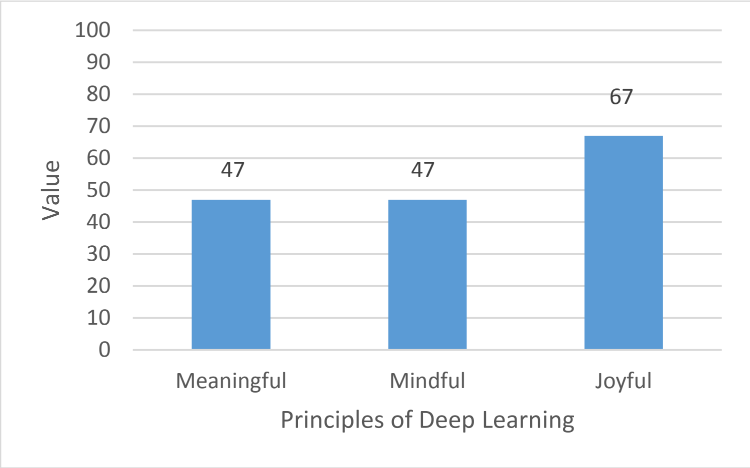


**Fig. 2**. Deep Learning Integration Analysis Results

Based on the data in Figure 2, the joyful pillar scored the highest at 67 due to an inclusive and stress-free classroom environment built on interactive Q&A sessions. Conversely, both the meaningful and mindful pillars are stuck at a low 47, indicating that physics learning for the Work and Energy topic remains confined to surface learning, where students prioritize rote formula memorization over real-world conceptual connections and lack post-learning metacognitive exercise.

[33], who found that meaningless learning causes an inability to apply physics because the subject is reduced to abstract formulas, as well as [34], who emphasized that the mindful pillar is crucial for self-regulation and that lacking reflective materials prevents students from identifying misconceptions. Consequently, this gap highlights the urgent necessity to reorganize instructional resources to integrate the mindful, meaningful, and joyful pillars in a balanced manner.

*Analysis of the Integration of Local Wisdom*

In order to determine how much local traditional culture and technology have been included as contextual instruments in formal science education, the analysis that follows focuses on the integration of local expertise. Table 4 below provides a detailed presentation of the indicators pertaining to the incorporation of local knowledge from West Sumatra into the "Work and Energy" curriculum.

**Table 7**. Results of the Analysis of the Integration of Local Wisdom

| Indicator | Score | Category |
|---|---|---|
| Contextual Material | 33 | Low |
| Local Values & Morals | 47 | Enough |
| Social Relevance | 47 | Enough |
| Local Resources | 40 | Enough |
| Participatory Method | 33 | Low |

Based on the analysis in Table 7, the indicators for Local Values & Morals and Social Relevance ranked highest at a modest 47%, showing that while schools foster basic group cooperation and cultural awareness, a critical gap remains because Local Contextual Materials and Participatory Methods scored lowest at only 33%. This quantitative data underscores a severe disconnect in the field where foundational physics concepts like Work and Energy are entirely isolated from local wisdom in available textbooks, leaving indigenous community knowledge un-reconstructed into formal scientific principles because students are never engaged to physically model or analyze these traditional technologies. This regional deficit is highly consistent with findings from the UNP Department of Physics by [35], who note that local wisdom implementation in West Sumatra is heavily constrained by the lack of structured contextual modules, despite the immense pedagogical potential demonstrated by [36] showing that the traditional Minangkabau *Kincia Aie* inherently embodies extensive physics concepts including Newton's laws, work, energy transfer, and fluid dynamics.

*Analysis of the Student Learning Style*

Students' technological readiness must be taken into account in order to facilitate the creation of electronic student worksheets that are combined with in-depth learning and local knowledge. A key component of facilitating the efficient use of technology in learning practices is technological proficiency. One educational innovation that helps students prepare for the demands of a constantly changing era is the creation of electronic student worksheets through a variety of web-based applications or platforms and artificial intelligence [37]. As a result, these circumstances facilitate the creation of electronic worksheets for students using Canva AI. The results of the study of the student learning style questionnaire in Figure 3 support this conclusion.

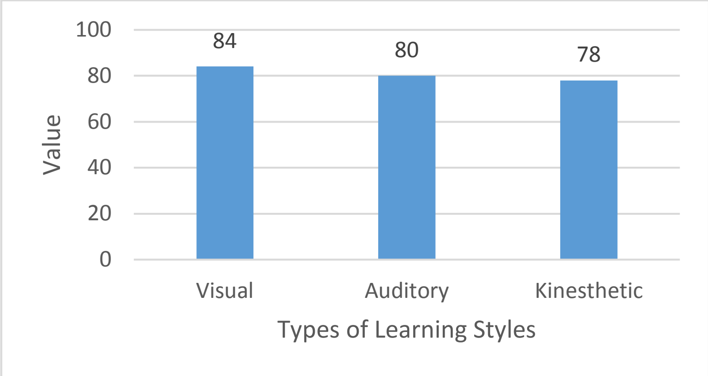


**Fig. 3**. Learning Style Analysis Result

Based on Figure 3, students predominantly exhibit auditory and visual learning styles, absorbing content more effectively through discussions, explanations, and graphic illustrations while maintaining a highly positive attitude toward technology that accelerates the learning process. Rather than relying on conventional printed materials, digital transformation enables the shift toward device-based E-Worksheets [38], making the integration of Canva AI highly relevant for optimization. Although students' critical thinking skills specifically problem interpretation, energy variable analysis, solution evaluation, and self-regulation remain low due to passive information consumption, 79% of students express high expectations for flexible, interactive digital resources. They anticipate adaptive learning materials featuring engaging visuals, local wisdom-based investigations, and interactive multimedia to facilitate autonomous learning. Therefore, developing E-Worksheets embedded with deep learning principles and local wisdom is a crucial step to address student needs, foster motivation, and systematically improve critical thinking skills.

The disparity between students' high expectations for interactive digital learning and their weak critical thinking abilities highlights how urgent it is to provide cutting-edge, student-centered teaching resources. E-Worksheets, which combines conceptual comprehension with exploratory activities that promote active cognitive engagement, provides a pertinent answer. It is based on a deep learning approach and local wisdom and is backed by Canva AI. This method not only helps students understand the theoretical ideas of work and energy, but it also directs them to investigate real-world phenomena, like West Sumatra's local wisdom technology, with purpose and awareness. The integration of digital features and interactive multimedia through Canva AI has been proved to boost learner engagement, facilitate the depiction of abstract physics concepts, and create room for students to reflect on their learning process in a fun manner. These benefits enhance students' conceptual comprehension and critical thinking abilities while boosting the efficacy of ongoing education. In order to improve the quality of physics education and make it more responsive to the needs of students and the requirements of 21st-century skills, it is imperative that an interactive E-Worksheets based on Deep Learning and local wisdom be developed with the help of Canva AI.

**Discussion**

According to the findings of a preliminary study on the subject of work and energy, there is a fundamental disconnect between pupils' strong capacity for digital literacy and their poor command of critical thinking abilities. The current learning process still prioritizes procedural reasoning and formula memorization over in-depth conceptual comprehension, which is in line with the findings of [39]. This leads to emerging surface learning, where pupils can perform basic arithmetic computations but are unable to evaluate, analyze, and draw conclusions when confronted with contextual physical facts. Because the technology has so far only been used to transport text to a screen without incorporating interactive multimedia aspects that encourage higher-order thinking, the present digital learning materials have not been able to close this gap.

The results of the textbook analysis and classroom implementation indicate this pedagogical structure's shortcomings. The low levels of the "Mindful" and "Meaningful" pillars within the Deep Learning framework are directly impacted by the formulation of Learning Outcomes (LOs) in textbooks, which routinely ignores the "Condition" component with a lack of scientific activity scenarios and exploratory stimuli. Students are not taught to assess their own cognitive processes in the absence of guiding cues and room for metacognitive reflection (self-regulation). The lack of integration of local knowledge, such as the principles of mechanics in *Kincia Aia* West Sumatra, exacerbates this imbalance. Physics concepts become disconnected from students' real-world experiences as a result of this disregard for local context, which makes the subjects of work and energy seem academic and abstract.

There is an urgent need to restructure learning media due to the dichotomy of students' high level of digital preparedness and the scarcity of pertinent teaching resources. These findings' theoretical and practical ramifications highlight the need for an integrated system of instructional materials rather than just interactive software. A contextual solution is provided by the creation of E-Worksheets, which is based on Deep Learning and Local Wisdom with assistance from Canva AI. While the combination of Deep Learning and local wisdom serves as a cognitive stimulation to convert passive learning into meaningful critical exploration, the integration of Canva AI enables interactive visualizations that are sensitive to students' learning preferences.

## IV. CONCLUSION

According to preliminary analytical results, students' critical thinking skills with relation to the Work and Energy topic are still insufficient, especially when it comes to analysis, assessment, inference, and explanation. This is because traditional instructional materials don't integrate deep learning and local wisdom, don't support higher-order thinking skills, and don't make the best use of ICT. The creation of interactive E-Worksheets based on deep learning and local wisdom supported by Canva AI and in line with Facione's indicators represents a highly urgent strategic solution given the prevalence of visual-auditory learning styles and students' high expectations for technology-based media. Future studies will concentrate on the development stage, expert validation, and evaluating the usefulness and efficacy of these E-Worksheets in the classroom in order to quantify their influence on improving students' critical thinking abilities.

## REFERENCES


[1] Emiliannur, Ratnawulan, and R. Doni, "*Technical Guidance on Creating Digital Formative Assessments to Support the Implementation of the Merdeka Curriculum for Teachers at SMAN 1 Lubuk Sikaping*," *Pelita Eksakta*, vol. 08, no. 02, pp. 94–100, 2025, doi: 10.24036/pelitaeksakta/vol08-iss02/276.

[2] P. Mahulae and A. Tumanggor, Pembelajaran Fisika Abad 21 Dengan Model Pembelajaran dan Pendekatan Deep Learning. Tahta Media Group, 2025.

[3] F. Novitra, Festiyed, and Yohandri, "*Preliminary research of networked-based inquiry model development to improve 21st-century competencies of students on physics learning in senior high school*," in *Journal of Physics: Conference Series*, IOP Publishing Ltd, May 2021. doi: 10.1088/1742-6596/1876/1/012047.

[4] R. Lestari and R. Sari, "Implementasi Pembelajaran Berbasis Proyek Dalam Pengembangan Kemampuan Berpikir Kritis Peserta Didik Smp," *Jurnal Review Pendidikan dan Pengajaran*, vol. 7, no. 1, 2024.

[5] H. Syahmi and Y. Darvina, "*Meta Analysis Of The Effect Of The Use Of Module On Students' Critical Thinking Ability In Physics And Science Courses*," *Pillar of Physics Education*, vol. 139, no. 2, pp. 139–145, Jul. 2022.

[6] M. P. Sari and Emiliannur, "Analisis Kebutuhan E-LKPD Berbasis *Problem Based Learning* Untuk Memfasilitasi Kemampuan Berpikir Kritis Siswa Pada Materi Dinamika Partikel," 2025, [Online]. Available: https://jurnal.univpgri-

[7] Hamatun and R. Rusmalinda, "Efektivitas Penggunaan LKS Berbasis Prolem Based Learning Dalam Meningkatkan Kemampuan Berpikir Kritis Siswa SMA Pada Materi Usaha dan Energi," 2025, doi: 10.47902/al-ikmal.v4i1.395.

[8] S. Nurazizah, P. Sinaga, and A. Jauhari, "Profil Kemampuan Kognitif dan Keterampilan Berpikir Kritis Siswa SMA pada Materi Usaha dan Energi," vol. 3, no. 2, 2017, doi: 10.21009/1.

[9] N. A. Putri and A. Bakar, "Pengembangan E-LKPD Berbasis Masalah Pada Materi Usaha Dan Energi Di Kelas X," 2025, [Online]. Available: https://jurnal.univpgri-

[10] Y. Cao and Yongke Sun, "*The Research on the Application of Deep Learning in Education*," *IETI Transactions on Data Analysis and Forecasting (iTDAF)*, vol. 2, no. 3, pp. 4–11, Oct. 2024, doi: 10.3991/itdaf.v2i3.51413.

[11] E. M. Elbashbishy, "*Deep Learning in Education*," 2024. [Online]. Available: https://seg.journals.ekb.eg/

[12] A. G. Prawiyogi and A. Rosalina, *Deep Learning* dalam Pembelajaran Sekolah Dasar. Bandung: Indonesia Emas Group, 2025.

[13] H. Pardede, P. Sitorus, and G. H. D. Sinaga, "Pengembangan e-Book Interaktif Fisika Berbasis Kearifan Lokal dengan Pendekatan Pembelajaran Inkuiri," *Lensa: Jurnal Kependidikan Fisika*, vol. 12, no. 2, 2024, doi: 10.33394/j-lkf.v12i2.13789.

[14] D. Safitri, P. T. Febrianto, and F. Nurharini, "Pengaruh Penerapan Deep Learning Terhadap Kemampuan Berpikir Kritis Siswa Pada Pembelajaran Ipas Materi Kearifan Lokal," *PENDAS: Jurnal Ilmiah Pendidikan Dasar*, vol. 10 No. 4, Dec. 2025.

[15] A. Asra, Festiyed, F. Mufit, and Asrizal, "Pembelajaran Fisika Mengintegrasikan Etnosains Permainan Tradisional," *KONSTAN: Jurnal Fisika dan Pendidikan Fisika*, vol. 6, no. 2, Dec. 2021, [Online]. Available: http://jurnalkonstan.ac.id/index.php/jurnalHalaman|66

[16] Y. Yuliyus and N. Susilawati, "Tradisi Maelo Pukek di Kota Padang," *Culture & Society: Journal Of Anthropological Research*, vol. 2, no. 3, pp. 123–129, Feb. 2021, doi: 10.24036/csjar.v2i3.73.

[17] W. Alti, "Pendidikan Inklusi Berbasis Nilai Kearifan Lokal di SEKOLAHALAM MINANGKABAU Kota Padang Sumatera Barat," *Culture & Society: Journal Of Anthropological Research*, vol. 1, no. 3, pp. 172–179, Jan. 2020, doi: 10.24036/csjar.v1i3.28.

[18] A. Khoiroh and S. P. Indriwardhani, "Penerapan Liveworksheets Sebagai E-LKPD untuk Menunjang Pembelajaran Bahasa Jerman Kelas X IPS 1 di SMA Negeri 1 Lawang," *Seminar Nasional Pembelajaran Bahasa dan Sastra (SELASAR)*, vol. 6, no. 1, 2022.

[19] V. K. Cheva and R. Zainul, "Pengembangan e-modul berbasis inkuiri terbimbing pada materi sifat keperiodikan unsur untuk SMA/MA kelas x," 2019.

[20] G. Pelangi, "Pemanfaatan Aplikasi Canva Sebagai Media Pembelajaran Bahasa Dan Sastra Indonesia Jenjang SMA/MA," *Jurnal Sasindo Unpam*, vol. 8, no. 2, 2020.

[21] I. Nisa, N. Ainia, and D. M. Miftah Nur, "Pemanfaatan Aplikasi Canva dalam Penyusunan Media Pembelajaran Berbasis Teknologi," *RUKASI: Jurnal Ilmiah Perkembangan Pendidikan dan Pembelajaran*, vol. 02, no. 02, pp. 67–77, 2025.

[22] A. Maulah, A. Rulyansah, M. Ibrahim, and D. W. Rahayu, "Canva AI: Untuk Mengeksplorasi Computational Thinking Siswa Sekolah Dasar," *DIDAKTIKA : Jurnal Pemikiran Pendidikan*, vol. 31, no. 2, pp. 192–206, Sep. 2025, doi: 10.30587/didaktika.v31i2.10138.

[23] Tj. Plomp and Nienke. Nieveen, *Educational design research : an introduction*. SLO, 2013.

[24] A. N. Fadhila, "Pengembangan E-LKPD Berbasis PBL Menggunakan Flip PDF Professional untuk Meningkatkan Literasi Sains pada Materi Medan Magnet," *Nusantara: Jurnal Pendidikan Indonesia*, vol. 2, no. 1, pp. 53–70, Jan. 2022, doi: 10.14421/njpi.2022.v2i1-4.

[25] R. A. Yusra, F. H. Kusumah, and A. Suryadi, "Pengaruh PjBL-STEM terhadap Peningkatan Keterampilan Berpikir Kritis pada Materi Energi Terbarukan dalam Mendukung Pendidikan yang Berkualitas," *Jurnal Pendidikan Matematika dan Sains*, vol. 13, no. Special_issue, pp. 26–37, Jun. 2025, doi: 10.21831/jpms.v13ispecial_issue.86537.

[26] D. A. Nasution and F. O. Rahmi, "Pengembangan Lembar Kerja Peserta Didik Berbasis PjBL-Deep Learning Pada Materi Keanekaragaman Hayati Fase E," *Al-Alam: Islamic Natural Science Education Journal*, vol. 4, no. 2, pp. 213–220, Jul. 2025, doi: 10.33477/al-alam.v4i2.12091.

[27] P. A. Facione, "*Critical Thinking: What It Is and Why It Counts*," 2020.

[28] H. Herunata, R. Amayliadevi, and H. Widarti, "Analisis keterampilan berpikir kritis pada indikator memberikan penjelasan lebih lanjut materi hidrokarbon," *J-PEK (Jurnal Pembelajaran Kimia)*, vol. 5, no. 1, 2020, doi: 10.17977/um026v5i12020p047.

[29] Riduwan, "Dasar-Dasar Statitiska," *2015*, 2015.

[30] S. N. Ariadila, Y. Silalahi, and F. H. Fadiyah, "Analisis Pentingnya Keterampilan Berpikir Kritis Terhadap Pembelajaran Bagi Siswa," vol. 9, pp. 664–669, Oct. 2023.

[31] Y. Budiasih, Abdurrahman, and D. Lengkana, "Studi Pendahuluan: Pengembangan E-LKPD Dalam Upaya Pemahaman Keterampilan Berpikir Kreatif Pada Pembelajaran Ilmu Pengetahuan Alam," *Al-Jahiz: Jurnal of Biology Education Research*, vol. 3, no. 2, pp. 158–165, Jun. 2022.

[32] S. Ollina, L. Setriani, and T. Febriani, "Penerapan E-LKPD Berbasis *Liveworksheet* Dapat Meningkatkan Motivasi Belajar Peserta Didik Fase E Di Sma Negeri 16 Padang," Sep. 2025.

[33] Hariyono, M. Muchson, M. Anas, and R. Forijati, "Implementasi Pembelajaran Mendalam untuk Meningkatkan Mutu Pendidikan di Indonesia: Tantangan dan Strategi," vol. 8, no. 8, Jul. 2025.

[34] H. G. Utami and E. Emiliannur, "*Design of Electronic Worksheets Integrated with Problem Based Learning and Ethnoscience to Improve Critical Thinking Skills of High School Students*," *Jurnal Penelitian Pembelajaran Fisika*, vol. 11, no. 2, 2025, doi: 10.24036/jppf.v11i2.16.

[35] F. Festiyed, A. Asrizal, and F. Mufit, "*Ethnophysics Studies in Various Indonesian Cultures: A Systematic Literature Review*," *Journal of Innovation in Educational and Cultural Research*, vol. 5, no. 1, pp. 169–179, Apr. 2024, doi: 10.46843/jiecr.v5i1.905.

[36] N. Nurhasnah, L. Lufri, and A. Asrizal, "*Effect Size Analysis of the Implications Ethnoscience Approach to the Improvement of 21st Century Skills in Science Learning*," *Jurnal IPA & Pembelajaran IPA*, vol. 6, no. 3, pp. 287–299, Sep. 2022, doi: 10.24815/jipi.v6i3.26116.

[37] Z. Dami and P. Parikaes, "Regulasi Diri dalam Belajar Sebagai Konsekuen," vol. 1, pp. 82–95, Jul. 2018.

[38] L. Augia, J. Copriady, and S. Susilawati, "E-LKPD Berbasis Experiential Learning Menggunakan Liveworksheets pada Materi Asam-basa," *Jurnal Pendidikan Matematika dan Sains*, vol. 13, no. 2, pp. 336–346, Jul. 2025, doi: 10.21831/jpms.v13i2.87663.

[39] F. Ardiyanti and H. Nuroso, "Analisis Tingkat Keterampilan Berpikir Kritis Siswa Kelas Xi Mipa Dalam Pembelajaran Fisika," *Kast: Jurnal Pendidikan Fisika dan Terapannya*, vol. 4, 2021.