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Development of Problem-Based E-Learning to Enhance Critical Thinking and Learning Motivation

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Abstract: This study aims to: (1) develop feasible, problem-based e-learning media for fifth-grade students; (2) evaluate its practicality in social studies learning; and (3) examine its effectiveness in enhancing critical thinking and learning motivation. Using the ADDIE model, the research involved 55 fifth-grade students at SDIT Salman Al-Farisi II. Data were collected through interviews, questionnaires, tests, and motivation scales. Experts validated the media as highly feasible (media: 74; content: 60) and considered highly practical based on teacher and student responses. Effectiveness testing revealed that the experimental group using the e-learning media achieved higher N-Gain scores in critical thinking (0.72, high) and learning motivation (0.53, moderate) than the control group (0.48 and 0.21, respectively). MANOVA analysis confirmed significant differences between groups in both variables (Wilks' Lambda = 0.118, F = 7.715, p = 0.000). These results demonstrate the statistical effectiveness of the problem-based e-learning approach. This study contributes a validated, interactive e-learning design that integrates problem-based strategies to foster 21st-century skills in elementary education. The findings provide practical insights for educators and researchers seeking to enhance student engagement, critical thinking, and learning motivation through digital learning environments.

Keywords: Critical thinking; E-learning; Elementary education; Learning motivation; Problem-based learning

Introduction

In order to successfully navigate the challenges of the 21st century, students must be equipped with critical thinking skills that allow them to assess information objectively, solve problems effectively, and make informed decisions. Critical thinking is broadly defined as the ability to think rationally and systematically to understand the relationships between ideas and facts, as well as to evaluate information with reason and logic (Triwulandari et al., 2022; Basri et al., 2021). These skills empower individuals to analyze complex information, assess varying perspectives, and respond adaptively to multifaceted real-world challenges (Ariadila et al., 2023; Novandi et al., 2025). Within the educational environment, cultivating critical thinking has been shown to enhance students' ability to identify problems, develop innovative solutions, and construct deep, meaningful understandings (Doyan et al., 2023; Ibrahim et al., 2023; Kurniawan et al., 2023). It also strengthens their resilience and preparedness for the dynamic, uncertain demands of the modern era (Jamaluddin et al., 2023; Sulhan et al., 2023).

Despite its vital role, the development of students' critical thinking skills in Indonesia remains suboptimal. Data from the Programme for International Student Assessment (PISA) 2022 indicate that Indonesian students continue to perform below the OECD average in domains requiring critical thinking and problem-solving. The majority of students scored below the 400-point threshold, typically falling within Levels 2–3, which reflects limited competence in applying

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knowledge to unfamiliar problems (OECD, 2023). Similarly, results from the 2024 PISA creative thinking assessment, closely related to critical thinking, revealed that only 31% of Indonesian students reached the basic proficiency level (Level 3), in contrast to 78% across OECD countries. Even more striking is that only 5% of Indonesian students achieved top-level performance (Level 5 or 6), significantly below the OECD average of 27% (OECD, 2024). These data highlight a pressing concern: a large proportion of Indonesian students struggle to generate creative ideas or innovative solutions in complex contexts, an essential indicator of critical thinking ability.

The low critical thinking outcomes can be attributed to several interrelated factors. One major issue is the limited application of adaptive and student-centered teaching strategies that encourage deep learning. Additionally, a lack of emotional support, minimal constructive feedback from teachers, and poor student motivation contribute to disengagement in the classroom (Hilmi & Kismiantini, 2024; Shen et al., 2024; Kanchana et al., 2025). Studies have shown that when students are not actively engaged in learning, the development of their critical thinking skills is hindered (Karoror & Jalmo, 2022; Wahyudiati, 2022; Zulhamdi et al., 2022). Moreover, Fajriati et al. (2024) emphasized that barriers to critical thinking stem not only from internal student factors but also from external challenges such as inadequate parental support and underutilization of technology in the learning process.

This issue becomes particularly visible in primary schools. A case study in an elementary school located in the Ngemplak area, Sleman, Yogyakarta, illustrates the practical implications of these challenges. Based on a literature review and field interviews with teachers and the school principal, it was found that Social Studies (IPS) learning still predominantly uses the lecture method. There is a lack of innovation in pedagogical approaches, leading to student boredom, passive learning behaviors, and diminished motivation. This aligns with the findings of Susanto et al. (2020), who reported that monotonous teaching methods and limited media use reduce student engagement and enthusiasm, especially in subjects that require higher-order thinking such as IPS.

Motivation has long been identified as one of the central drivers of successful learning (Sardiman, 2018). Students with high motivation tend to display curiosity, perseverance, and resilience when faced with cognitive challenges (Hutagaliung et al., 2025). Conversely, low motivation is associated with boredom, reduced focus, and passivity in class (Sari et al., 2021). These findings reinforce the importance of designing learning environments that are not only intellectually stimulating but also emotionally engaging.

To address these challenges, especially in Social Studies learning at the primary level, this research proposes the development of a problem-based e-learning model. This model is grounded in constructivist learning theory, which emphasizes the importance of student agency, contextual exploration, and collaborative knowledge construction. Unlike conventional e-learning that often replicates passive instructional models, problem-based e-learning engages students with real-world scenarios, reflective quizzes, case-based videos, and multimedia resources that enhance both engagement and cognitive depth (Setiyaningsih & Subrata, 2023; Liu et al., 2024; Renninger, 2024). Through these features, students are positioned not only as recipients of content but as active participants in constructing knowledge—aligning with the transformative vision of 21st-century education (Nawawi et al., 2024).

The novelty of this research lies in its targeted development of a problem-based e-learning model specifically tailored for elementary school students in Social Studies learning contexts, a combination rarely explored in previous studies. It integrates reflective thinking, contextual inquiry, and multimedia-supported instruction to improve two core educational outcomes: students' critical thinking skills and learning motivation. While numerous studies have examined the impact of e-learning in general or problem-based learning at higher educational levels, few have investigated how this integrative approach can be effectively designed and implemented in early educational settings in Indonesia.

Thus, this study is important not only for addressing the national challenge of low critical thinking performance but also for contributing practical pedagogical innovation that aligns with the needs of today's digital learners. It offers empirical evidence on how interactive, student-cantered digital learning tools can be utilized to foster more meaningful learning experiences, with specific relevance for Indonesian primary schools and Social Studies education.

Method

This research is a research and development (R&D) study that aims to produce products in the form of problem-based e-learning media and to test the validity, practicality, and effectiveness of their use in teaching Social Studies (IPS) to fifth-grade students. R&D was selected because it is congruent with the primary objective of the study, which is to produce educational products and to assess their efficacy in a real-world setting (Sugiyono, 2020). The research location was determined at SDIT Salman Al-Farisi II, Ngemplak District, Sleman Regency, Yogyakarta Special Region,

and 55 grade V students participated in the product trial as subjects.

The development model employed is the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model proposed by Branch (2009).

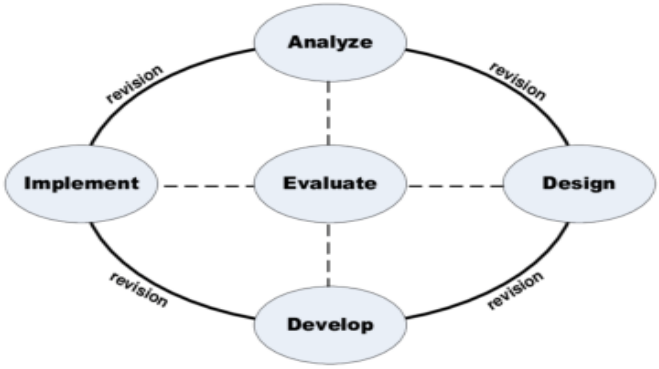

Figure 1. Flow of the ADDIE development model

The analysis stage entailed the conduction of interviews and the administration of needs analysis questionnaires to teachers and students, with the objective of identifying social studies learning problems and media needs. During the design stage, researchers developed an e-learning media design that incorporates navigation structure, user interface, learning materials, and problem-based features pertinent to the social studies theme. The development stage encompasses the creation of media through a web-based open-source platform, the validation of material and media experts, and the refinement of the product. The implementation stage is executed with a restricted trial in class V to obtain teacher and student responses related to the practicality of use. The final stage of the research process entailed the evaluation of the media's validity, practicality, and effectiveness, which was informed by the data obtained during the study.

The product developed is a web-based e-learning platform that contains grade V social studies materials themed "Social and Environmental Interaction," "Social and Cultural Diversity," and "National Heroes." This media has been developed according to a problem-based learning approach, which incorporates problem scenarios, discussion forums, interactive quizzes, and contextual learning videos. The interface has been designed to be child-friendly and responsive for both laptop and tablet devices. The product under consideration is open-source, which means that it can be accessed, modified, and used freely by teachers and other elementary school.

The data collection process involved the implementation of several techniques, including: (1) the administration of interviews and needs questionnaires to explore learning problems and students' needs for media; (2) the use of validation questionnaires for media and material experts to assess the feasibility of content, appearance, and media usability; (3) the administration of response questionnaires for teachers and students to assess the practicality of msedia in learning; and (4) the implementation of pretest and posttest questions to measure the effectiveness of media on critical thinking skills and student learning motivation.

The validity analysis was conducted using a 5-point Likert scale, with a score of 1 (very unsuitable) to 5 (very suitable). The mean score for each aspect was calculated using the following formula:

$$x = \frac{\sum x}{N} \quad (1)$$

Description:
X : Average score
∑x : Total score obtained
N : Total assessment

The mean score is subsequently classified according to the interpretation guidelines established by Azwar (2012), as illustrated in Table 1.

Table 1. Guidelines for Product Feasibility Assessment Score Categorization

Score Interval	Predicate	Category
X > (M + 1.50.S)	A	Very Appropriate
(M+0.50.S)< X ≤ (M+1.50.S)	B	Appropriate
(M–0.050.S)<X ≤ (M+1.50.S)	C	Sufficient
(M–1.50.S) < X ≤(M–0.50.S)	D	Less Appropriate
X ≤ (M–1.50.S)	E	Not Appropriate

Description:
M : Mean ideal = $\frac{1}{2}$ x maximum score
S : Standard Deviation = $\frac{1}{3}$x (M)
X : Student Score

A practical analysis was conducted by processing the results of teacher and student questionnaires using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The mean score was then interpreted based on Table 2 below:

Table 2. Practicality Category of the Media

Score Interval	Category
4.21 – 5.00	Very Practical
3.41 – 4.20	Practical
2.61 – 3.40	Sufficient
1.81 – 2.60	Less Practical
1.00 – 1.80	Not Practical

The effectiveness of learning media is measured through descriptive and inferential analysis. The pre-test and post-test scores were then subjected to analysis using the following Normalized Gain (N-Gain) formula (Hake, 1999):

$$N - Gain = \frac{Post\ test - Pre\ Test}{Score\ Maximum - Pre\ test} \quad (1)$$

The N-Gain interpretation criteria are as follows:

Table 3. N-Gain Interpretation Criteria

N-Gain Score Range	Interpretation
N-Gain < 0.3	Low
0.3 ≤ N-Gain ≤ 0.7	Moderate
N-Gain > 0.7	High

To assess the overall impact of the learning media on multiple dependent variables simultaneously, namely critical thinking and student motivation, Multivariate Analysis of Variance (MANOVA) was employed. The selection of this statistical test was predicated on its capacity to facilitate concurrent evaluation of media effectiveness across both cognitive and affective domains. All inferential analyses were conducted at a significance level of 0.05 using SPSS statistical software.

Result and Discussion

This section outlines the development and testing process of a problem-based e-learning media aimed at enhancing critical thinking and learning motivation in fifth-grade Social Studies (IPS). The development followed the ADDIE model (Branch, 2009), comprising five stages: Analysis, Design, Development, Implementation, and Evaluation. Each stage generated results that are analyzed below.

Analyse

A preliminary needs analysis was carried out using a combination of interviews and questionnaires administered to both students and teachers. The results painted a consistent picture: student enthusiasm and motivation toward Social Studies learning remained low. Much of the instructional process was still dominated by traditional, lecture-cantered approaches that offered little room for interaction, exploration, or contextual relevance—factors known to limit student engagement, particularly in subjects perceived as abstract or monotonous.

Despite these pedagogical challenges, the learning environment demonstrated strong potential for digital transformation. Most students had regular access to computer labs and stable internet connections at school, and a significant number owned smartphones that they used daily. These conditions point to a high level of digital readiness, making the integration of e-learning not only feasible but strategically promising.

Further supporting this optimism, 78% of the 55 fifth-grade students surveyed responded positively to the idea of using e-learning platforms, expressing the belief that such tools would enhance their understanding of the material. This enthusiasm underscores the shifting expectations of learners in the digital era and aligns with findings by Nikodemus et al. (2022) and Indriani et al. (2023), who emphasized that familiarity with digital tools and exposure to media-rich environments significantly boost student engagement and conceptual comprehension.

Design

Based on the findings of the needs analysis, a series of learning objectives was carefully formulated to address the identified gaps in student engagement and motivation. These objectives were then translated into a coherent and interactive e-learning structure designed to foster active participation and critical inquiry. The content was developed in accordance with the fifth-grade Social Studies curriculum, specifically centered around the theme *"Our Environment as Our Friend"* and the subtheme *"The Impact of Economic Activities on Community Welfare."*

To support these objectives, a detailed storyboard and interface design were constructed, resulting in the integration of various multimedia elements—including informative text, contextual videos, interactive quizzes, discussion forums, and animations. These features were embedded into a Moodle-based learning platform, selected for its flexibility and compatibility with diverse content formats.

This design process reflects the principles emphasized by Dick et al. (2014), who argue that instructional design must be closely aligned with the characteristics and needs of learners. By blending problem-based learning with user-friendly digital tools, the platform not only addresses curriculum goals but also creates an engaging, exploratory environment that encourages students to connect academic concepts with real-world issues. The incorporation of intuitive navigation and visually appealing elements further ensures that the platform remains accessible and stimulating for elementary-level users.

Development

The development phase marked the transformation of the design blueprint into a tangible and functional e-learning product. For this purpose, the Moodle platform was chosen due to its high degree of flexibility, open-source framework, and robust capacity to host diverse multimedia formats such as text, images, videos, animations, quizzes, and discussion forums (Gamage et al., 2022). These features made Moodle particularly suitable for accommodating the interactive and problem-based components envisioned in this project.

The product is then subjected to a rigorous evaluation by experts who determine its viability for

field use. The Moodle-assisted e-learning web page that has been created is https://sditsalmanalfarisi2yogyakarta.edukati.com. The initial display of the Moodle-assisted problem-based e-learning contains the home page. The home page displays the supporting web name (LMS Edukati), the login page, and a description of the Moodle-assisted problem-based e-learning.

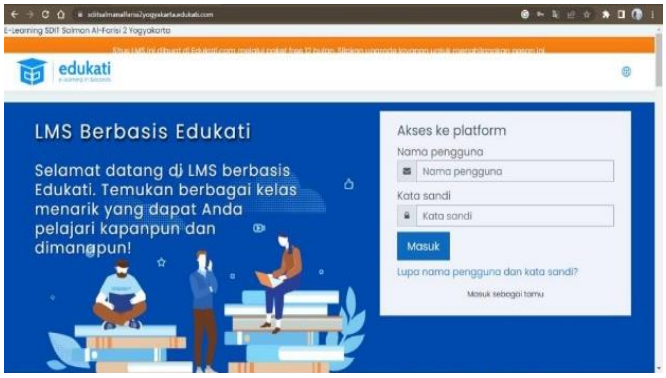

Figure 2. E-learning login page display

The login page contains three account types: administrator, teacher, and student. The subsequent step in this process is to create a page that will contain the main menu. The primary menu comprises the following options: "Site Home," "Dashboard," "Calendar," "Private Files," "Site Administration," and "Main Menu Available Courses." As this study concentrates on Social Studies for 5th-grade elementary school students, the researcher can directly select the class and subsequently the course. The researcher selected the page designated for Theme 8, entitled "Our Friendly Environment."

Once the prototype was constructed, it underwent a rigorous validation process conducted by two independent experts. The material validation was carried out by Dr. Anwar Senen, M.Pd., who assessed the content's relevance, the alignment of learning objectives, the quality of evaluation instruments, and the clarity of language used. The results of material validation can be seen in Table 4.

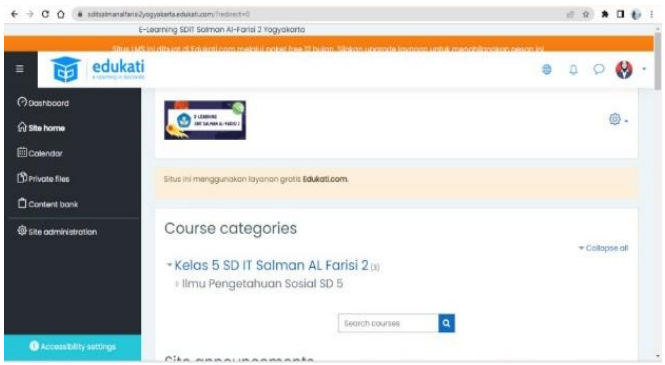

Figure 3. Initial menu display of e-learning

Figure 4. Menu display home site available courses e-learning

Figure 5. Main course menu display

Figure 6. Main course menu, attendance and teaching materials page, video

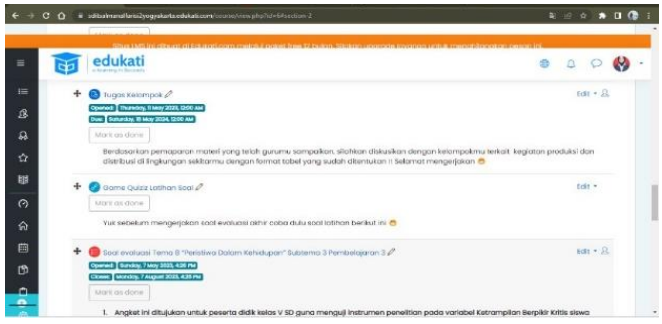

Figure 7. Main course menu assignment page, quiz games, and evaluation questions

The product received a near-perfect score of 74 out of 75, placing it in the "Very Appropriate" category (Grade A). His assessment underscored the coherence of the learning materials with national curriculum standards and their capacity to support inquiry-based learning.

Table 4. E-learning Assessment Results According to Subject Matter Experts

Aspect	Score	Predicate	Category
Materials (quality of materials and objectives)	25	A	Very Appropriate
Questions and Evaluation	30	A	Very Appropriate
Language and Implementation	19	A	Very Appropriate
Total	74	A	Very Appropriate

Simultaneously, the media validation was performed by Prof. Herman Dwi Surjono, Ph.D., an expert in instructional technology, who evaluated the product in terms of software engineering, visual communication, and learning design. The results of media validation can be seen in Table 5 as follows.

Table 5. E-Learning Assessment Results According to Media Experts

Aspect	Score	Predicate	Category
Software Engineering	12	A	Very Appropriate
Visual Communication	24	A	Very Appropriate
Learning Design	24	A	Very Appropriate
Total	60	A	Very Appropriate

Media assessment by an expert yielded a perfect score of 60 out of 60, again categorized as "Very Appropriate." The validator highlighted the platform's intuitive layout, aesthetic consistency, and responsiveness as strong points that enhanced user experience.

These expert validations offer strong evidence that the developed e-learning media not only meet educational and technical standards but also demonstrate exemplary quality in integrating pedagogical intent with digital innovation. As Adawiyah et al. (2024) emphasize, the strength of effective digital learning lies in its ability to blend curriculum alignment with engaging multimedia design—an aspect clearly reflected in the high scores and positive evaluations received during this stage.

Implementation

Following the expert validation process, the developed Moodle-assisted problem-based e-learning media was implemented in a real classroom setting to assess its practicality in an authentic learning environment. The implementation took place in Class V Al-Biruni of SDIT Salman Al-Farisi II, located in Sleman, Yogyakarta, and involved 55 students as research participants.

During the implementation, students accessed the e-learning platform using laptops provided by the school and participated in Social Studies learning activities under the theme *"Our Environment as Our Friend."* The activities were structured around contextual problem scenarios that encouraged students to collaborate, discuss, and construct knowledge actively. Teachers played a key facilitative role by guiding group discussions, clarifying instructions, and ensuring that all students remained engaged with the media in accordance with the intended learning flow.

This implementation phase not only provided students with an opportunity to experience inquiry-based learning through technology, but also enabled teachers to observe student behavior, participation, and responsiveness in a digital learning setting. The transition from traditional lecture-based instruction to a more interactive, student-centered model marked a significant pedagogical shift within the classroom.

To evaluate the media's practicality from the instructional perspective, a structured questionnaire was distributed to teachers. The instrument measured their perceptions of the media's usability, functionality, and pedagogical support across three domains: learning aspects, visual display, and programming-language integration. The results are summarized in Table 6.

Table 6. Practical Test Results According to Teachers

Aspect	Score	Predicate	Category
Learning Aspects	53	A	Very Practical
Display Aspects	36	A	Very Practical
Programming and Language Aspects	19	A	Very Practical
Total	108	A	Very Practical

Based on the results, the teachers gave consistently high ratings, highlighting the intuitive interface, effective integration of multimedia, and the media's alignment with learning objectives. Particularly, the learning aspects component received strong endorsement, indicating that the media succeeded in supporting meaningful and structured classroom interaction. These results resonate with the findings of Hoang et al. (2025), who emphasize that the practical value of digital instructional tools lies not only in their content delivery but in their ability to facilitate teacher-student and student-student interaction.

In addition, Student perceptions were measured using a separate questionnaire focusing on two key elements: clarity of learning objectives and student interest. All 55 students completed the questionnaire after using the media during the classroom sessions. The results are detailed in Table 7.

The results of the student responses to problem-based e-learning media assisted by Moodle scored 2160, with a percentage of 80%, and were classified as "very Practical." Students demonstrated a particularly high level of enthusiasm toward the interactive nature of the

e-learning media. Their positive responses suggest that the combination of visual, auditory, and collaborative elements contributed to making the Social Studies content more engaging and accessible. The dynamic presentation of materials appeared to support their understanding of abstract concepts, while also fostering a more enjoyable and meaningful learning experience. This finding reinforces the idea that interactive digital environments can play a significant role in enhancing both student motivation and cognitive engagement, as noted in prior studies (Li et al., 2024; Agustina et al., 2024).

Table 7. Practical Test Results According to Students

Aspect	Score	Category
Learning objectives	1026	Very Practical
Student Interest	1134	Very Practical
Total	2160	
Average score percentage	80%	Very Practical

Evaluation

The evaluation stage represents the culmination of the ADDIE development process and aims to assess the overall feasibility, practicality, and effectiveness of the Moodle-assisted problem-based e-learning media in fifth-grade Social Studies instruction. This stage was carried out through both formative evaluation (during the development process) and summative evaluation (after classroom implementation).

Formative evaluation was conducted throughout the early phases of development, especially during the analysis, design, and development stages. During the analysis phase, interviews and questionnaires helped identify student learning needs and preferences, which were used to shape the media's structure and interactive features. The design stage then translated these insights into a multimedia-rich interface and storyboard aligned with the Social Studies curriculum.

Furthermore, validation by a subject matter expert and a media expert provided critical input on the content quality, instructional alignment, interface design, and media usability. Based on expert suggestions, revisions were made to improve clarity, interactivity, and functionality before the product was deployed in the classroom. This iterative process ensured that the final product met high standards of pedagogical and technical quality.

Following development and revision, the media was implemented in a real classroom setting to assess its practicality. The product was used in Class V Al-Biruni at SDIT Salman Al-Farisi II, Sleman, Yogyakarta, with 55 students participating in the trial.

Teachers evaluated the media based on its instructional relevance, visual appeal, and ease of use. Likewise, students provided feedback on how well the platform supported learning objectives and sustained their interest. Across both groups, responses indicated that the media was highly practical, user-friendly, and engaging. The positive feedback reflected the platform's ability to enhance classroom participation and facilitate group-based problem solving.

Rather than merely functioning as a content delivery tool, the media was perceived as an active learning environment that helped make abstract Social Studies concepts more concrete and accessible. These findings align with previous research (Ambiyar et al., 2021; Pigai & Yulianto, 2024), which emphasizes that multimedia and problem-based elements can boost learner motivation and involvement, particularly when designed with young learners in mind.

To measure the effectiveness of the e-learning media, two approaches were used: a descriptive analysis of normalized gain (N-Gain) scores, and an inferential statistical test using Multivariate Analysis of Variance (MANOVA).

Table 8. N-Gain Results

Variable	Group	N-Gain Score	Category
Critical Thinking	Experimental	0.72	High
	Control	0.48	Moderate
Learning Motivation	Experimental	0.53	Moderate
	Control	0.27	Low

The N-Gain analysis revealed that the experimental group, which utilized the e-learning media, attained an average N-Gain score of 0.72 in critical thinking skills, which is categorized as high. In contrast, the control group obtained a score of 0.48, which falls into the moderate category. With respect to the issue of learning motivation, the experimental group attained an average N-Gain score of 0.53, which falls within the moderate category. In contrast, the control group achieved a score of 0.27, designated as low. The findings of this study indicate that the implementation of e-learning media has resulted in significant enhancements not only in students' critical thinking skills but also in their learning motivation when compared to conventional learning methods.

To further validate these differences, a MANOVA test was performed to assess the impact of the learning model on two dependent variables: critical thinking skills and learning motivation.

Table 9. MANOVA Test Result

Test Statistics	Value
Wilks' Lambda	0.118
F (2, 27)	7.715
Significance (p)	0.000

The analysis showed a statistically significant effect (Wilks' Lambda = 0.118, F = 7.715, p = 0.000) between the experimental and control groups. These findings indicate that the use of Moodle-assisted problem-based e-learning significantly enhanced both students' cognitive and affective learning domains.

The effectiveness of the media can be attributed to its integration of contextual problem scenarios, collaborative learning features, and interactive multimedia components, which collectively created a richer and more meaningful learning experience. As supported by Wijaya et al. (2023) and Handayani et al. (2024), such student-centered digital learning approaches are particularly powerful in cultivating 21st-century competencies, including critical thinking and motivation to learn.

Conclusion

This research was designed to develop a Moodle-assisted problem-based e-learning media aimed at enhancing critical thinking skills and learning motivation among fifth-grade students in Social Studies. Employing the ADDIE development model, the product was systematically designed, validated, and evaluated across five phases: analysis, design, development, implementation, and evaluation. The findings confirmed that the developed media is: Feasible — Expert validation indicated that the content, visual design, and technological components were well-aligned with pedagogical standards, earning "Very Appropriate" ratings in all categories. Practical — Teachers and students provided highly favorable responses regarding the usability, clarity, and engagement potential of the media. The practicality feedback demonstrated that the platform was user-friendly and suitable for integration into real classroom settings. Effective — The implementation of the media resulted in significantly higher learning gains compared to traditional instruction, as reflected by the N-Gain scores 0.72 for critical thinking (high category) and 0.53 for learning motivation (moderate category). Furthermore, the MANOVA test showed a statistically significant impact on students' critical thinking and motivation (Wilks' Lambda = 0.118, F = 7.715, $p < 0.001$). Collectively, these results highlight the strength of combining problem-based learning principles with interactive digital tools to create a more meaningful and student-centered learning experience. The media successfully engaged learners in contextual exploration, collaborative problem solving, and reflective thinking — key components in fostering 21st-century skills. This study not only contributes to the development of digital instructional resources for primary education but also provides a practical framework for improving Social Studies learning through technology-enhanced pedagogy. The integration of problem-based scenarios into a flexible e-learning platform has proven to be a promising strategy to overcome instructional monotony, increase motivation, and support the development of higher-order thinking in young learners.

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Author Contributions
C.I. was responsible for the conceptualization of the research study, the aggregation of data, and the coordination of the implementation of learning trials. E.S. conducted a needs analysis, designed and developed the learning media, and carried out validation with material and media experts. N.I.K. compiled instruments in the form of a questionnaire for critical thinking skills and student learning motivation, and processed data from the media effectiveness test results. All authors were actively involved in the writing process and have approved the final manuscript.

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No conflict interest.

References

Adawiyah, E. R., Winarno, A., & Onia, S. I. (2024). Effectiveness of Interactive Learning Media Development Based on Articulate Storyline 3 in Elementary School Education. *EDUCARE: Journal of Primary Education, 5*(2), 105–122. https://doi.org/10.35719/EDUCARE.V5I2.253

Agustina, I., Joshua, W., Julanos, J., & Niva, M. (2024). The Impact of Implementing Game-Based Learning on Student Motivation and Engagement. *Journal Emerging Technologies in Education,* 2(3), 241–253. https://doi.org/10.70177/jete.v2i3.1069

Ambiyar, Verawardina, Lubis, A. L., Ramadhani, D., & Asnur, L. (2021). Application of Adaptive Media and Enganging E-learning for Students in E-learning Courses. *Jurnal Pendidikan Indonesia, 10*(2), 288–296. https://doi.org/10.23887/jpi-undiksha.v10i2.24376

Ariadila, S. N., Silalahi, Y. F. N., Fadiyah, F. H., Jamaluddin, U., & Setiawan, S. (2023). Analisis

Pentingnya Keterampilan Berpikir Kritis Terhadap Pembelajaran Bagi Siswa. *Jurnal Ilmiah Wahana Pendidikan, 9*(20), 664–669. https://doi.org/10.5281/zenodo.8436970

Azwar, S. (2012). *Reliabilitas dan Validitas*. Pustaka Pelajar.

Basri, H., Jannah, U. R., Nuritasari, F., & Yahya, A. (2021). Identifikasi Kemampuan Berpikir Kritis Siswa pada Masalah dengan Informasi yang Kontradiksi. *JIPM (Jurnal Ilmiah Pendidikan Matematika), 10*(1), 63. https://doi.org/10.25273/jipm.v10i1.9290

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Department of Educational Psychology and Instructional Technology University of Georgia.

Dick, W., Carey, L., & Carey, J. O. (2014). *The Systematic Design of Instruction*. Pearson Education.

Doyan, A., Melita, A. S., & Makhrus, M. (2023). Increasing Critical Thinking Skills Through the Development of STEM-Based Physics Learning Media on Temperature and Heat. *Jurnal Penelitian Pendidikan IPA, 9*(6), 4096–4102. https://doi.org/10.29303/jppipa.v9i6.3724

Fajriati, A. S., Humaira, M. A., & Efendi, I. (2024). Hambatan Kemampuan Berpikir Kritis Siswa dalam Pembelajaran Bahasa Indonesia Menggunakan Aplikasi Quizizz. *Karimah Tauhid, 3*(4), 5036–5047. https://doi.org/10.30997/karimahtauhid.v3i4.13029

Gamage, S. H. P. W., Ayres, J. R., & Behrend, M. B. (2022). A systematic review on trends in using Moodle for teaching and learning. *International Journal of STEM Education, 9*(1). https://doi.org/10.1186/s40594-021-00323-x

Hake, R. R. (1999). *Analyzing change/gain scores*. USA: Dept of Physics Indiana University.

Handayani, R. H., Miaz, Y., Hidayati, A., & Bentri, A. (2024). Development of Interactive Multimedia Based on Adobe Flash CS6 to Improve Learning Outcomes. *Jurnal Penelitian Pendidikan IPA, 10*(SpecialIssue), 46–52. https://doi.org/10.29303/jppipa.v10ispecialissue.7838

Hilmi, I., & Kismiantini. (2024). Teacher Competencies, The Shortage of School Resources and Mathematics Achievement Based on PISA 2018 Indonesia. *Mathematics Education Journal, 18*(2), 245–258. https://doi.org/10.22342/jpm.v18i2.pp245-258

Hoang, N. T., & Le, B. P. (2025). The Impact of Interactive Teaching Methods on Student's Learning Outcomes in Blended Learning Environment at Higher Education Institutions. *Journal of Posthumanism, 5*(4), 1447–1458. https://doi.org/10.63332/joph.v5i4.1269 The

Hutagaliung, F., Pasaribu, S. B., Hutabarat, P. S., & Turnip, H. (2025). Konsep Dasar Motivasi. *Jurnal Pendidikan Agama Dan Teologi, 3*(1), 42–53. https://doi.org/10.59581/jpat-widyakarya.v2i4.4488

Ibrahim, I., Marwan, M., & Firmansyah, J. (2023). Enhancing Critical Thinking Skills in Biology Subject with the Legendary Model of Cooperative Learning. *Jurnal Penelitian Pendidikan IPA, 9*(5), 2368–2373. https://doi.org/10.29303/jppipa.v9i5.2323

Indriani, R. P., Sigit, D. V., & Miarsyah, M. (2023). Meta-analisis: Pengaruh Media E-learning Terhadap Keterampilan Berpikir Kritis dan Kreatif. *Cetta: Jurnal Ilmu Pendidikan, 6*(1), 58–71. https://doi.org/10.37329/cetta.v6i1.1862

Jamaluddin, A. Bin, Pratiwi, A. C., Safira, I., & Nurdiyanti, N. (2023). Character, Resilience, and Critical Thinking of Biology Students after the Covid-19 Pandemic: How They are Correlated. *Jurnal Penelitian Pendidikan IPA,* 9(4), 1585–1592. https://doi.org/10.29303/jppipa.v9i4.1574

Kanchana, R., Techanan, P., Phusavat, K., Kusumastuti, A., & Lesjak, D. (2025). Sustaining Learning Interest Among Disengaged Students: Impacts of Constructive Feedback. *Sustainability (Switzerland), 17*(9). https://doi.org/10.3390/su17093830

Karoror, I., & Jalmo, T. (2022). Profile of Critical Thinking Ability in Ecosystem Materials using the Rasch Model. *Jurnal Penelitian Pendidikan IPA, 8*(3), 1599–1604. https://doi.org/10.29303/jppipa.v8i3.1394

Kurniawan, D. A., Darmaji, D., Astalini, A., & Muslimatul Husna, S. (2023). Study of Critical Thinking Skills, Science Process Skills and Digital Literacy: Reviewed Based on the Gender. *Jurnal Penelitian Pendidikan IPA, 9*(4), 1741–1752. https://doi.org/10.29303/jppipa.v9i4.1644

Li, Y., Chen, D., & Deng, X. (2024). The impact of digital educational games on student's motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment. *PLoS ONE, 19*(1), 1–21. https://doi.org/10.1371/journal.pone.0294350

Liu, L., Jansrisukot, J., & Wanpen, S. (2024). Instructional Design Using The Constructivism Theory And Problem-Based Learning Approach To Enhance The Chinese Reading And Writing Abilities Of Primary School Students In China. *Journal of Liberal Art of Rajamangala University of Technology Suvarnabhumi, 6*(2), 562–576. Retrieved from https://so03.tci-thaijo.org/index.php/art/article/view/277744

Nawawi, S., Johari, A., Siburian, J., & Anggereini, E. (2024). The Transformative Power of Challenge-Based Learning in Cultivating 21 st -Century Skills. *Indonesian Journal of Educational Research and Review, 7*, 679–693. https://doi.org/10.23887/ijerr.v7i3.84243

Nikodemus, Nasiruddin, F. A.-Z., & Jainuddin. (2022). Pengaruh Penggunaan E-Learning Terhadap Motivasi Belajar Matematika di SMP Negeri Kota Makassar. *Jurnal Ilmiah Pendidikan Dan Pengembangan Pembelajaran,* 2(1), 62–69. https://doi.org/10.26858/edustudent.v2i1.38535

Novandi, M., Serani, G., Djudin, T., & Suratman, D. (2025). Keterampilan Berpikir Kritis dan Pengajarannya di Sekolah Dasar. *Jurnal Pendidikan Dasar Perkhasa: Jurnal Penelitian Pendidikan Dasar, 11*(1). https://doi.org/10.31932/jpdp.v11i1.4509

OECD. (2023). *PISA 2022 Results (Volume II): Learning During – and From – Disruption*. OECD Publishing. https://doi.org/10.1787/a97db61c-en

OECD. (2024). *PISA 2022 Results (Volume III): Creative Minds, Creative Schools*. OECD Publishing. https://doi.org/10.1787/765ee8c2-en

Pigai, F. Y. P., & Yulianto, S. (2024). Development of Flipbook Learning Media to Improve Learning Outcomes IPAS. *Jurnal Penelitian Pendidikan IPA, 10*(8), 5775–5781. https://doi.org/10.29303/jppipa.v10i8.7937

Renninger, E. P. (2024). Exploring the Impact of Constructivist Learning on Students' Problem-Solving Abilities in Education. *Jurnal Ilmu Pendidikan Dan Humaniora, 13*(02), 81–91. Retrieved from https://journals.ristek.or.id/index.php/jiph/index

Sardiman, A. M. (2018). *Interaksi dan Motivasi Belajar Mengajar* (4th ed.). Rajagrafindo Persada.

Sari, R. K., Chan, F., Hayati, D. K., Syaferi, A., & Sa'diah, H. (2021). Analisis Faktor Rendahnya Motivasi Belajar Siswa dalam Proses Pembelajaran IPA di SD Negeri 80/I Rengas Condong Kecamatan Muara Bulian. *Al Jahiz: Journal of Biology Education Research, 1*(2), 63–79. https://doi.org/10.32332/al-jahiz.v1i2.3146

Setiyaningsih, S., & Subrata, H. (2023). Penerapan Problem Based Learning Terpadu Paradigma Konstruktivisme Vygotsky Pada Kurikulum Merdeka Belajar. *Jurnal Ilmiah Mandala Education, 9*(2), 1322–1332. https://doi.org/10.58258/jime.v9i2.5051

Shen, S., Tang, T., Pu, L., Mao, Y., Wang, Z., & Wang, S. (2024). Teacher Emotional Support Facilitates Academic Engagement Through Positive Academic Emotions and Mastery-Approach Goals Among College Students. *SAGE Open, 14*(2), 1–11. https://doi.org/10.1177/21582440241245369

Sugiyono. (2020). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (2nd ed.). Alfabeta.

Sulhan, A. S., Wilujeng, I., & Prasetyo, Z. K. (2023). Improving Critical Thinking Skills Students Through Problem Based Learning E-Module. *Jurnal Penelitian Pendidikan IPA, 9*(11), 9481–9486. https://doi.org/10.29303/jppipa.v9i11.5231

Susanto, A., Qurrotaini, L., & Mulyandini, N. (2020). Peningkatan Kemampuan Berpikir Kritis Siswa Pada Mata Pelajaran Ips Melalui Model Controversial Issue. *Jurnal Holistika, 4*(2), 71. https://doi.org/10.24853/holistika.4.2.71-76

Triwulandari, S., & U.S, S. (2022). Analisis Inteligensi Dan Berpikir Kritis. *Utile: Jurnal Kependidikan, 8*(1), 50–61. https://doi.org/10.37150/jut.v8i1.1618

Wahyudiati, D. (2022). The Critical Thinking Skills and Scientific Attitudes of Pre-Service Chemistry Teachers Through the Implementation of Problem-Based Learning Model. *Jurnal Penelitian Pendidikan IPA, 8*(1), 216–221. https://doi.org/10.29303/jppipa.v8i1.1278

Wijaya, M. A. W., Yanto, A. D., & Kohar, A. W. (2023). Critical Thinking Ability of Students with Rational Personality in Solving Higher Order Thinking Skills (HOTS) Problems. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPIPM), 7*(1), 51–66. https://doi.org/10.26740/jrpipm.v7n1.p51-66

Zulhamdi, Z., Rahmatan, H., Artika, W., Pada, A. U. T., & Huda, I. (2022). The Effect of Applying Blended Learning Strategies Flipped Classroom Model on Students' Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA, 8*(1), 86–93. https://doi.org/10.29303/jppipa.v8i1.1186