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Needs Analysis to Develop Heat E-Teaching Material Integrated Deep Learning and Local Wisdom to Facilitate Students' Creative Thinking Skills

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ABSTRACT

Effective physics learning requires digital instructional materials that are interactive, contextual, and capable of integrating local wisdom with a deep learning approach to support students' creative thinking skills and conceptual understanding. However, heat instruction continues to face several challenges, including students' low creative thinking skills, inadequate conceptual understanding, and the limited use of digital technology and local wisdom in existing teaching materials. These limitations contribute to suboptimal learning outcomes and reveal a gap between the competencies required for 21st-century education and the instructional resources currently used in schools. This study aims to analyze the need for developing digital teaching materials that integrate local wisdom with a deep learning approach to facilitate students' creative thinking skills. A mixed-methods approach was employed, with data collected through questionnaires, creative thinking skill tests, and analyses of students' learning outcome documents. The findings indicate that such digital teaching materials have the potential to increase students' learning motivation, active participation, creative thinking skills, and conceptual understanding of physics concepts. Therefore, integrating local wisdom and deep learning into digital teaching materials represents an innovative strategy for improving physics instruction while addressing students' learning needs and supporting the development of competencies required in the 21st century.

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INTRODUCTION

Rapid advances in science and technology have supported various aspects of human life, including education. Advances in science and technology have given rise to various innovations that facilitate the teaching and learning process (Safitri & others, 2024). One of the major transformations in education is the shift to digital learning, which has become a hallmark of 21st-century education and has significantly influenced education systems worldwide (Siringoringo & Alfaridzi, 2024). As a result, every individual is expected to master 21st-century skills in order to respond effectively to these technological developments.

Therefore, education must equip students with the competencies needed to thrive in an increasingly digital and technology-driven society.

The 21st century is characterized by globalization and increasingly intense competition. Twenty-first-century skills refer to the competencies that enable individuals to successfully face increasingly complex challenges and achieve success in various aspects of life (Mufita et al., 2020). The century education, in line with the development of the Industrial Revolution 4.0, demands mastery of new skills known as the 4Cs: critical thinking, creativity, collaboration, and communication. The 4Cs skills framework has become a global educational benchmark because it plays a crucial role in developing students' full potential and preparing them to face the challenges of the increasingly complex digital era. These competencies are essential for equipping students with the ability to overcome challenges emerging in the Industrial Revolution 4.0 era (Asrizal et al., 2026; Kahar et al., 2021). Holistic development emphasizes the cultivation of human reasoning and thinking abilities. Therefore, education is expected to foster these abilities effectively while enhancing students' competencies and developing positive character.

Mastery of the 4C competencies is essential for individuals to cope with the demands of life and the workplace in the 21st century. According to Maleni et al. (2025), these competencies play a significant role in career advancement and in preparing individuals to meet the demands of modern industries. Therefore, 21st-century competencies are not only important for individual development but are also crucial for meeting the needs of society and the ever-evolving world of work. As a result, educational institutions need to integrate the development of the 4C competencies into the learning process in order to equip students with the knowledge, skills, and adaptability necessary to face future challenges.

Creative thinking is the ability to generate original ideas and develop innovative solutions to problems through approaches that differ from those commonly used by others. This ability involves effectively utilizing intuition and imagination to overcome real life challenges (Asrizal et al., 2023; Rindasari, 2023). A person can be said to possess creative thinking skills if they meet the four indicators of creative thinking: fluency, flexibility, originality, and elaboration. Fluency in thinking: To meet this indicator, students ask many questions and are able to propose similar ideas to solve a problem. Flexibility in thinking: To meet this indicator, students can offer various interpretations of an image. Original thinking: Students meet this indicator by generating unique answers using their own language or words that are easy to understand. Elaboration: Students can develop or enrich others’ ideas and outline detailed steps (Khotimah & Lestari, 2023).

Deep learning is a learning approach that aims to foster students’ meaningful, conscious, in-depth, critical, creative, and real-life-relevant understanding (Ningsi, 2025). The primary focus of this approach is to enhance students’ ability to think creatively through activities that involve exploration, reflection, and the application of their knowledge in concrete situations. Physics instruction using the deep learning approach emphasizes students’ active engagement in building a deep, meaningful, and applicable conceptual understanding of natural phenomena. This approach encourages students to explore physics concepts, ask meaningful questions, and analyze the relationships between concepts through contextual learning experiences (Kusumaningtyas, 2025).

Creative thinking enables individuals to generate new ideas and knowledge to solve various problems. This skill is particularly important for students because it encourages them to develop the knowledge and competencies required to create entrepreneurial opportunities while producing innovative ideas and solutions. Various efforts have been implemented to enhance students' creative thinking skills, one of which is improving the learning process by providing opportunities for students to practice creative thinking (Lestari & Ilhami, 2022). Learning activities that encourage exploration, collaboration, and reflection allow students to express original ideas, evaluate alternative solutions, and apply their knowledge in different contexts. According to Zuhra et al. (2025), to develop students' creative thinking skills, the learning process must provide students with the freedom and opportunity to actively participate in problem-solving and developing creative ideas. Therefore, mastering critical and creative thinking skills is essential for promoting meaningful learning, improving problem-solving abilities, and preparing students to face the challenges of an increasingly dynamic world (Rahmayani & Asrizal, 2024).

In response to these educational demands, Indonesia launched the Merdeka Curriculum. This curriculum reflects the vision for 21st-century education while addressing the challenges of the Fourth Industrial Revolution by emphasizing the development of new competencies and students' holistic potential. This curriculum is designed to equip students with the competencies needed to effectively respond to the demands of the Fourth Industrial Revolution (Yanti et al., 2024). It also promotes the development of reasoning abilities and higher-order thinking skills as fundamental human capacities. Therefore, education is expected to effectively foster these competencies while strengthening students' skills and character development.

Information technology plays a crucial role in creating engaging physics learning experiences. With digital technology, physics learning can be more interactive, enjoyable, and effective. For example, computer simulations, educational videos, and physics learning apps help students visualize complex physics concepts (Astuti et al., 2024). Technological advances have created a global learning environment and enabled students to access information and learning resources more easily through online educational services. Although technology offers many benefits, it also presents several challenges. One of the main obstacles to implementing digital learning is the limited availability of information and communication technology (ICT) infrastructure, which restricts teachers' and students' access to digital technology and internet connectivity in the classroom (Husen et al., 2025). To overcome these challenges, teachers need to develop the knowledge and skills necessary to effectively utilize digital tools and learning resources during the learning process.

Ideal teaching materials should optimize the use of information and communication technology (ICT) to support interactive and contextualized physics learning. These teaching materials should be accessible through computer networks and the internet while incorporating interactive learning software and multimedia elements, including text, images, audio, video, animations, and simulations, to facilitate students' understanding of physics concepts (Muskhir et al., 2024). E-learning materials offer users easy access and flexible use. With features such as text, images, videos, audio, links, animations, and simulations, these materials become more engaging and interactive (Manihuruk & Sutabri, 2024). E-learning materials can facilitate independent student learning (Idayanti & Suleman, 2024). Additionally, the use of e-learning materials can enhance students' skills because it involves technology and internet access (Ayu et al., 2022).

However, the current conditions in schools have not yet met these expected standards. This situation was identified through a preliminary study conducted at SMAN 5 Padang. The preliminary study examined various problems and needs encountered during the physics learning process. The findings revealed four major aspects requiring attention, namely the context of teaching materials and the implementation of the deep learning approach, students' creative thinking skills, heat as a learning topic, and students' prior knowledge. The research instruments were specifically designed according to the objectives of each needs analysis.

The first finding was related to the teaching materials currently used in the school. Data were collected using a contextual analysis instrument completed by the researcher to compare the ideal conditions with the actual conditions at SMAN 5 Padang. The results indicated that the school had not yet implemented digital teaching materials and still relied primarily on printed textbooks to support classroom instruction. The integration of information and communication technology into the learning process was also not yet optimal. The contextual analysis revealed a considerable gap between the expected and actual conditions. The teaching materials component was classified as "less appropriate" with an average score of 39.84, while the implementation of the deep learning approach was categorized as "moderate" with an average score of 47.18. Specifically, the meaningful learning component obtained an average score of 50.70, the joyful learning component scored 42.50, and the mindful learning component achieved 48.33. These findings indicate that physics learning at the school has not yet fully implemented local wisdom-integrated teaching materials based on a deep learning approach. Consequently, the utilization of educational software to support instruction remains limited, and learning activities continue to depend primarily on printed instructional materials without maximizing the potential of information and communication technology.

The second issue identified in the preliminary study concerns students' creative thinking skills. Students' initial creative thinking abilities were assessed using a performance assessment sheet. The results obtained at SMAN 5 Padang showed an average score of 36, consisting of 41 for fluency, 31 for flexibility, 36 for originality, and 26 for elaboration. These indicators are consistent with the creative thinking framework proposed by Harisuddin (2019). Based on these findings, students' creative thinking skills can be categorized as low.

The third issue relates to student academic achievement. This analysis focuses on students' cognitive achievement in Phase F by examining the Final Summative Assessment (FSA) scores of 11th-grade students who selected Physics as an elective course. The average PAS score was 64.51, which falls into the moderate category. These findings indicate that students' conceptual understanding and academic achievement in Physics still need to be improved. They also highlight the need for more effective learning strategies that actively engage students in building conceptual understanding and enhancing their cognitive learning outcomes.

The fourth issue relates to students' understanding of the topic of heat. The questionnaire results indicate that students experience significant difficulty in understanding heat-related concepts. This finding is reflected in the average score of 63.56, indicating that many students are unable to explain everyday phenomena based on the concepts of heat transfer, temperature change, and changes in the state of matter. These results suggest that students require learning experiences that connect heat concepts to real-life phenomena in order to foster deeper conceptual understanding and meaningful learning. Therefore, the development of contextual teaching materials that integrate authentic daily experiences is expected to help students construct scientific concepts more effectively and improve their overall understanding of heat-related topics.

A comparison between the expected conditions and the actual conditions observed in the field reveals a substantial gap. This discrepancy indicates the existence of significant educational problems that require immediate attention. The findings demonstrate that students' conceptual understanding and creative thinking skills remain relatively low, while the heat topic continues to be difficult for students to comprehend. Furthermore, the teaching materials currently used in schools have not been able to facilitate students' competencies effectively. Most teaching materials are still available only in printed form, and their availability is limited.

The development of digital instructional materials that integrate local wisdom with a deep learning approach is a potential solution for enhancing practical, engaging, and meaningful learning experiences, as well as for developing students' creative thinking skills. The integration of local cultural contexts and deep learning principles supports students in actively constructing knowledge, applying scientific concepts to real-life situations, and developing 21st-century competencies. The authors aim to design, develop, and implement digital instructional materials on heat that combine local wisdom and a deep learning approach to effectively enhance students' creative thinking skills and learning outcomes in line with the demands of 21st-century education.

METHODS

This study is a type of research that employs the research and development (R&D) method. It is designed to produce a specific product and test its effectiveness (Sugiyono, 2019). The research and development were conducted to produce an electronic teaching material on heat that integrates local wisdom with deep learning to foster students' creative thinking skills. The instructional materials developed follow the Hannafin & Peck development model, which consists of three phases: the needs assessment phase, the design phase, and the development and implementation phase (Hannafin & Peck, 1988).

The subject of this study is Integrated E-Learning Materials Using a Deep Learning Approach to Foster Students' Creative Thinking Skills. These e-learning materials will be validated by three faculty members. If the final product is deemed valid, it will proceed to a practicality test. The practicality test will be conducted with two teachers and students at SMAN 5 Padang. The results of the validation and practicality tests will provide evidence of the quality and feasibility of the developed e-learning materials for use in the learning process, ensuring that the materials are appropriate, practical, and capable of supporting meaningful learning while fostering students' creative thinking skills.

The validity instrument used in this study was a validity assessment questionnaire that had been reviewed and validated by the supervisor before being administered. The questionnaire was designed to evaluate the suitability of the developed e-learning materials based on five aspects: content substance, visual communication presentation, instructional design, the use of information and communication technology (ICT), and the integration of local wisdom with a deep learning approach. The validation results were analyzed quantitatively using the Aiken V-index (Aiken, 1985) to measure the level of agreement among expert validators regarding the validity of each assessment item. The Aiken's V coefficient was calculated using the formula (V = agreement index), where V represents the agreement index, S is the score given minus the lowest validity score ($S = r - l_0$), r is the score given by the rater, l_0 is the lowest validity score, and c is the number of response options available to the validators. A higher Aiken's V value indicates a higher level of agreement among the experts, reflecting stronger evidence of the validity of the developed e-learning material. formula as follows:

$$V = \frac{\sum s}{n(c-1)} \text{ , with } s = r - l_0$$

The next step is to evaluate the practicality of the e-learning materials. Practicality is assessed using questionnaires to examine students' responses regarding the ease of use, attractiveness, usefulness, and clarity of the developed product (Isa et al., 2025). The e-learning materials are considered highly practical if they meet these criteria to a very high degree. The assessment is conducted after the materials have been implemented in the classroom. The practicality indicators include six criteria: usability, ease of use, attractiveness, clarity, cost-effectiveness, and the integration of local wisdom with deep learning (Afrizon & Dewi, 2019). Data were collected through practicality questionnaires completed by teachers and students after using the developed e-learning materials. The questionnaire items were developed based on the established practicality indicators. The data were analyzed using descriptive quantitative analysis based on the following formula, where N represents the practicality score, R is the total respondent score, and SM is the maximum possible score. The resulting percentage was then used to determine the practicality level of the developed e-learning materials according to the predetermined assessment criteria:

$$N = \frac{R}{SM} x100$$

The practicality scores obtained from the teacher and student questionnaires were converted into percentage values to determine the level of practicality of the e-learning materials developed. These percentage scores were then interpreted using predefined classification criteria, enabling a systematic evaluation of the practicality level. This procedure provides an objective basis for determining whether the developed e-learning materials are appropriate and suitable for use in the classroom. The interpretation criteria, adopted from (Purwanto, 2010), are presented in Table 1.

Table 1. Assessment criteria for the practicality instrument

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

(Purwanto, 2010)

Data analysis techniques, the analysis techniques used in this study were needs analysis and validation testing. The needs analysis was conducted using descriptive statistical tables, including an analysis of instructional materials, the integration of the deep learning approach, an analysis of learning objectives, an analysis of learning arrangements, an analysis of students' difficulty with heat-related material, and an analysis of students' creative thinking skills through discourse-based questions. The results of the needs analysis were analyzed using a selected scoring system, where the maximum score was multiplied by 100 (Riduwan, 2010). Meanwhile, for the validity test, the analysis technique used in this study was descriptive statistics. The data from the validity test results were presented in graphical form. The validity of the e-learning materials was analyzed using a Likert scale, with scores assigned to each answer item on a scale ranging from excellent (5), good (4), fair (3), poor (2), to very poor (1). Subsequently, the validity score in this study was calculated using Aiken's V formula (Aiken, 1985).

RESULTS AND DISCUSSION

Results

The results of the needs analysis regarding digital teaching materials that integrate local wisdom based on the deep learning approach are presented in Figure 1. The analysis examined three main aspects that teachers considered important in developing digital teaching materials for teaching about heat: digital teaching materials (DTM), local wisdom (LW), and the deep learning approach (DLA). As shown in Figure 1, the deep learning approach received the highest percentage, indicating that teachers consider it the most important component to be integrated into the development of digital teaching materials. Meanwhile, digital teaching materials and local wisdom are also considered important aspects, highlighting the need for digital learning resources that not only support meaningful learning but also incorporate local cultural contexts. These findings suggest that the integration of digital technology, local wisdom, and the deep learning approach should serve as the primary foundation for developing teaching materials that are relevant to students' learning needs and the demands of 21st-century education.

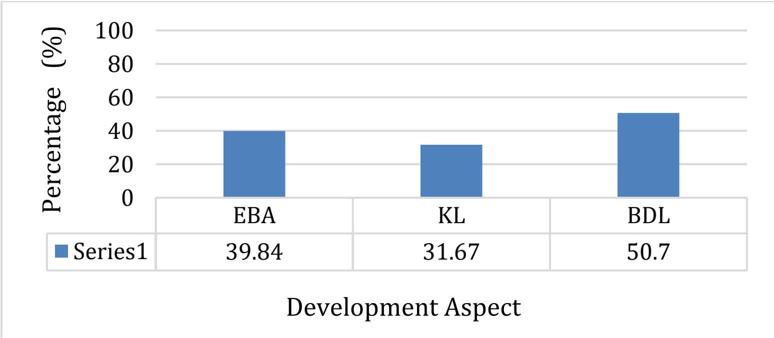

Figure 1. Contextual Analysis of Teaching Materials Used in Schools

The contextual analysis revealed that the school has not yet implemented digital teaching materials and continues to rely primarily on printed textbooks to support the learning process. In addition, the integration of information and communication technology (ICT) into classroom instruction has not been optimized. The analysis identified a considerable gap between the expected conditions and the actual implementation in schools. The teaching materials component obtained a score of 39.84, indicating that it falls within the less appropriate category. The integration of local wisdom into teaching materials achieved a score of 31.67, while the implementation of the deep learning approach received a score of 50.70. These findings indicate that physics learning at the school has not fully incorporated local wisdom-integrated teaching materials based on a deep learning approach. Consequently, the use of educational software to support learning activities remains limited, and classroom instruction still depends largely on printed instructional materials rather than utilizing information and communication technology effectively.

The results of the student characteristics analysis, conducted to identify student profiles and learning preferences as a foundation for developing digital learning materials that integrate local wisdom based on a deep learning approach. The analysis covers several aspects, including educational background (EB), interest in learning (IL), motivation to learn (ML), educational attitude (EA), learning style (LS), visual learning style (VLS), auditory learning style (ALS), kinesthetics learning style (KLS). Understanding these characteristics is crucial to ensuring that the developed e-learning materials align with students' needs and support meaningful learning experiences. The results presented in Figure 2 provide an overview of the dominant characteristics that need to be considered in instructional design.

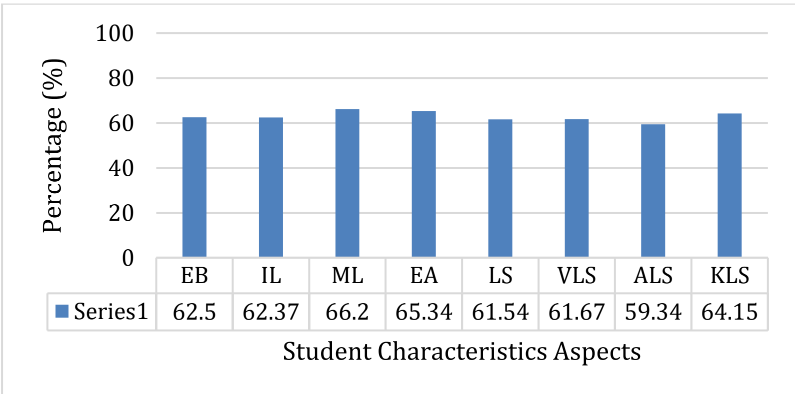

Figure 2. Analysis of Student Characteristics

The analysis of student characteristics identified several important factors influencing the quality of learning. Students' educational background obtained a score of 62.50, indicating that background characteristics may influence their learning abilities. Students' learning interest received a score of 62.37, suggesting that many students demonstrate relatively low interest in learning, which may reduce their engagement and academic achievement. In addition, the auditory learning style obtained a score of 59.34, indicating that not all students prefer learning primarily through listening to explanations. Overall, these findings suggest that appropriate educational interventions are necessary to improve students' learning interest and learning attitudes in order to achieve better learning outcomes.

The results of the analysis of students' creative thinking skills, conducted to identify their initial level of creativity prior to the implementation of the developed digital learning materials. Creative thinking is considered one of the essential competencies in the deep learning approach, as it enables students to generate meaningful ideas, solve problems from various perspectives, and construct new knowledge. This analysis is based on four indicators of creative thinking: fluency, flexibility, originality, and elaboration. The results shown in Figure 3 provide an overview of students' strengths and weaknesses in these indicators and serve as a basis for designing learning activities that foster higher-order thinking skills.

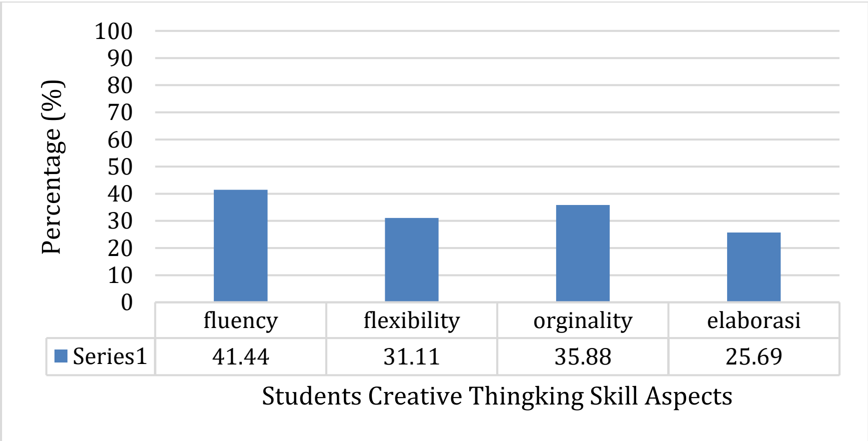

Figure 3. Analysis of Students' Creative Thinking Skills

The analysis of students' creative thinking skills produced an average score of 33.53 across four indicators, namely fluency, flexibility, originality, and elaboration. These indicators are based on the creative thinking framework proposed by Harisuddin (2019). Among the four indicators, originality and elaboration obtained the lowest scores, indicating that students experienced considerable difficulty in generating original ideas and developing detailed explanations when solving problems. In addition, students encountered challenges in applying the same concept through different approaches and in providing comprehensive solutions to scientific problems. Based on these findings, students' creative thinking skills can be classified as low. Therefore, greater attention should be given to developing instructional strategies that actively promote students' creative thinking abilities.

Results of the analysis of classroom instruction management during the implementation of deep learning. This analysis was conducted to evaluate the effectiveness of instruction management across three instructional phases: introductory, core, and concluding activities. Effective instruction management is a key factor in supporting meaningful learning and facilitating the successful implementation of the deep learning approach. The results presented in Figure 4 provide an overview of the strengths and areas for improvement in each phase of the instructional process.

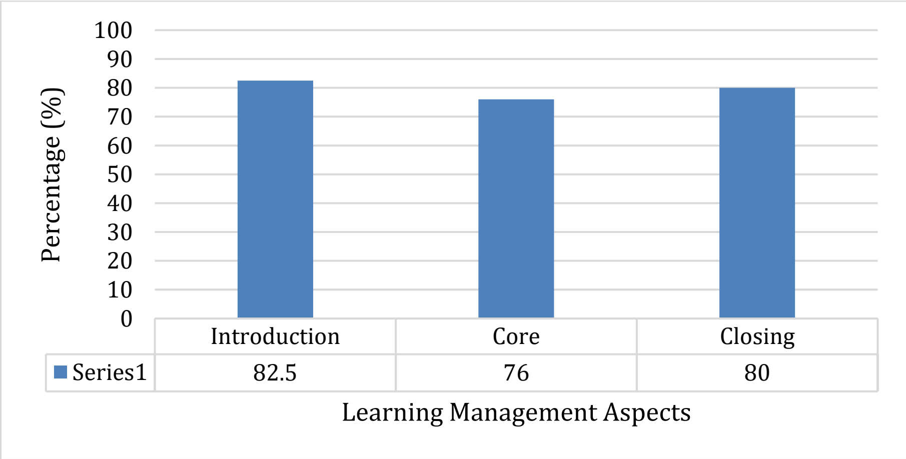

Figure 4. Analysis of Learning Management

The analysis of learning management indicates that the highest score was obtained in the introductory activities, with a score of 82.50, followed by the closing activities with a score of 80.00, while the core learning activities achieved a score of 76.00. These findings suggest that, overall, classroom learning management has been implemented effectively, particularly during the opening and closing stages of instruction. However, the lower score achieved in the core learning activities indicates that improvements are still needed in organizing and implementing the main instructional process. These improvements may include more effective classroom management, the application of a wider variety of instructional methods, and greater student engagement throughout the learning process so that classroom activities become more active, meaningful, and effective.

Results of the analysis of learning objectives for the topic of heat based on the Audience, Behaviour, Condition, and Degree (ABCD) framework. This analysis was conducted to evaluate the extent to which the existing learning objectives meet the characteristics of well-formulated instructional objectives. Each indicator was evaluated across three instructional materials to identify strengths and areas for improvement. The findings presented in Figur 5 serve as the basis for revising the learning objectives to better support the development of e-learning materials that integrate local wisdom based on a deep learning approach.

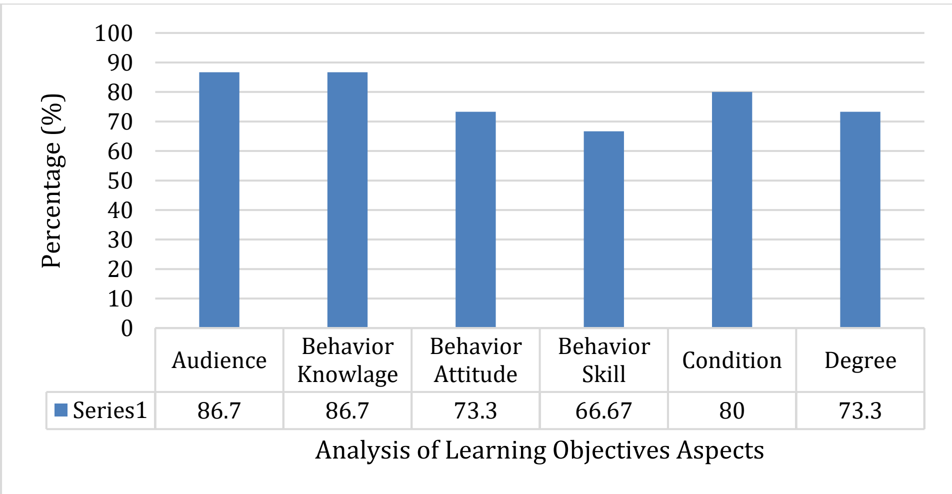

Figure 5. Analysis of Learning Objectives

The analysis results show that the learning objectives do not yet fully meet the ABCD criteria (Audience, Behaviour, Condition, and Degree). The Audience and Behaviour (knowledge) aspects received the highest score (86.7), indicating that the target learners and knowledge competencies have been clearly defined. The Condition aspect also achieved a high score (80), indicating that the learning conditions have generally been defined, although they could still be refined to better support the implementation of learning activities. Meanwhile, the Behaviour (attitude) and Degree aspects each received a score of 73.3, indicating that the expected attitudes and achievement criteria have been included but require further refinement to become more specific and measurable. The Skill Behaviour aspect received the lowest score (66.67), indicating that the formulation of skill competencies needs to be strengthened to better reflect the expected performance of the students. Therefore, revisions to the learning objectives should focus on improving the formulation of skill competencies, achievement criteria, and learning conditions to make them more specific, measurable, and aligned with e-learning materials that integrate local wisdom through a deep learning approach, which emphasizes meaningful learning and the development of 21st-century competencies.

Discussion

The findings of this study demonstrate a considerable gap between the expected conditions of physics learning in the 21st century and the actual practices implemented at SMAN 5 Padang. The contextual analysis revealed that teaching and learning activities continue to rely primarily on printed instructional materials, while the integration of information and communication technology (ICT) remains limited. This situation indicates that the existing teaching materials have not yet supported technology-enhanced learning, which has become an essential component of modern education. According to Siringoringo & Alfaridzi (2024), the digital transformation of education requires teaching materials that effectively integrate technology to promote active, flexible, and student-centered learning. Similarly, Husen et al., (2025) reported that inadequate ICT infrastructure and limited utilization of digital resources remain major challenges in implementing effective digital learning. Therefore, the development of digital instructional materials is essential to bridge the gap between current educational practices and the competencies required in the 21st century, thereby enabling students to engage in more interactive, meaningful, and technology-supported learning experiences that will better prepare them to face future academic and real-world challenges.

The results also revealed that students' creative thinking skills remain relatively low, particularly in the indicators of originality and elaboration. These findings suggest that students still experience difficulties in generating original ideas, applying concepts through different perspectives, and developing comprehensive solutions to scientific problems. Creative thinking is one of the essential competencies required for solving complex problems in contemporary education and future workplaces. Lestari & Ilhami, (2022) emphasized that learning environments encouraging active participation and authentic problem-solving significantly contribute to the improvement of students' creative thinking skills. Consequently, instructional innovation is required to create learning experiences that stimulate students to explore ideas independently and construct knowledge through meaningful activities.

Another important finding concerns students' understanding of the heat topic. The analysis showed that many students still had difficulty relating heat concepts to real-life phenomena. This indicates that existing learning resources have not adequately provided contextual learning experiences that connect abstract physics concepts with students' everyday lives. Contextual learning is widely recognized as an effective approach to improving conceptual understanding because it helps students relate scientific concepts to authentic situations. Therefore, integrating local wisdom into teaching materials is expected to strengthen this connection by presenting learning content that reflects students' cultural and environmental contexts, making physics learning more meaningful and relevant.

The analysis of learning management showed that classroom activities were generally implemented effectively during the introductory and closing stages. However, the lower score for the core learning activities indicates that improvements are still needed to better engage students throughout the learning process. The core stage allows students to investigate problems, discuss ideas, collaborate with peers, and construct scientific understanding. Therefore, enhancing the quality of these activities is expected to improve students' engagement, conceptual understanding, and creative thinking skills. In addition, better alignment between learning objectives, instructional strategies, and assessment can strengthen the effectiveness of the learning process and support the achievement of intended learning outcomes. Incorporating contextual learning experiences that connect scientific concepts with local wisdom and real-life situations can also make learning more meaningful while promoting higher-order thinking and problem-solving skills.

A needs analysis indicates the importance of developing digital instructional materials that integrate local wisdom with a deep learning approach. Gaps in ICT use, creative thinking skills, understanding of heat concepts, and learning management highlight the need for innovation in instructional materials. Integrating local wisdom is expected to promote meaningful learning, active participation, knowledge construction, and students' creative thinking skills. These findings provide a strong foundation for designing instructional materials that meet the demands of 21st-century education. Moreover, digital instructional materials developed through a deep learning approach can support student-centered learning by encouraging inquiry, reflection, collaboration, and the application of scientific concepts in authentic contexts. As a result, these materials are expected to improve students' conceptual understanding of heat while fostering lifelong learning skills, including critical thinking, creativity, communication, and collaboration.

CONCLUSION

The results of this needs analysis indicate that the development of digital instructional materials that integrate local wisdom with a deep learning approach is essential for enhancing students' creative thinking skills. Currently, the instructional materials used in schools are still dominated by printed textbooks and do not make optimal use of information technology, resulting in a learning process that lacks interactivity and contextual relevance. Students' creative thinking skills particularly in terms of originality and elaboration remain relatively low, while their conceptual understanding of thermal concepts also requires improvement. The integration of local wisdom is expected to make learning more meaningful and relevant to students' daily lives, thereby encouraging their active participation and creativity in the learning process. Furthermore, the deep learning approach fosters the development of higher-order thinking skills and stronger knowledge construction. Therefore, the development of e-teaching materials that combine these two aspects serves as an innovative solution to address 21st-century educational challenges and support the achievement of holistic competencies. The next step is to refine the design, development, and practical testing of these teaching materials to measure their effectiveness in the learning process.

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