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Development of Canva-Based Interactive Learning Media Integrated with Problem-Based Learning to Enhance Fifth-Grade Students' Critical Thinking Skills in IPAS (Food Chain Topics)

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Abstract: The development of critical thinking skills has become an essential competence in 21st-century education, requiring learning processes that are meaningful and problem-oriented. However, science learning (IPAS) in elementary schools still tends to emphasize conceptual memorization, resulting in students' critical thinking skills, particularly in ecosystem topics such as food chains, being insufficiently developed. This study aimed to develop and examine the effectiveness of Canva-based interactive media integrated with the Problem-Based Learning (PBL) model in improving fifth-grade students' critical thinking skills. The study employed a Research and Development (R&D) approach using the ADDIE model, followed by an effectiveness test using a Pretest–Posttest Control Group design. The research participants consisted of 44 students, including 25 in the experimental group and 19 in the control group. Data were collected using a validated critical thinking test that assessed the indicators of interpretation, analysis, evaluation, and inference. Data analysis was conducted using a t-test and effect size calculation. The results indicate that the implementation of Canva-based interactive media through the PBL model had a significant positive effect on students' critical thinking skills. The effect size value of 1.670 indicates a very high level of impact. These findings suggest that integrating interactive digital media with problem-based learning effectively enhances students' active engagement and analytical abilities in IPAS learning.

Keywords: Canva; Critical thinking; Elementary science education; Interactive media; Problem-Based Learning

Introduction

The transformation of education in the twenty-first century emphasizes learning environments that promote active student engagement, inquiry, and the integration of digital technology. Educational practices are gradually shifting from teacher-centered instruction toward learner-centered approaches that enable students to construct knowledge through interaction, exploration, and collaborative problem solving. In this context, digital technology functions not only as a supporting tool but also as a medium that facilitates meaningful learning experiences. The use of interactive digital media allows students to explore concepts visually and interactively, thereby improving comprehension and engagement during the learning process (Safira et al., 2025). Within elementary science education, particularly in the subject of Ilmu Pengetahuan Alam dan Sosial (IPAS), digital learning media play a significant role in helping students understand abstract ecological concepts such as ecosystems and food chains through visual representations that make scientific phenomena more concrete and accessible (Prasetyo et al., 2024).

In addition to the integration of technology, the development of higher-order thinking skills, especially critical thinking, has become a fundamental objective of contemporary education. Critical thinking refers to a set of cognitive abilities that enable learners to interpret information, analyze relationships between variables,

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evaluate evidence, and formulate logical conclusions based on rational consideration (Seventika et al., 2018). These competencies are essential for enabling students to understand scientific concepts beyond surface-level memorization and to develop the ability to reason scientifically when confronted with real-world problems. Learning environments that encourage inquiry, analysis, and reflection are therefore necessary to cultivate these skills. One instructional approach that has been widely recognized for supporting the development of critical thinking is Problem-Based Learning (PBL). Through authentic problem situations, PBL encourages students to engage in investigative activities, collaborative discussion, and evidence-based reasoning processes that strengthen analytical and problem-solving abilities (Hotimah, 2020; Kurniawan et al., 2023).

Despite the growing emphasis on student-centered learning and technological integration, classroom practices in many elementary schools remain predominantly teacher centered. Learning activities are often limited to the delivery of information and the memorization of factual knowledge, resulting in limited student participation in analytical discussions or scientific reasoning processes. In IPAS learning, this condition is reflected in the tendency for students to memorize sequences within food chains without fully understanding the causal relationships and ecological interactions among organisms. Consequently, students' critical thinking abilities, particularly those related to analysis and inference, are not optimally developed. Furthermore, although digital media have begun to be introduced into classroom instruction, their implementation frequently remains limited to static presentations that do not actively engage students in inquiry-based or problem-solving learning activities.

Preliminary observations conducted at SDN Suco 01 revealed similar conditions. Many fifth-grade students experienced difficulties in explaining the interrelationships among organisms in food chains and were unable to analyze the ecological consequences that occur when one component of the food chain disappears. Among the 25 students observed, most tended to rely on memorized examples rather than demonstrating a conceptual understanding of energy flow within ecosystems. Interviews with teachers also indicated that digital platforms such as Canva had been utilized in classroom instruction; however, their use was mainly limited to simple visual presentations and had not yet been integrated with pedagogical approaches that encourage analytical thinking and problem-solving processes. These findings indicate a gap between the potential of digital technology in education and its actual pedagogical implementation in the classroom.

Canva has emerged as a promising digital platform for developing interactive learning media due to its diverse features, including animation tools, embedded videos, hyperlinks, and digital quiz elements that are relatively easy for teachers to design and implement (Fauziah et al., 2022). Previous studies have demonstrated that Canva-based learning media can improve student engagement and facilitate conceptual understanding through interactive visual presentations (Hafizah & Samosir, 2023; Himah et al., 2024). However, most existing studies primarily emphasize the visual and presentation aspects of Canva-based media, while limited research has explored its integration with pedagogical models that explicitly aim to develop higher-order thinking skills. Integrating Canva-based interactive media with the Problem-Based Learning (PBL) model offers a novel approach that combines technological affordances with inquiry-oriented pedagogy. Through this integration, digital media can function not only as a visualization tool but also as a platform that supports students in analyzing problems, formulating hypotheses, evaluating information, and constructing scientifically grounded solutions (Hastawan et al., 2023).

Based on this research gap, the present study aims to develop Canva-based interactive learning media integrated with the Problem Based Learning model to enhance fifth-grade students' critical thinking skills in IPAS learning on the topic of food chains. This study is expected to contribute both theoretically and practically by providing an innovative learning design that integrates digital technology with problem-oriented pedagogy in elementary science education. Furthermore, the findings of this research are expected to offer practical guidance for teachers in utilizing accessible digital platforms to support the development of critical thinking skills that are essential for twenty-first century learning. Accordingly, this study addresses the following research questions: (1) How feasible is Canva-based interactive media integrated with the Problem Based Learning model in improving fifth-grade students' critical thinking skills in IPAS learning on food chain topics at SDN Suco 01? (2) Does the implementation of Canva-based interactive media through the Problem Based Learning model significantly affect fifth-grade students' critical thinking skills in IPAS learning on food chain topics at SDN Suco 01?

Method

Time and Location of the Research

This research was conducted at SDN Suco 01, Jember Regency, Indonesia, during the second semester of the 2025/2026 academic year. The study involved fifth-grade students and was implemented through two stages: a limited trial and a field trial.

The limited trial involved four fifth-grade students and aimed to examine the readability of the instruments, the clarity of instructions, and the preliminary validity and reliability of the research instruments. Meanwhile, the field trial involved 44 fifth-grade students divided into two classes. Class Va, consisting of 25 students, served as the experimental group, while Class Vb, consisting of 19 students, served as the control group. The research participants were selected using purposive sampling by considering the similarity of academic characteristics and the curriculum implemented in both classes.

Research Methods

This study employed a Research and Development (R&D) approach aimed at producing Canva-based interactive learning media integrated with the Problem-Based Learning (PBL) model to enhance fifth-grade students' critical thinking skills in IPAS learning on food chain topics. The development process adopted the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation (Adeoye et al., 2024; Widyastuti & Susiana, 2019). This model was selected because it provides a systematic framework for designing, testing, and refining technology-based instructional products to ensure their feasibility and effectiveness in classroom implementation.

To examine the effectiveness of the developed product, this study used a quasi-experimental design with a pretest–posttest non-equivalent control group design. This design was chosen because the school context did not allow full random assignment of participants while still enabling a systematic comparison between the experimental and control groups (Kim & Steiner, 2016).

The experimental group received instruction using Canva-based interactive media integrated with the PBL model, whereas the control group followed conventional instruction commonly implemented by the teacher. Both groups administered a pretest prior to the intervention to measure students' baseline critical thinking skills and a posttest after the intervention to examine changes in learning outcomes.

The research instrument consisted of an essay-based critical thinking test developed based on four indicators: interpretation, analysis, evaluation, and inference (Seventika et al., 2018). The pretest was administered to identify students' initial critical thinking abilities, while the posttest was conducted after the intervention to measure improvements in critical thinking skills.

To enhance internal validity, baseline equivalence between the experimental and control groups was examined through descriptive analysis of pretest scores. Additionally, instructional implementation in both groups was conducted with the same teacher, learning materials, and time allocation, enabling differences in outcomes to be more clearly attributed to the use of Canva-based interactive media integrated with the PBL model.

Development Stages

The development of Canva-based interactive learning media integrated with the Problem-Based Learning (PBL) model followed the ADDIE framework, which consists of five stages: analysis, design, development, implementation, and evaluation (Adeoye et al., 2024).

The analysis stage aimed to identify the potentials and challenges of IPAS instruction in fifth-grade classrooms. Data were collected through classroom observations, teacher interviews, and a review of students' learning outcome documents. The findings indicated that food chain instruction remained focused primarily on memorization and did not sufficiently promote students' ability to analyze cause and effect relationships within ecosystems. In addition, the use of digital media was generally limited to static presentations and had not been integrated with problem-based instructional approaches. A needs analysis was also conducted through discussions with teachers to identify students' learning characteristics, including dominant visual–kinesthetic learning styles and the need for interactive media capable of stimulating critical thinking skills.

The design stage focused on developing the structure of Canva-based interactive media integrated with the PBL syntax. Activities included selecting learning materials appropriate for students' characteristics, designing media storyboards, determining problem-based learning strategies, and developing critical thinking assessment instruments. The media were designed to include contextual problem orientation, exploration of food chain concepts, analysis of ecosystem impacts, and Higher Order Thinking Skills (HOTS)-based quizzes. The critical thinking indicators referred to interpretation, analysis, evaluation, and inference (Seventika et al., 2018).

The development stage involved producing interactive learning media using the Canva platform. The media incorporated concise textual explanations, visual illustrations, videos, animations, navigation buttons, and interactive quizzes to support student engagement. Learning materials were compiled from credible scientific sources to ensure conceptual accuracy. At this stage, the developed media were validated by media experts, language experts, subject-matter experts, and critical thinking assessment experts using Likert-scale validation instruments. The validation results were used as the basis for revising and refining the product to ensure content validity, visual quality, and instructional feasibility prior to classroom implementation.

The implementation stage was conducted to examine the attractiveness, feasibility, and effectiveness of the developed media in instructional practice. The media implemented experimental class through two instructional meetings using the PBL syntax, while the control class received conventional instruction. The research participants consisted of 44 fifth-grade students, including 25 students in the experimental group and 19 students in the control group. Each instructional meeting lasted 105 minutes (3×35 minutes), in accordance with the allocated instructional time for food chain topics in the curriculum. During the learning process, the teacher acted as a facilitator who guided students through problem analysis and discussion activities. Following the implementation, students completed a posttest measuring critical thinking skills. In addition, feedback from teachers and students was collected to evaluate the practicality and usability of the developed media in authentic classroom settings.

The final stage involved a comprehensive evaluation of both the development process and learning outcomes. Evaluation consisted of formative evaluation based on expert validation results and limited trial findings, as well as summative evaluation through analysis of differences in posttest critical thinking scores between the experimental and control groups. This stage aimed to finalize the product to ensure that the developed media were valid, practical, and effective for classroom use.

Data Analysis

Data analysis in this study was conducted in several stages in accordance with the research objectives and the quasi-experimental pretest–posttest non-equivalent control group design. The analyzed data consisted of students' critical thinking scores obtained from the pretest and posttest results in both the experimental and control groups.

Descriptive Analysis

Descriptive analysis was used to describe students' critical thinking skill profiles before and after the intervention. Pretest data were analyzed to examine baseline equivalence between the experimental and control groups, while posttest data were analyzed to describe students' critical thinking performance after the implementation of the learning media. The descriptive statistics included the mean, standard deviation, minimum score, and maximum score. This analysis served as an initial step to identify data tendencies and provided a basis for interpreting the results of inferential statistical analysis (Sugiyono, 2019).

Product Validation Instruments

Expert assessment sheets were employed as product validation instruments to examine the feasibility of the Canva-based interactive media before it was implemented in the field. Validation was conducted by media experts, subject-matter experts, language experts, and critical thinking assessment experts to ensure the quality of the product from multiple perspectives.

Media expert validation focused on visual appearance, design consistency, text readability, clarity of illustrations, slide navigation, and the level of interactivity. Subject-matter expert validation examined the alignment of the content with fifth-grade IPAS learning objectives, the conceptual accuracy of food chain material, content depth, and integration with the Problem-Based Learning syntax. Language expert validation emphasized clarity of wording, appropriateness of language for elementary school students, and the readability of instructions and narratives. Meanwhile, validation by critical thinking instrument experts assessed the alignment of test items with critical thinking indicators, clarity of stimuli, and appropriateness of cognitive demands.

The use of expert validation is consistent with development research principles that emphasize expert judgment to ensure content validity prior to broader implementation (Adeoye et al., 2024; Almanasreh et al., 2019; Mertler, 2024). Validation results were used as the basis for revising and refining both the media and research instruments before the implementation stage.

Critical Thinking Skills Instrument

The critical thinking skills instrument took the form of an essay test consisting of 15 items. This development adopted a critical thinking framework comprising four essential indicators: interpretation, analysis, evaluation, and inference, as suggested by Seventika et al. (2018). These indicators were selected due to their relevance to IPAS learning objectives, which require students to understand cause-and-effect relationships and interactions among ecosystem components.

The assessment items were formulated to measure higher-order cognitive levels (C4–C6) as defined in the revised Bloom's Taxonomy, encouraging students to move beyond recall toward analyzing problems, evaluating changes within food chains, and drawing logical conclusions based on available information. The test contexts were presented through real-life scenarios familiar to students, such as changes in organism populations and their impacts on ecosystem balance.

Assessment of critical thinking skills was conducted using an analytic rubric with graduated scoring scales developed for each critical thinking indicator. The use of an analytic rubric aimed to enhance scoring consistency, reduce assessor subjectivity, and provide a detailed description of students' critical thinking performance (Alrawili et al., 2020; Retnawati et al., 2018). To identify improvements in students' critical thinking skills, the instrument was administered prior to and after the implementation of the Canva based interactive media integrated with the PBL model.

Assumption Testing

Before conducting inferential statistical analysis, posttest data were tested to ensure that the assumptions of parametric statistical tests were met. The assumption tests included variance homogeneity and normality tests.

Variance homogeneity was tested using Levene's test to determine whether the variances of the experimental and control groups were homogeneous (Sugiyono, 2019). The data were considered homogeneous when the significance value (p) exceeded 0.05 (Field, 2024).

Normality was tested using the Shapiro–Wilk test because it has greater statistical power than the Kolmogorov–Smirnov test, particularly for small to medium sample sizes. This approach is consistent with Field (2024), who states that the Shapiro–Wilk test is more sensitive in detecting deviations from normal distribution. The decision criteria followed Ghozali (2021), whereby a significance value (p) greater than 0.05 indicates normally distributed data.

Media Effectiveness Testing

The effectiveness of the Canva-based interactive media integrated with the PBL model was examined using an independent samples t-test applied to posttest critical thinking scores. This test was used to determine whether a statistically significant difference existed between the learning outcomes of the experimental and control groups after the intervention. The independent samples t-test is appropriate for comparing two independent groups that meet the assumptions of normality and homogeneity of variance (Creswell & Creswell, 2017).

In addition to significance testing, effect size was calculated using Cohen's d to measure the practical magnitude of the intervention's impact. Effect size analysis is recommended in educational research because it provides meaningful information regarding the strength of an intervention beyond reliance on p-values alone (Gignac & Szodorai, 2016). Cohen's d values were interpreted according to conventional criteria: small (0.2), medium (0.5), and large (0.8).

All quantitative data analyses in this study were conducted using SPSS software. The results of these analyses served as the basis for drawing conclusions regarding the effectiveness of Canva-based interactive media integrated with the Problem-Based Learning model in improving fifth-grade students' critical thinking skills in IPAS learning.

Result and Discussion

Initial Product Feasibility

In this phase, the feasibility of the developed product was examined through a validation process that engaged several experts. Media validation was carried out by a lecturer from Universitas Muhammadiyah Jember on December 19, 2025. Language validation was conducted by a lecturer in Elementary School Teacher Education specializing in Indonesian language on November 3, 2025. In addition, content and critical thinking instrument validation were performed by a lecturer in Elementary School Teacher Education specializing in science education on November 7, 2025. The purpose of the validation process was to examine the feasibility of the developed product, with expert feedback and suggestions serving as a foundation for product revision and refinement.

Expert validation is a crucial stage in development research, as it ensures that the product meets quality standards before field implementation. According to (Arikunto, 2021), a development product is considered feasible when it achieves a validation percentage above 80%, which falls within the "very good" or "highly feasible" category. Furthermore, Adeoye et al. (2024) emphasize that expert validation conducted during the formative evaluation stage of the ADDIE model functions to identify potential weaknesses early, allowing for targeted revisions.

Table 1. Expert Validation Results of the Interactive Learning Media

Validation Aspect	Validation Index	Category
Media Expert	94%	Highly Feasible
Language Expert	95%	Highly Feasible
Content Expert	86%	Highly Feasible
Critical Thinking Instrument Expert	91%	Highly Feasible

Based on Table 1, the validation results indicate that the developed interactive learning media achieved a score of 94%, demonstrating that the visual design, navigation, and alignment with learning objectives were fulfilled at a very high level. This finding is consistent with Fauziah et al. (2022), who emphasize that Canva-based interactive learning media are considered effective when they present engaging visual displays, clear navigation, and strong support for achieving instructional objectives. Nevertheless, suggestions regarding the enhancement of color contrast align with the views of Prasetyo et al. (2024), who argue that visual characteristics significantly influence elementary students' focus and comprehension, particularly in abstract science learning.

Language expert validation yielded a score of 95%, categorized as highly feasible. Recommendations to simplify sentence structures and clarify cause-and-effect relationships are in line with Safira et al. (2025), who highlight that readability and clarity of sentence construction in interactive learning media play a crucial role in supporting students' logical understanding of instructional content. The use of causal conjunctions further strengthens students' conceptual understanding by reinforcing logical connections among ideas.

Based on the content experts' evaluation, the developed product achieved a feasibility score of 86%, placing it in the highly feasible category. Suggestions to incorporate explicit learning outcomes, refine learning objectives using the ABCD format, and enrich visual materials and learning resources are consistent with the instructional design principles proposed by Adeoye et al. (2024) within the ADDIE model, which stress alignment among objectives, content, and assessment to achieve optimal instructional effectiveness. Similarly, Gita (2024) asserts that clearly articulated learning objectives and comprehensive visual materials significantly enhance the meaningfulness of digital learning, particularly at the elementary school level.

Validation of the critical thinking instrument obtained a score of 91%, categorized as highly feasible. Recommendations to simplify item wording and align indicators with students' cognitive levels correspond with Seventika et al. (2018)'s view that critical thinking assessment must be adapted to learners' characteristics to ensure accurate measurement of interpretation, analysis, evaluation, and inference skills.

Figure 1. Media design before revision

Figure 2. Revised version with enhanced color contrast

Figure 3. Media design before revision

Figure 4. Revised version with simplified sentence structure and reduced redundancy

Figure 5. Media design before revision

Figure 6. Revised version with added learning outcomes

Figure 10. Revised version with additional organism labels and energy flow arrows

Figure 7. Media design before revision

Figure 11. Media design before revision

Figure 8. Revised version with improved measurable learning objectives

Figure 12. Revised version with complete video source information

Figure 9. Media design before revision

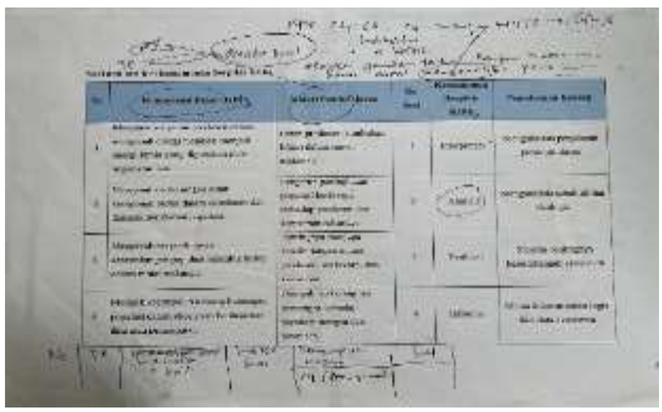

Figure 13. Media design before revision

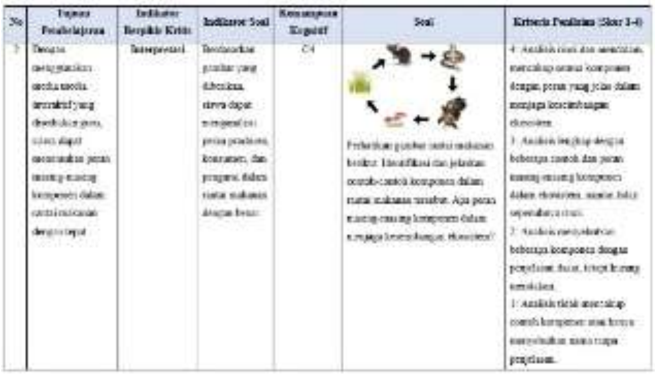

Figure 14. Revised version with simplified language while maintaining HOTS level

Overall, the synthesis of expert validation results indicates that the Canva-based interactive media integrated with the PBL model, along with the developed critical thinking instrument, meet the criteria of content validity, linguistic appropriateness, visual quality, and instructional feasibility. These findings support Hafizah et al. (2023)'s conclusion that interactive learning media with high expert validity are ready for classroom implementation with only minor revisions.

Results of the Limited Trial

The limited trial was conducted with four fifth-grade students on January 5, 2026. This stage aimed to examine instrument readability, clarity of item wording, and the internal consistency of the critical thinking skills instrument prior to its use in the field trial. The limited trial constituted an integral part of the development research and served as an initial testing phase to ensure that the instrument was both technically and conceptually appropriate. Data obtained from the limited trial were used solely as the basis for instrument refinement and were not included in the main statistical analysis during the effectiveness testing stage.

Table 2. Results of Instrument Reliability Testing

Cronbach's Alpha	N of Items
0.964	15

The reliability of the instrument was assessed by applying the Cronbach's Alpha coefficient to examine the internal consistency across the test items. As shown in Table 2, the critical thinking skills instrument, consisting of 15 essay items, obtained a Cronbach's Alpha value of 0.946 based on a sample of four students. The obtained value is far above the minimum acceptable level of 0.70, demonstrating that the instrument exhibits a very high level of internal reliability.

Descriptive Analysis Results

Students' critical thinking skills in the control and experimental groups before and after the intervention were examined using descriptive analysis to provide an overall profile. The analyzed data consisted of pretest and posttest scores of students' critical thinking skills obtained from both groups, serving as a basis for examining baseline conditions as well as changes in performance following the learning process.

Table 3. Descriptive Statistics of Pretest Scores on Critical Thinking Skills

Variable	Group	N	Mean	SD	Min	Max
Critical	Control	19	35.58	7.36	25	47
Thinking Skills	Experimental	25	46.68	9.86	25	60

Table 3 illustrates that the pretest descriptive analysis revealed relatively similar levels of critical thinking skills between the control and experimental groups, with the experimental group showing a slightly higher average. The control group had a mean pretest score of 35.58 with a standard deviation of 7.36, while the experimental group reported a mean score of 46.68 and a standard deviation of 9.86. The pretest score range in the control group was between 25 and 47, while the experimental group scores ranged from 25 to 60. Descriptively, these findings suggest that both groups exhibited initial ability variations that remained sufficiently comparable prior to the implementation of the intervention.

Results of Prerequisite Assumption Analysis

Results of the Homogeneity Test

The homogeneity of variance test was applied to assess the equivalence of variances in critical thinking scores between the experimental and control groups. This test is a key prerequisite for the use of parametric statistical analyses, particularly the independent samples t-test, which assumes homogeneity of variance between the groups being compared.

Table 4. Results of the Homogeneity of Variance Test for Critical Thinking Skills

Variable	Levene Statistic	df1	df2	Sig
Critical Thinking Skills	0.841	1	42	0.364

Levene's Test based on the mean was employed in this study to examine the homogeneity of variance. Based on the results presented in Table 4, the obtained significance value (Sig.) of 0.364 exceeded 0.05, indicating that the variances of the experimental and control groups did not differ significantly from a statistical perspective.

These findings suggest that the critical thinking score data from both groups exhibit relatively similar variance characteristics. These results confirm that the assumption of homogeneity of variance was satisfied, thus supporting the use of parametric statistical tests for subsequent analyses.

Results of the Normality Test

The normality test was conducted to determine whether the pretest scores of students' critical thinking skills in the control and experimental groups were normally distributed. Considering that the sample size in each group was below 50 students, the Shapiro–Wilk test was used to examine data normality. The Shapiro–Wilk test is recommended for small sample sizes due to its higher sensitivity compared to other normality tests.

Table 5. Results of the Normality Test for Pretest Critical Thinking Scores

Group	Statis tic	Df	Sig.	Interpretation
Control Group	0.926	19	0.146	Normal
Experimental Group	0.934	25	0.110	Normal

As presented in Table 5, the Shapiro–Wilk test indicated significance values of 0.146 for the control group and 0.110 for the experimental group in the pretest critical thinking scores. Both values exceed the significance threshold of 0.05.

These results indicate that, from a statistical perspective, the initial distribution of students' critical thinking scores in both groups satisfied the assumption of normality. Accordingly, subsequent statistical analyses were appropriately conducted using parametric methods, particularly the independent samples t-test.

Results of the Effectiveness Test

The effectiveness of the Canva-based interactive learning media integrated with the Problem Based Learning (PBL) model was evaluated by comparing students' critical thinking skills with those achieved through conventional instruction. Data analysis in this study focused on posttest results, as these scores represent students' levels of achievement after the intervention and have met the required analytical assumptions, including normal data distribution and homogeneity of variance.

Table 6 summarizes the findings of the Independent Samples T-Test conducted to evaluate students' critical thinking skills.

Table 6. Group Statistics for Critical Thinking Skills

	Group	N	Mean	Std. Deviation	Std. Error Mean
value	posttest Control	19	74.32	7.616	1.747
	posttest_ Experimental	25	87.84	8.444	1.689

Table 7. Independent T-Test for Critical Thinking Skills

Variance Assumption	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	-5.486	42	0,000	13.524

Based on the data shown in Table 6, the experimental group recorded a higher average posttest score in critical thinking skills (M = 87.84, SD = 8.44, n = 25) compared to the control group (M = 74.32, SD = 7.62, n = 19). This difference suggests that students who learned through Canva-based interactive media integrated with PBL demonstrated higher levels of critical thinking than those who received conventional instruction. The statistical significance of the difference was examined by performing an independent samples t-test on the posttest scores.

Table 7 indicates that the t-test results showed a t-value of 5.486 with 42 degrees of freedom and a significance value (Sig. 2-tailed) of 0.000. Since the significance value was less than 0.05, a statistically significant difference was found between the critical thinking skills of students in the experimental and control groups after the intervention. These results indicate that learning using Canva-based interactive media through the PBL model had a significant positive effect on students' critical thinking skills. To strengthen the interpretation of statistical significance, effect size was computed within the effectiveness analysis to assess the magnitude and practical importance of the differences observed.

Table 8. Effect size (Cohen's d)

Measure	Standardizer	Point Estimate	95% Confidence Interval (Lower–Upper)
Cohen's d	8.100	-1.670	-2.357 – -0.968
Hedges' correction	8.248	-1.640	-2.315 – -0.950

The results presented in Table 8 reveal a Cohen's d value of 1.670, which corresponds to a very large effect size. This finding demonstrates that, in addition to being statistically significant, the difference in critical thinking achievement between the experimental and control groups represents a strong practical impact in the learning context.

In summary, the combined results of the independent samples t-test and effect size analysis confirm that the use of Canva-based interactive media integrated with the Problem-Based Learning model was more effective than conventional teaching in fostering fifth-grade students' critical thinking skills in IPAS learning, particularly on food chain topics.

Discussion

This section discusses the research findings by examining their alignment with relevant theoretical perspectives, earlier empirical studies, and the context of instructional practices in elementary education. The primary focus of this discussion is the improvement of students' critical thinking skills as a result of implementing Canva-based interactive media integrated with the PBL model, compared to conventional instruction.

The results indicate that students who learned using Canva-based interactive media through the PBL model achieved significantly higher critical thinking outcomes than those in the control group. This difference was not only reflected in higher posttest mean scores but was also reinforced by a very large effect size, suggesting that the intervention had a strong and practically meaningful impact. In educational research, reporting effect size is considered essential to complement statistical significance testing, because it reflects the practical magnitude of the impact produced by an instructional intervention (Field, 2024; Gignac & Szodorai, 2016).

Pedagogically, the observed gains in critical thinking skills within the experimental group can be understood as a result of the key principles underlying PBL, which positions contextual problems as the starting point of learning. PBL is designed to actively engage students in inquiry, information analysis, and real-world problem solving, thereby supporting the development of higher-order thinking skills (Anggraeni et al., 2023; Fadilla et al., 2021; Jaganathan et al., 2024). In the developed media, students were not immediately presented with finalized concepts; instead, they were guided to explore food chain phenomena through guiding questions and problem-based scenarios closely related to their daily experiences. This approach encouraged students to engage in initial interpretation, identify relevant information, and construct cause-and-effect relationships, key components of critical thinking (Seventika et al., 2018). Such processes align with the view that critical thinking develops most effectively when learners are confronted with authentic problems that require reasoning rather than memorization.

From the media perspective, Canva functioned as a visual-interactive tool that helped concretize abstract concepts in IPAS learning. Food chain topics, which require an understanding of energy flow and interactions among organisms, became more accessible through the use of visual diagrams, color-coded illustrations, and structured interactive navigation. This form of visualization is consistent with the Cognitive Theory of Multimedia Learning, which posits that learning is more effective when information is presented through integrated verbal and visual representations, as this can reduce cognitive load and enhance information processing (Schrader et al., 2021; Sorden, 2020). Accordingly, the Canva-based interactive media in this study served as a form of cognitive scaffolding that supported students in conducting analysis, evaluation, and inference related to ecosystem problems.

These findings support the constructivist perspective that learning occurs through an active process of knowledge construction resulting from learners' interactions with their learning environment (Saleem et al., 2021). Canva-based interactive media provided opportunities for students to explore information independently and collaboratively, while the PBL model offered a pedagogical framework that guided such exploration toward clearly defined learning objectives. This synergy between media and instructional model appears to have contributed to improvements in critical thinking indicators, particularly analysis, evaluation, and inference, as measured using Facione's framework.

Moreover, the implementation of PBL through interactive media fostered discussion and collaborative work, enabling students to process information not only individually but also through peer interaction. The process reflects a social constructivist view, where cognitive development is shaped through social interaction and the collaborative negotiation of meaning (Vygotsky & Cole, 2018). Group discussions during food chain problem-solving activities required students to articulate reasoning, evaluate peers' arguments, and collaboratively formulate conclusions. Such activities strengthen critical thinking skills by encouraging students to reflect on and evaluate their own thinking within a social context, as emphasized in social constructivist perspectives.

The use of effect size in this study contributes significantly to the interpretation of the results. The effect size, which falls within the very large category, indicates that the difference between the control and experimental groups was not only statistically significant but also practically meaningful within the context of instructional practice. This finding reinforces the argument that the effectiveness of Canva-based interactive media integrated with PBL was not driven solely by the novelty of the media, but rather by a learning design that intentionally engaged students in higher-order cognitive activities.

This study's findings corroborate the results reported in prior research. Kurniawan et al. (2023) reported that PBL is effective in enhancing elementary students' critical thinking skills, particularly in the areas of analysis and evaluation. Similarly, Erdyati et al. (2024) and Ameliya et al. (2023) found that Canva is an effective interactive medium for increasing student engagement and conceptual understanding. However, several of these studies noted that improvements in critical thinking tend to be limited when media are used without integration into an appropriate instructional model. Thus, the present study addresses this research gap by demonstrating that the simultaneous integration of Canva and PBL produces a stronger impact on critical thinking skills than the use of either component alone.

Despite these results, the findings of this study need to be interpreted cautiously. The quasi-experimental design employed did not involve full randomization, meaning that the influence of external variables, such as differences in class characteristics or students' learning motivation, could not be entirely eliminated. However, efforts were made to control these factors by ensuring equivalent instructional time, learning materials, and teacher involvement across both groups, allowing observed differences to be more confidently attributed to the instructional media and model.

In addition, the limited scope of the study, restricted to a single school and a specific instructional topic, limits the generalizability of the findings. Therefore, the results are not intended to support universal causal claims but rather to provide preliminary empirical evidence regarding the potential of integrating Canva and PBL in elementary IPAS instruction.

From a practical standpoint, the findings suggest that elementary school teachers can utilize pedagogically designed Canva-based interactive media as an alternative instructional approach to foster students' critical thinking skills. However, the effective use of such media must be accompanied by appropriate facilitation strategies, particularly in managing discussions and problem-solving activities, to ensure that students are cognitively engaged rather than merely visually stimulated.

For future research, it is recommended to employ experimental designs with stronger randomization, larger sample sizes, and more detailed measurements of critical thinking across individual indicators. Further studies may also explore the role of teachers as facilitators and the dynamics of group interaction as moderating variables in the implementation of Canva-based interactive media integrated with the PBL model.

Conclusion

Based on the results of data analysis, discussion, and hypothesis testing, it can be concluded that the Canva-based interactive learning media integrated with the Problem-Based Learning (PBL) model are highly feasible and effective for use in fifth-grade IPAS learning on food chain topics at SDN Suco 01. The feasibility of the developed media was confirmed through expert validation results, which were categorized as highly feasible, including media expert validation (94%), language expert validation (95%), content expert validation (86%), and critical thinking assessment expert validation (91%). These results indicate that the developed media meet the required quality standards in terms of visual design, language clarity, content accuracy, and alignment of assessment instruments with critical thinking indicators. Furthermore, the implementation of the media significantly improved students' critical thinking skills, as evidenced by the independent samples t-test results showing a significance value of 0.000 ($p < 0.05$), indicating a significant difference between the experimental and control groups. Students in the experimental class achieved higher posttest scores compared to those in the control class, demonstrating that the integration of Canva-based interactive media with the PBL model is more effective in enhancing critical thinking skills. This finding is further supported by the effect size analysis, which produced a Cohen's d value of 1.670, categorized as a very large effect, indicating that the developed media not only yielded statistically significant results but also had a substantial practical impact on improving students' ability to analyze cause-and-effect relationships and understand interactions among ecosystem components in food chain learning.

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Author Contributions
A.D.: Conceptualization, writing the original draft, methodology; A.D.; conceptualization, methodology, writing, review and editing; H.: curation, writing the original draft; A.D.; methodology; K.W.: formal analysis; H.: validation.

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Conflicts of Interest
The authors declare no conflict of interest.

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