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Developing a Problem-Based Digital Module to Enhance Elementary Students' Critical Thinking Skills

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Abstract: The research aim to develop a problem-based digital module that is valid, practical, and effective in improving fifth-grade students' critical thinking and conceptual understanding. The ADDIE paradigm implements research and development (R&D). The study had 25 fifth-grade students as subjects. Data were gathered via observation, interviews, questionnaires, and pre- and post-testing equipment. The experts validate the modules and instruments. N-gain is used for data analysis to help students improve their critical thinking and conceptual comprehension. The expert validation results demonstrated that this module was very practical in terms of material, media, and language. Product effectiveness was demonstrated using N-gain analysis and paired sample t-tests, which revealed a significant improvement in student learning outcomes. Positive feedback from students and teachers further validated the module's effectiveness. This study is unique because it integrates the PBL paradigm into a digital platform developed explicitly to translate conceptual understanding of Pancasila into applicable critical thinking abilities. The study found that implementing a PBL-based digital module in elementary schools improved students' critical thinking skills and conceptual comprehension of Pancasila Education.

Keywords: conceptual understanding; critical thinking; digital module; elementary education; problem-based learning

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Introduction

Education in the digital era faces significant challenges in fostering students' critical thinking skills and conceptual understanding, particularly at the elementary school level. Through critical thinking, students can analyze information in a coherent manner and make choices based on careful consideration (Adhikari, 2023; Adhikari et al, 2025). The synergy between educator competence and the use of instructional media is a determining factor in realizing pedagogical standards that are oriented towards escalating the quality of learning (Lubis et al., 2023; Supriatna et al., 2026). Critical thinking skills are a potential that every person has, can be measured, trained and developed (Bahari et al., 2026; Mulyawati et al., 2024; Susilawati, et al., 2020). Critical thinking skills are a cognitive process in systematically and specifically analyzing the problems faced, distinguishing problems carefully and thoroughly, and identifying and reviewing information in order to plan problem-solving strategies (Alkam et al., 2026; Mulyani, 2022).

Skills in identifying relevant facts, recognizing limitations, assumptions or specificities related to the procedures used, and determining rational answers (Bahari et al., 2026; Changwong et al., 2018). Critical thinking is a cognitive aspect that functions to identify a problem so that a solution can be found and a decision or consideration can be produced that is processed logically in solving the problem (Fitriyah & Ramadani, 2021). When students engage in critical thinking, they are not only able to detect weaknesses; their efforts to improve them directly activate and implement creativity, problem solving, and innovation in an integrated manner (Patras et al., 2024).

The integration of engaging learning media is therefore necessary to facilitate effective knowledge transfer and monitor students' progress. Consequently, both teachers and students are expected to develop technological competence in order to adapt to the rapid digital transformation in education (Kies & Kies, 2024).

The advancement of internet technology has stimulated various innovations in instructional design, including digital applications, interactive media, and digital modules. Digital modules offer several advantages, such as cost efficiency, flexibility, and suitability for distance learning environments (Culajara et al., 2022). Moreover, they promote independent learning. Among instructional approaches that foster higher-order thinking, Problem-Based Learning (PBL) has been widely recognized for encouraging students to engage in collaborative inquiry and solve authentic, real-life problems (Bhaumik et al., 2024).

Within the implementation of the *Merdeka Curriculum*, *Pancasila* education in fifth grade especially the topic *Pancasila* in my life is still frequently delivered through rigid, teacher-centered, and memorization-oriented instruction. This approach tends to position students as passive recipients of information and provides limited opportunities for them to analyze, question, and reflect on the meaning of *Pancasila* values in real-life situations. As a consequence, learning often focuses on recalling concepts rather than developing deeper understanding and critical thinking skills. In contrast, Problem-Based Learning (PBL) offers a more contextualized and student-centered learning experience by engaging learners in authentic problems related to their daily lives. Through this approach, abstract values of *Pancasila* can be connected to concrete social situations, enabling students to construct meaning, discuss perspectives, and apply values in practical contexts. Such learning experiences are aligned with the broader goals of twenty-first-century education, which emphasize the development of the 4C competencies: critical thinking, communication, collaboration, and creativity (Tohani & Aulia, 2022). Among these competencies, critical thinking plays a particularly vital role because it equips students with the ability to evaluate information, make reasoned decisions, and solve problems effectively in real-life contexts (Hutsalo et al., 2024). Therefore, integrating PBL into *Pancasila* education has the potential to transform learning from rote memorization into a meaningful process that nurtures reflective, responsible, and critically minded learners.

Empirical evidence indicates that Indonesia continues to face substantial educational challenges. The Programme for International Student Assessment (PISA) ranked Indonesia 74th out of 79 participating countries (Solihin et al., 2024; Esti et al., 2023) and 71st out of 81 countries in 2022, reflecting persistent skill gaps. As noted by the Minister of Education, Indonesia demonstrates abundant resources yet comparatively low performance quality, highlighting the urgency of systemic improvement (Konadu, 2025). Evidence from the PISA report and the 2022 Minimum Competency Assessment (MCA) confirms the low critical thinking and reasoning skills of students in Indonesia (Prabawa et al., 2024; Putri et al., 2024; Dina & Ekawati, 2022). However, preliminary observations conducted through Google Form from elementary students, revealed that 48.84% students demonstrated low critical thinking skills, while conceptual understanding was moderate (46.34%). Learning preferences indicated limited exposure to digital modules (15.73%), with instruction predominantly relying on textbooks and lectures. Furthermore, existing technological facilities including internet access, laptops, and projectors remain underutilized in classroom practice.

Previous studies have shown gaps in the integration of PBL pedagogy into digital media, which is still unidirectional and dominated by science subjects (Intan & Widowati, 2025; Rizal et al., 2023; Wen & Wen, 2020). The novelty of this research lies in the development of a digital *Pancasila* education module for fifth-grade students, designed as a digital social laboratory with a narrative structure based on local issues. By optimizing technology as an active pedagogical instrument, this research aims to produce valid teaching tools to improve students' critical thinking and conceptual understanding. Its primary contribution is to provide practical solutions for teachers in realizing meaningful learning while enriching the literature on technology-based character education in elementary schools. The research aimed to develop a Problem-Based Learning (PBL)-based digital module that is valid, practical, and effective in enhancing fifth-grade students' critical thinking and conceptual understanding of the topic *Pancasila in My Life*. Through this approach, it is hoped that practical solutions will be created for educators in realizing meaningful learning that aligns with the demands of the Independent Curriculum and the acceleration of digital transformation in global education.

Methods

Research Design and Participants

This Research and Development (R&D) study applied the ADDIE (Analysis, Design, Development, Implementation, Evaluation) (Creswell, 2009) model conducted at State elementary school in Bekasi. Through a saturated sampling technique, this study involved all fifth-grade students (n = 25) as participants by upholding research ethics through informed consent and guaranteeing data anonymity. Data collection instruments included a Likert scale validation sheet for material, media, and language experts, as well as a learning outcome test consisting of 20 multiple-choice questions (pre-test) and 10 HOTS-based essay questions (post-test) to measure indicators of student analysis, evaluation, and inference. Although using a one-group pretest-posttest design that has limited internal validity due to the absence of a control group, the researcher mitigated this by

applying N-gain score analysis to measure the net improvement in learning outcomes. Furthermore, the significance of the improvement was tested through a Paired Sample t-test at the alpha level = 0.05, while the practicality of the module was evaluated based on the average score (M) of the teacher and student response questionnaires. The following research flow diagram can be seen in Figure 1.

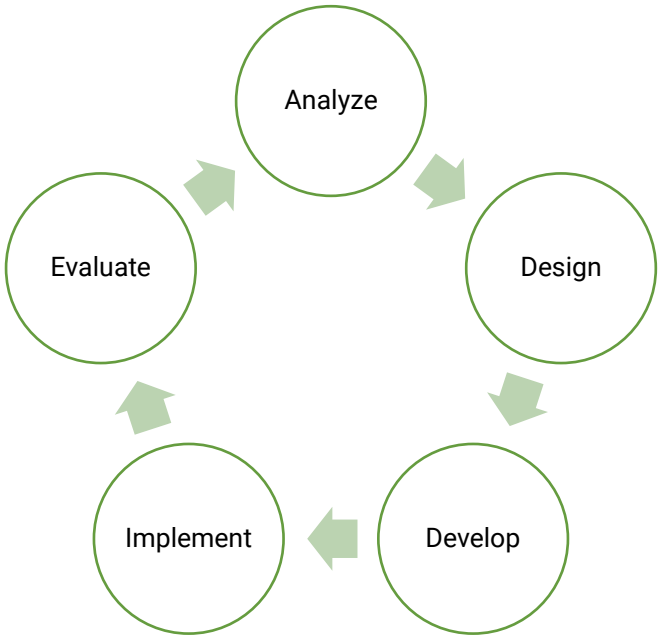

Figure 1. Research Flow Diagram

Data were collected through observation, interviews, questionnaires, tests (pre-test and post-test), and documentation. Observation was conducted during the preliminary study and product trial stages using a checklist instrument based on a Guttman scale. Interviews with the fifth-grade teacher aimed to identify instructional problems and learning needs. Questionnaires were administered to experts (content, media, and language) and students. Expert validation employed a five-point Likert scale (1 = very poor to 5 = very good). Content validity was calculated using the Content Validity Ratio (CVR) proposed by Lawshe (1975), and the overall Content Validity Index (CVI) was computed as the average CVR across items. CVR values range from −1 to +1, with positive values (> 0.00) indicating essential items (Almanasreh et al., 2022).

Student response questionnaires consisted of 18 closed-ended Likert-scale items and 2 open-ended questions. The percentage scores are calculated using interpretation criteria that follow the Likert scale percentage categories (Lutfiyah et al., 2023). The study employed a five-point Likert scale to measure participants' responses. Each response option was assigned a numerical score ranging from 1 to 5, where a score of 5 (strongly agree), 4 (agree), 3 (neutral), 2 (disagree), and 1 (strongly disagree). This scoring system enabled the researchers to quantify respondents' perceptions, attitudes, and levels of agreement toward the statements presented in the instrument. Higher scores reflected more positive responses and stronger agreement with the measured constructs, whereas lower scores indicated less favorable perceptions or stronger disagreement.

The test instrument measuring critical thinking and conceptual understanding was validated before implementation. Item validity was analyzed using the Pearson product–moment correlation. Reliability is assessed using the KR-21 formula. The reliability test results were interpreted based on the classification of correlation coefficient (r-value) levels. An r-value below 0.20 was categorized as indicating a very low relationship, suggesting minimal consistency among the measured items. Values ranging from 0.21 to 0.40 were classified as a low relationship, while coefficients between 0.41 and 0.60 indicated a moderate or sufficient relationship. Furthermore, r-values between 0.61 and 0.80 were interpreted as representing a strong or high relationship, reflecting good consistency among the instrument items. Finally, coefficients ranging from 0.81 to 1.00 were categorized as a very strong or very high relationship, indicating excellent reliability and a high degree of consistency in measuring the intended construct. This classification served as the basis for evaluating the reliability level of the research instrument and determining its suitability for data collection. (Livingston, 2018).

Quantitative data were analyzed using descriptive statistics (mean, standard deviation, minimum, and maximum scores), normality testing, normalized gain (N-gain), and paired-samples t-tests to determine the effectiveness of the intervention. The value range of 0.70 to 1.00 is categorized as High, which indicates high

effectiveness, the range of 0.30 to 0.69 is categorized as Medium, having moderate effectiveness, the range of 0.00 to 0.29 is categorized as Low, having low effectiveness. Qualitative data from interviews, observations, and open-ended responses were analyzed thematically to identify patterns related to students' critical thinking skills and conceptual understanding.

Result and Discussion

Result

In the development phase, the PBL-based digital module underwent a series of rigorous expert validations to ensure the quality of the materials, media, and language before the pilot phase. Content experts provided crucial input regarding the synchronization between contextual issues and the *Pancasila* principles to prevent misconceptions. While previously the problem narratives tended to be general, after the revision, social cases were designed to be more specific to stimulate students' critical reasoning in the realm of everyday life. From the media aspect, optimizations were made to the navigation system and interactive feature instructions. Before the revision, some icons were considered confusing, but after the revision, the interface became more intuitive through the addition of clear visual cues (scaffolding) for fifth-grade students. Meanwhile, language experts recommended simplifying technical terms, so that after the revision, all diction was adjusted to the literacy level of elementary school students without reducing the essence of civic values. This series of iterative processes successfully transformed the module into a digital social laboratory that is substantively accurate, visually engaging, and communicative in supporting independent learning.

Analysis Stage

Teacher Needs Analysis

The teacher needs analysis figure 2 revealed a gap between available technological facilities and pedagogical integration. Although learning conditions (84%), student constraints (82%), media availability (75%), and technology utilization (70%) were categorized as good, the availability of structured and problem-oriented teaching materials was rated relatively low (59%).

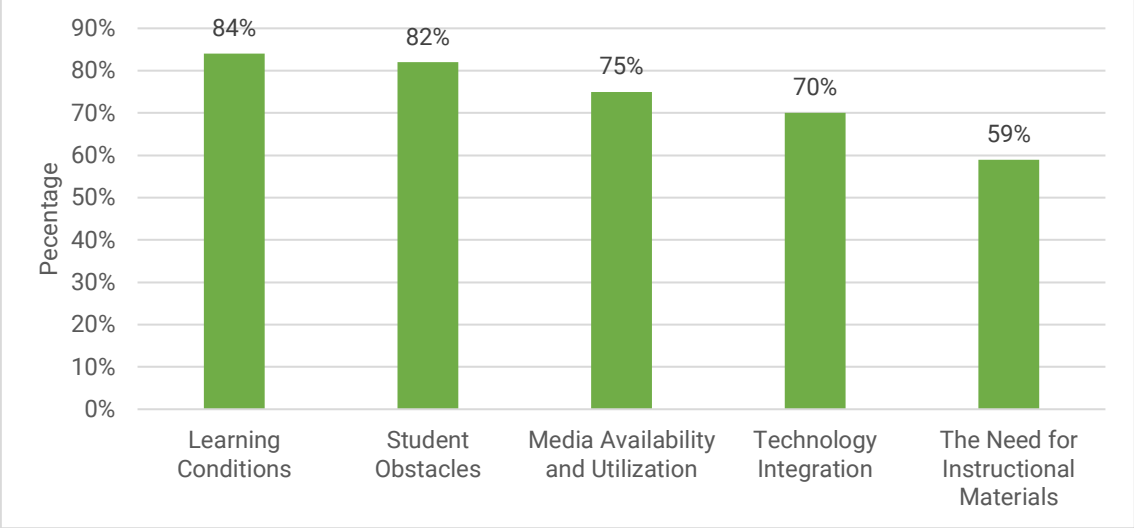

Figure 2. Results of Teacher Needs Analysis

These findings indicate that, although teachers generally have adequate access to various digital technologies and online learning resources, the availability of technology alone has not been accompanied by the provision of systematically designed instructional materials that effectively support learning. The results reveal that existing teaching resources have not yet integrated the stages of Problem-Based Learning (PBL) in a coherent and structured manner, limiting their potential to facilitate meaningful student engagement and higher-order thinking processes. This interpretation is further supported by the interview data, which showed that teachers predominantly rely on PowerPoint presentations and YouTube videos as their primary instructional media. While these digital tools can enhance content delivery and student interest, they are often used as supplementary resources rather than as components of a comprehensive pedagogical framework. Consequently, learning activities tend to focus on information presentation rather than guiding students through the stages of problem identification, investigation, collaboration, and solution development that characterize effective PBL implementation. The absence of integrated, PBL-oriented digital modules therefore points to a

pedagogical gap rather than a technological limitation. These findings highlight the need for the development of structured digital teaching materials that not only utilize available technologies but also systematically embed PBL principles to support active learning, critical thinking, and meaningful knowledge construction.

Student Needs Analysis

The student questionnaire results revealed generally positive perceptions toward the use of digital learning materials, as presented in Figure 3. Among the assessed dimensions, the need for instructional materials obtained the highest score (81%), indicating that students strongly expected the availability of more effective, engaging, and supportive learning resources. The instructional materials dimension also received a high score (79%), suggesting that students viewed digital learning resources as valuable tools for supporting their learning experiences. Likewise, the critical thinking dimension achieved a favorable score (78%), reflecting students' recognition of the importance of activities that encourage reasoning, analysis, and problem-solving. These findings suggest that students are receptive to the integration of digital technologies in learning and perceive such resources as beneficial for enhancing their educational experiences. Overall, the relatively high scores across these dimensions indicate a positive learning climate and a strong foundation for the implementation of more innovative instructional approaches supported by digital media.

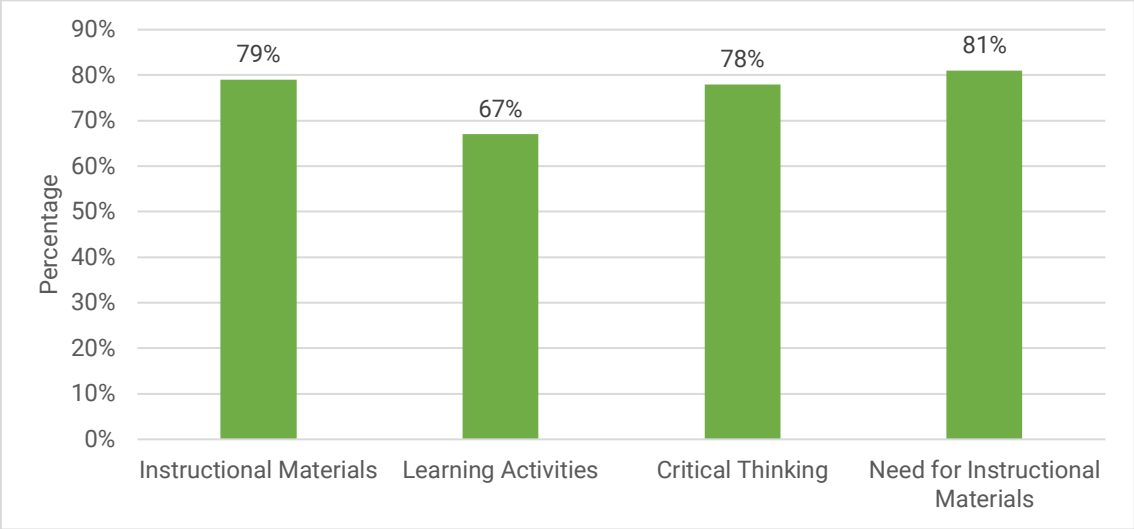

Figure 3. Results of Student Needs Analysis

Despite these positive perceptions, the learning activity dimension recorded the lowest score (67%), indicating that classroom practices remained predominantly teacher-centered and provided limited opportunities for active student engagement. This result suggests that students were not yet fully involved in meaningful learning processes that promote interaction, exploration, and independent thinking. Interview data further supported this finding, revealing that students preferred learning experiences that incorporated contextual problem scenarios, collaborative discussions, and opportunities to propose and evaluate solutions. Students expressed greater enthusiasm for activities that allowed them to connect learning content with real-life situations rather than simply responding to recall-based questions. Such preferences indicate a desire for more participatory and authentic learning experiences that foster deeper understanding and knowledge construction. Therefore, although students are regularly exposed to digital media, the current learning design has not yet fully utilized digital resources to support higher-order thinking skills. These findings highlight the need for instructional materials that integrate interactive and problem-based learning activities capable of promoting critical thinking, collaboration, and student-centered learning.

Student Characteristics and Baseline Competence

The majority of students (80%) owned smartphones, and 96% reported using them for learning purposes. Students perceived digital media as motivating (56% agree; 44% strongly agree). However, qualitative findings also revealed potential distractions, such as gaming and social media usage, highlighting the necessity of structured digital learning environments and teacher guidance. Baseline assessments revealed that critical thinking skills were not yet optimal. The lowest aspect was "providing explanations" (56%), while the highest was "strategy and tactics management" (73%). These results indicate uneven development across critical thinking dimensions. Similarly, conceptual understanding ranged from 68% to 80%. While students were able to identify and exemplify *Pancasila* principles, their ability to deeply connect concepts to authentic social

situations remained limited. These findings collectively justify the development of a structured PBL-based digital module designed to bridge the gap between basic recognition and higher-order conceptual reasoning.

Curriculum Alignment

The curriculum document analysis confirmed that the developed module was closely aligned with the principles and learning outcomes of the Merdeka Curriculum. The analysis revealed that the targeted learning objectives for the topic *Pancasila in My Life* were primarily situated at the cognitive levels of C2 (understanding) and C3 (application), requiring students not only to comprehend the meaning of *Pancasila* values but also to demonstrate their ability to apply these values in various everyday situations. Such objectives emphasize the development of meaningful understanding rather than rote memorization, encouraging students to connect conceptual knowledge with real-life experiences. Based on these curriculum requirements, the module was intentionally designed to incorporate contextual problem cases that reflect situations commonly encountered by elementary school students. Through these authentic scenarios, students were guided to analyze issues, discuss alternative responses, and determine appropriate actions grounded in *Pancasila* values. The integration of problem-based learning activities was therefore not incidental but directly derived from the curriculum analysis, ensuring consistency between instructional design and expected learning outcomes. As a result, the module provides opportunities for students to actively construct understanding, apply concepts in relevant contexts, and develop critical thinking skills while achieving the competencies mandated by the Merdeka Curriculum. (**Table 1**).

Table 1. Results of Analysis of School Class V Independent Curriculum Documents

Learning outcomes	Scope of Material	Learning Objectives	Learning Achievement Indicators	Dimensions of Graduate Profiles
Understanding the chronology of the history of the birth of Pancasila; imitate the attitude of the formulators of *Pancasila* and apply it in the community	*Pancasila* in My Life	Students can understand the history of the birth of *Pancasila*, imitate the attitude of the figures who formulated Pancasila, and apply it in daily life	1. Describing the History of the Birth of *Pancasila* 2. Explaining the exemplary values of the figures who formulated *Pancasila* 3. Providing examples of the application of *Pancasila* values in the school and home environment	Faith and fear of God Almighty, citizenship, critical reasoning

Design Stage

The sequential flow chart of the classroom learning experience designed within the developed digital instructional material (**Figure 4**). The learning process begins with the opening stage, where students are welcomed and introduced to the lesson through an engaging introductory activity intended to capture their attention and prepare them for learning. This is followed by the navigation stage, which provides clear guidance on how students can access and move through the learning content systematically. After becoming familiar with the learning environment, students proceed to the concept introduction stage, where key concepts and essential knowledge related to the topic are presented. This stage serves as a foundation for subsequent learning activities by helping students develop an initial understanding of the content. The next stage focuses on learning objectives, enabling students to recognize the expected outcomes and competencies that should be achieved throughout the learning process. By clearly communicating the objectives, students are encouraged to engage more purposefully and monitor their own learning progress.

Figure 4. Sequential Flow Chart: Classroom Learning Experience

Following the presentation of concepts and learning objectives, students participate in PBL activities, which constitute the core component of the instructional design. During this stage, learners are actively engaged in analyzing contextual problems, collaborating with peers, discussing alternative perspectives, and proposing potential solutions. These activities are intended to promote critical thinking, problem-solving, communication, and collaboration skills through meaningful learning experiences. The integration of authentic problems encourages students to connect theoretical knowledge with real-life situations, thereby fostering deeper understanding and knowledge construction. The learning sequence concludes with an evaluation stage, where students complete assessments designed to measure their achievement of the learning objectives. In addition to assessing learning outcomes, this stage provides feedback that can help both teachers and students identify strengths and areas for improvement. Overall, the sequential design illustrates a structured learning pathway that guides students from initial engagement to active problem solving and final evaluation, ensuring a coherent and student-centered learning experience.

Development Stage

The developed module integrated multimedia components, including visual representations of the five *Pancasila* principles, contextual narratives, embedded problem-solving tasks, and formative quizzes. The main uniqueness of this module compared to conventional PBL modules lies in its transformation into a digital social laboratory that integrates multimedia not only as a presentation tool, but also as an active pedagogical instrument. Unlike static PBL modules that generally only present text-based case studies, this module uses contextual narratives and interactive visual representations to connect the abstract concepts of the five principles of *Pancasila* to the local realities of fifth-grade students. The integration of problem-solving tasks combined with formative quizzes provides instant feedback, thus enabling a digital mentoring process that guides students to understand the complexity of the problem independently. Thus, the excellence of this module lies in its ability to create an interactive and personalized learning ecosystem, effectively bridging character values with critical thinking skills through meaningful learning experiences. To maintain concision while demonstrating product authenticity, the following core representations are retained (**Figure 5**).

Figure 5. Pages of Material 5 Precepts of *Pancasila* and Examples of Its Application

This digital module was declared highly suitable based on expert assessments covering various essential dimensions. The content assessment yielded a score of 93.33%, indicating that the material has been structured with a high level of relevance and precision. In terms of media development, the 86% score demonstrates that the module's design and interactivity support user-friendliness. The module's excellence is further enhanced by a language validation score of 95.99%, ensuring the material's readability for students. Collectively, these results

demonstrate that this module meets high-quality standards for use as an innovative solution for classroom learning. Content validity analysis using Content Validity Ratio (CVR) and Content Validity Index (CVI) (Lawshe, 1975) indicated CVR = 1.00 and CVI = 1.00 across indicators. According to Azwar (2016), positive CVR values (> 0.00) indicate essential agreement among experts. Minor revisions included improving capitalization consistency and refining learning objectives using the ABCD framework. After revision, experts declared the module suitable for classroom testing.

Implementation Stages

Teacher practicality testing yielded an overall mean of 4.5/5, indicating that the module was easy to use and pedagogically supportive. Teachers emphasized clarity of instructions, logical sequencing, and device flexibility. Student practicality results (**Table 2**) produced a mean of 4.05/5. The highest rating was in motivation, suggesting that the module successfully enhanced engagement. Slightly lower ratings in feedback/adaptation indicate that some students required guidance in interpreting instructions independently.

Table 2. Results of Practicality Test by Students

No	Aspects	Item	Average
1	Presentation design	1&2	4,1
2	Quality of content/material	3&4	4,22
3	Accessibility	5&6	4,12
4	Learning objectives	7&8	3,84
5	Feedback and adaptation	9	3,6
6	Motivation	10	4,4
	Practicality score by learners		4,05

The results of the student practicality test indicate that the developed module achieved a high overall practicality score of 4.05 out of 5 (**Table 2**). This finding suggests that students generally perceived the module as easy to use, useful, and supportive of their learning activities. Among the evaluated aspects, motivation received the highest average score (4.40), demonstrating that the module was successful in increasing students' interest, enthusiasm, and engagement during the learning process. The quality of content/material also obtained a high score (4.22), indicating that students considered the learning materials relevant, understandable, and beneficial for achieving the intended learning outcomes. Similarly, the presentation design (4.10) and accessibility (4.12) aspects were positively rated, suggesting that the module provided an attractive visual appearance and could be accessed conveniently across learning contexts. In contrast, the learning objectives aspect received a slightly lower score (3.84), while feedback and adaptation recorded the lowest average (3.60). These results imply that some students may have experienced difficulties in interpreting instructions, monitoring their learning progress, or independently utilizing the feedback provided within the module. Nevertheless, the consistently positive ratings across all assessed dimensions indicate that the module possesses a strong level of practicality and has the potential to effectively support student-centered learning while enhancing motivation and engagement in the classroom.

The results of the descriptive statistical analysis indicate a substantial improvements in students' critical thinking skills after using the PBL-based digital module. Based on the research data, the average score in the pre-test stage was recorded at 61.20 (SD = 13.09). After the intervention, the score increased significantly in the post-test stage to 82.96 (SD = 10.55). In addition to showing a sharp increase in the average score, the decrease in the standard deviation value in the post-test results indicates that the distribution of students' critical thinking skills became more even after using the module. The reduction in standard deviation suggests improved homogeneity of performance, indicating that the module not only raised average achievement but also reduced disparities among students. Normality testing using Shapiro–Wilk yielded p = 0.187 (pretest) and p = 0.053 (posttest), confirming normal distribution and supporting parametric testing. The normalized gain (N-gain) mean was 0.4966, categorized as moderate improvement. The paired-samples t-test demonstrated a statistically significant difference (t = −7.922, p = 0.000), confirming that the module significantly improved students' critical thinking performance.

Evaluation Stage

Teacher interviews indicated increased student enthusiasm due to contextual problem integration. The PBL approach encouraged discussion, argumentation, and value-based reasoning. However, challenges included unequal device ownership and the need to maintain student focus on conceptual reasoning rather than purely interactive features. Teacher facilitation was therefore identified as a crucial factor in optimizing digital module use. However, student response data (**Table 3**) yielded a total feasibility score of 81.2, categorized as

highly feasible. Motivation scored highest (88), followed by content quality (84.8), indicating that students perceived both cognitive and affective benefits from the module. These findings triangulate with statistical improvement results and teacher observations, reinforcing the conclusion that the PBL-based digital module is pedagogically feasible, practically implementable, and statistically effective.

Table 3. Student Response Results to Digital Modules with PBL Model

ASPECT	ITEM	SHOES
Presentation Design	1	81,6
Quality of Content/ Material	2 & 5	84,8
Accessibility	3	77,6
Learning Objectives	4	78,4
Feedback and Adaptation	6	76,8
Motivation	7	88
Total Score		81,2

Discussion

This section discusses the research findings in relation to the four research questions that guided the study. First, it examines the characteristics of the developed Problem-Based Learning (PBL)-based digital module for the topic *Pancasila in My Life* and how its design features contribute to the enhancement of elementary students' critical thinking skills and conceptual understanding. Particular attention is given to the integration of contextual problems, student-centered learning activities, and digital learning components that support meaningful knowledge construction. Second, this section evaluates the feasibility of the developed module based on expert validation and user assessments, highlighting its strengths in terms of content quality, instructional design, and usability. Third, the discussion addresses the effectiveness of the module in improving students' learning outcomes, including their ability to understand concepts and apply critical thinking in problem-solving situations. Finally, teacher and student responses toward the implementation of the module are analyzed to provide insights into its practicality, acceptability, and potential for classroom application. By examining these four aspects collectively, the discussion offers a comprehensive understanding of the educational value of the developed module and its contribution to promoting more engaging, meaningful, and student-centered learning experiences in elementary *Pancasila* education.

Characteristics of the PBL-Based Digital Module

The developed digital module demonstrates several defining characteristics aligned with the theoretical foundations of Problem-Based Learning (PBL) and digital instructional design (Honra & Monterola, 2026; Liu et al., 2026). First, the module is grounded in contextual problem scenarios, positioning real-life situations related to *Pancasila* values as the entry point of learning. This design reflects the core principle of PBL, in which learning begins with authentic problems that stimulate inquiry and analytical reasoning. Second, the module systematically follows PBL stages, including problem orientation, problem analysis, collaborative exploration, solution formulation, reflection, and evaluation. By structuring the learning process according to these stages, the module shifts the instructional paradigm from teacher-centered transmission toward student-centered inquiry.

Third, the module promotes active and independent learning. Students are encouraged to seek information, engage in discussion, and propose reasoned solutions. This design aligns with the principles of digital module flexibility, which allow learning materials to be accessed anytime and anywhere (Hess, 2020). The portability and accessibility of digital modules enhance learning autonomy and continuity beyond classroom constraints. Fourth, the integration of interactive digital features strengthens the contextualization of concepts. PBL-based digital modules can present interactive scenarios and virtual simulations that allow students to connect theoretical understanding with real-world application (Liu et al., 2026; Sholikah & Kowiyah, 2024). In this study, case-based tasks embedded within the module enabled students to analyze situations involving classroom democracy, cooperation, and social responsibility in accordance with *Pancasila* values.

Fifth, the module contributes to the development of 21st-century competencies, particularly critical thinking. Digital teaching materials integrating audiovisual elements, structured content, varied question formats, collaborative tasks, and interactive activities have been shown to support 21st-century skill development (Trinova et al., 2025; Wen & Wen, 2020). The multimedia-rich structure of the module therefore not only increases engagement but also facilitates deeper cognitive processing. Collectively, these characteristics indicate that the module is not merely a digitized textbook but a structured, inquiry-driven learning environment designed to cultivate higher-order thinking and meaningful conceptual understanding.

Feasibility of the PBL-Based Digital Module

The feasibility of the module was confirmed through expert validation and practicality testing. Expert evaluation yielded very high scores across domains: content, media, and language. These findings suggest that the module meets pedagogical, technical, and linguistic standards for elementary education. From a media perspective, experts emphasized the importance of visual appropriateness, including color selection and image relevance for contemporary elementary learners. The significance of visual media in elementary learning is well established, as images enhance observational skills and facilitate cognitive engagement with learning objects (Stavridi, 2019). Thus, visual refinement is not merely aesthetic but pedagogically consequential.

The content expert recommended integrating HOTS-based narrative problems to further stimulate critical reasoning. Higher Order Thinking Skills (HOTS) encompass analytical, evaluative, and creative cognitive processes that support problem solving and critical reasoning (Jannah et al., 2026; Ragab et al., 2024). Incorporating HOTS-oriented tasks strengthens the module's alignment with PBL philosophy and ensures that learning extends beyond recall toward reasoning and evaluation. Language validation emphasized compliance with standardized Indonesian orthography (PUEBI). Linguistic accuracy is essential in educational materials, as phonemic and orthographic inconsistencies may affect comprehension (Alowalid et al., 2018). Ensuring linguistic precision therefore enhances both clarity and regulatory compliance.

The practicality testing results further demonstrated the feasibility of the developed module for classroom implementation. Teacher evaluations indicated high ratings across multiple aspects, including product clarity, ease of use, instructional structure, and multimedia integration, suggesting that the module effectively supported the teaching and learning process. Teachers reported that the content was presented in a clear and organized manner, enabling them to understand and implement the learning activities with minimal difficulty. The module's systematic presentation of materials, logical sequencing of learning stages, and alignment with instructional objectives contributed to its pedagogical value. In addition, technical features such as readable font sizes, intuitive navigation, and clear audiovisual elements enhanced accessibility and user experience (Kang & Li, 2026; Ferreira et al., 2021), allowing both teachers and students to interact with the module efficiently. The integration of multimedia components also enriched learning by making abstract concepts more engaging and easier to understand. These findings indicate that the module successfully combines pedagogical and technological elements to support effective learning. Therefore, based on the positive evaluations provided by teachers, the module can be considered both pedagogically feasible and practically implementable in elementary school classrooms.

Effectiveness of the PBL-Based Digital Module

The effectiveness analysis demonstrated statistically significant improvements in students' critical thinking and conceptual understanding after implementation. Descriptive statistics indicated substantial increases in mean post-test scores compared to pre-test scores. Normality testing confirmed that the data met parametric assumptions, enabling inferential analysis. The N-Gain results showed a moderate level of improvement, indicating meaningful learning progress rather than minimal surface-level gains. Normalized gain provides an index of learning improvement relative to maximum possible achievement, while classification standards categorize such gains as moderate (Halizha & Fathurrahman, 2025).

The paired-samples t-test revealed a statistically significant difference between pre-test and post-test results ($p < 0.05$). The confidence interval did not cross zero, confirming that the observed improvement was not due to chance. The reduction in score dispersion also indicates increased performance homogeneity, suggesting that the module benefited students across different ability levels. These findings align with theoretical expectations of PBL, which emphasizes inquiry, reflection, and contextual application as mechanisms for enhancing critical reasoning. By engaging students in authentic problem analysis and structured reflection, the module operationalized these theoretical principles in measurable classroom outcomes.

Overall, the convergence of expert validation, statistical significance, and positive user responses collectively confirm that this PBL-based digital module is pedagogically appropriate, practical, and effective in transforming *Pancasila* education from mere doctrinal memorization to a meaningful process of internalizing values. These findings reinforce previous studies by Sholikah and Kowiyah (2024) and Lutfiyah et al., (2023) which stated that the integration of authentic problems in digital media can stimulate critical reasoning in elementary school students beyond conventional lecture methods. Critically, this improvement in learning outcomes occurs because the narrative structure in the module triggers cognitive dissonance, forcing students to reconcile real social conflicts with *Pancasila* values, while their cognitive load is effectively managed through interactive multimedia visualizations.

However, this study has intrinsic limitations in its pilot scale limited to one grade level ($n = 25$) with a one-group design that limits the generalizability of the findings, as well as its high dependence on the stability of

school infrastructure that could potentially bias the results in environments with low technology access. Therefore, this research makes a significant contribution by providing a prototype digital social laboratory that serves as an active pedagogical tool for practitioners to produce analytical generations in the digital era. As a further implication, character value transformation no longer has to be monotonous, but can be accelerated through exploration in a broader and more diverse population to ensure the inclusivity and external validity of this technology-based character education innovation.

Conclusion

This study could be concluded that the implementation of this PBL-Module is valid, practical, and effective to enhance students critical thinking skills in elementary schools. The implementation of this "digital social laboratory" module has been statistically proven to produce significant changes in cognitive abilities, with a moderate increase in critical thinking. This success is driven by the module's characteristics, which integrate real-world problems with a structured PBL phase, thus shifting rote learning patterns to meaningful, in-depth analysis. As a development step, further research is recommended to expand the sample scale to a more diverse population, analyze long-term student retention of understanding, and integrate more adaptive digital scaffolding features to minimize obstacles in the early stages of independent learning. Teachers are encouraged to integrate PBL-based digital modules to promote active and contextual learning. Schools should provide adequate technological support to facilitate implementation. Media developers are advised to refine usability and expand contextual problem variations. Future research should examine long-term effects and apply similar models to other subjects and educational levels.

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