



The Effectiveness of the Problem Based Learning Model Assisted by Digital Pop Up Book Media on the Critical Thinking Ability of Elementary School Students.

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Abstrak

Penelitian ini bertujuan untuk menganalisis efektivitas model Problem Based Learning berbantuan media pop-up book digital terhadap kemampuan berpikir kritis siswa sekolah dasar. Penelitian menggunakan pendekatan kuantitatif dengan desain quasi experimental tipe nonequivalent control group design. Sampel penelitian terdiri dari 58 siswa kelas V sekolah dasar di Kecamatan Sukun, Kota Malang yang terbagi dalam kelompok eksperimen (30 siswa) dan kelompok kontrol (28 siswa). Instrumen penelitian meliputi tes kemampuan berpikir kritis, lembar observasi keterlaksanaan pembelajaran, dan angket respon siswa. Data dianalisis menggunakan statistik deskriptif dan ANCOVA. Hasil penelitian menunjukkan terdapat perbedaan signifikan kemampuan berpikir kritis antara kelompok eksperimen dan kontrol ($F=25,037$; $p<0,05$). Kelompok eksperimen mengalami peningkatan kemampuan berpikir kritis dengan N-gain score 0,49 (kategori sedang), sedangkan kelompok kontrol 0,23 (kategori rendah). Aspek evaluasi mengalami peningkatan tertinggi dengan N-gain score 0,63, diikuti aspek analisis (0,59), inferensi (0,52), interpretasi (0,41), dan eksplanasi (0,38). Siswa memberikan respon positif terhadap pembelajaran dengan rata-rata skor 3,49 dari skala 4. Simpulan penelitian ini adalah model Problem Based Learning berbantuan media pop-up book digital efektif meningkatkan kemampuan berpikir kritis siswa sekolah dasar dan menciptakan pengalaman belajar yang bermakna.

Kata kunci: Keterampilan berpikir kritis, Problem Based Learning, pop-up book digital.

Abstract

This research aims to analyze the effectiveness of Problem Based Learning model assisted by digital pop-up book media on elementary school students' critical thinking skills. The research used a quantitative approach with a quasi-experimental nonequivalent control group design. The research sample consisted of 58 fifth-grade elementary school students in Sukun District, Malang City, divided into experimental (30 students) and control groups (28 students). Research instruments included critical thinking skills tests, learning implementation observation sheets, and student response questionnaires. Data were analyzed using descriptive statistics and ANCOVA. The results showed a significant difference in critical thinking skills between the experimental and control groups ($F=25.037$; $p<0.05$). The experimental group experienced an increase in critical thinking skills with an N-gain score of 0.49 (moderate category), while the control group scored 0.23 (low category). The evaluation aspect experienced the highest improvement with an N-gain score of 0.63, followed by analysis (0.59), inference (0.52), interpretation (0.41), and explanation (0.38). Students responded positively to the learning with an average score of 3.49 on a scale of 4. The conclusion of this research is that the Problem Based Learning model assisted by digital pop-up book media effectively improves elementary school students' critical thinking skills and creates meaningful learning experiences.

Keywords: critical thinking skills, Problem Based Learning, digital pop-up book,

Introduction

Critical thinking skills are one of the skills of the 21st century that need to be developed from an early age in elementary school students. In a digital era full of information and complexity of problems, students are required to be able to analyze, evaluate, and solve problems systematically and logically (Dwyer et al., 2021). However, the reality on the ground shows that the critical thinking skills of elementary school students in Indonesia are still relatively low. This can be seen from the results of the 2022 Programme for International Student Assessment (PISA) study which shows that the literacy, numeracy, and science skills of Indonesian students are still below the OECD average (OECD, 2023).

One of the factors that affect the low critical thinking ability of students is the use of inappropriate learning models. Learning in elementary school is still dominated by conventional learning models that emphasize the transfer of knowledge from teacher to student without providing opportunities for students to develop their critical thinking skills (Mulyono et al., 2018). In fact, the development of critical thinking skills requires a learning model that actively involves students in the problem-solving process.

The Problem Based Learning (PBL) model is one of the learning models that has the potential to develop students' critical thinking skills. The PBL model emphasizes on using real-world problems as a context for students to learn about critical thinking and problem-solving skills, as well as to acquire essential knowledge and concepts from the subject matter (Savery, 2019). Through PBL, students are faced with authentic problems that require critical thinking to solve.

However, the application of the PBL model in elementary school students faces its own challenges, especially related to the presentation of problems that are interesting and in accordance with the characteristics of the students. Elementary school students have the characteristics of concrete operational thinking that require visualization and an interesting learning context (Adnan & Arsad, 2020). To overcome these challenges, learning media is needed that can help students visualize problems and understand abstract concepts.

Digital pop-up books are learning media innovations that combine traditional pop-up book elements with digital technology. This media

presents interactive and interesting three-dimensional visualizations, so that it can help students understand abstract concepts (Ahmadi et al., 2017). The use of digital pop-up books in the PBL model is expected to increase students' enthusiasm and involvement in learning, thus having a positive impact on the development of their critical thinking skills.

Several previous studies have shown the effectiveness of the PBL model in improving students' critical thinking skills. Cahyono's research (2020) shows that the application of the PBL model can improve the critical thinking skills of elementary school students in science subjects. Similarly, research by Rahmat et al. (2021) shows that the use of pop-up books as a learning medium can improve students' understanding of concepts and learning outcomes. However, research that integrates the PBL model with digital pop-up book media to improve the critical thinking skills of elementary school students is still limited.

Based on the description above, the formulation of the problem in this study is: "How effective is the Problem Based Learning model assisted by digital pop-up book media on the critical thinking ability of elementary school students?". More specifically, the questions of this study are:

1. Is there a difference in critical thinking skills between students who learn using the PBL model with the help of digital pop-up book media and students who learn using the conventional PBL model?
2. What aspects of critical thinking skills have experienced significant improvements after the implementation of the PBL model assisted by digital pop-up book media?
3. How do students respond to learning using the PBL model assisted by digital pop-up book media?

The objectives of this research are:

1. Analyze the difference in critical thinking skills between students who learn using the PBL model assisted by digital pop-up book media and students who learn using the conventional PBL model.
2. Identifying aspects of critical thinking skills that have increased significantly after the application of the PBL model with the help of digital pop-up book media.
3. Describe students' responses to learning using PBL models assisted by digital pop-up book media.

This research is expected to make a theoretical and practical contribution in the development of innovative learning models to improve the critical thinking skills of elementary school students. Theoretically, this study enriches the study of the integration of digital technology in the PBL model and its impact on critical thinking skills. Practically, the results of this research can be a reference for teachers in designing learning that can develop the critical thinking skills of elementary school students.

The novelty of this study lies in the development and testing of the effectiveness of integrating the PBL model with digital pop-up book media specifically designed to improve the critical thinking skills of elementary school students. In contrast to previous studies that tended to examine the effectiveness of the PBL model and pop-up book media separately, this study examines the effectiveness of its integration in the context of learning in elementary schools.

The difference between this study and previous research also lies in the use of digital pop-up book media that utilizes augmented reality (AR) technology to create a more interactive and immersive learning experience. The digital pop-up book media in this study is designed by considering aspects of critical thinking skills to be developed, such as the ability to analyze, evaluate, and synthesize information. In addition, this study also examines the impact of the integration of the PBL model with digital pop-up book media on various aspects of critical thinking skills in detail, not only on critical thinking skills in general

Method

This study uses a quantitative approach with a quasi-experimental *design type of nonequivalent control group design*. This design was chosen because it was not possible to randomize subjects into experimental and control groups (Creswell & Creswell, 2018). The design of this research can be described as follows:

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Eksperiment	O ₁	X	O ₂
Control	O ₃	-	O ₄

Information:

E : Experimental group

K : Control group

O₁ : Pretest of the experimental group

O₂ : Posttest experimental group

O₃ : Pretest control group

O₄ : Posttest control group

X : Treatment (PBL model assisted by digital pop-up book media)

The population in this study is all grade V elementary school students in Enrekang District, Enrekang Regency for the 2024/2025 school year, which totals 12 public elementary schools. The sampling technique used is purposive sampling with consideration of the equality of school characteristics, the availability of technology facilities, and the willingness of the school to participate in the research. Based on these considerations, two elementary schools were selected, namely SDN 1 Enrekang and SDN 3 Enrekang

The research sample consisted of 58 students divided into two groups, namely the experimental group (30 students) and the control group (28 students). The experimental group was students in class V-A SDN 1 Enrekang who received learning using the PBL model assisted by digital pop-up book media, while the control group was students in class V-B SDN 1 Enrekang who received learning using the conventional PBL model. The instruments used in this study are:

1. The critical thinking ability test, which consists of 15 description questions that cover five aspects of critical thinking skills according to Facione (2015), namely interpretation, analysis, evaluation, inference, and explanation. This instrument has been validated by three learning experts and declared valid with an average validity score of 3.75 on a scale of 4. The reliability test of the instrument used Alpha Cronbach and obtained a reliability coefficient of 0.82, which indicates that the instrument has high reliability.
2. The observation sheet on the implementation of learning, which is used to observe the implementation of learning stages using the PBL model assisted by digital pop-up book media and conventional PBL models. This observation sheet consists of 20 observation items that include the activities of teachers and students during the learning process.
3. Student response questionnaire, which is used to determine student responses to learning using the PBL model assisted by digital pop-up book media. This questionnaire consists of

15 statement items with a Likert scale of 1-4 (strongly disagree to strongly agree).

Digital pop-up book media is developed through several stages:

1. Analysis of student needs and characteristics
2. Storyboard design and visual design
3. Content development in accordance with the critical thinking ability aspect
4. Integration of pop-up elements and augmented reality technology
5. Validation of media and material experts
6. Revisions based on expert input
7. Limited trial
8. Final revision and finalization of media

The digital pop-up book media developed consists of five contextual problem themes that are relevant to students' daily lives and in accordance with the elementary school grade V curriculum. Each issue theme is presented with a three-dimensional pop-up visualization that can be accessed through an app on a tablet or smartphone. The media also comes with interactive features, such as quizzes, simulations, and problem-based discussions. The research procedure is carried out in several stages:

Preparation stage

1. Taking care of research licensing
2. Preparing research instruments
3. Perform instrument validation
4. Developing digital pop-up book media
5. Pretest the experimental and control groups

Implementation stage

1. Carrying out learning in the experimental group using the PBL model assisted by digital pop-up book media
2. Carrying out learning in the control group using the conventional PBL model
3. Learning was carried out in 6 meetings with a time allocation of 2 x 35 minutes per meeting

Evaluation stage

1. Posttest on experimental and control groups
2. Processing and analyzing data
3. Draw conclusions based on the results of data analysis

The data in this study was collected through several techniques:

1. The test is used to collect data on students' critical thinking skills before and after treatment.
2. Observation was used to collect data on learning implementation using PBL models

assisted by digital pop-up book media and conventional PBL models.

3. The questionnaire was used to collect data on student responses to learning using the PBL model assisted by digital pop-up book media.
4. Documentation, used to collect supporting data such as photos of learning activities and student work results.

The data that has been collected is analyzed using descriptive and inferential statistical analysis techniques:

1. Descriptive statistical analysis is used to describe students' critical thinking skills and students' responses to learning. The data is presented in the form of tables, graphs, as well as measures of central tendencies (mean, median, mode) and measures of variability (standard deviation, variance).
2. Inferential statistical analysis is used to test research hypotheses. Before the hypothesis test was carried out, an analysis prerequisite test was first carried out which included a normality test with the Kolmogorov-Smirnov technique and a homogeneity test with the Levene's Test technique.
3. The hypothesis test used the ANCOVA (Analysis of Covariance) technique to determine the difference in critical thinking skills between the experimental group and the control group by controlling the influence of the pretest. Data analysis was carried out using SPSS software version 26 with a significance level of 0.05.
4. To analyze the aspects of critical thinking ability that have significantly increased, an N-gain score analysis was used on each aspect of critical thinking ability.
5. Student response data was analyzed descriptively by calculating the percentage of students who responded positively to learning using the PBL model assisted by digital pop-up book media.

Result and Discussion

The results of the pretest of students' critical thinking skills in the experimental group and the control group are presented in Table 1.

Table 1. Description of Critical Thinking Ability
Pretest Score Statistics

Group	N	Mean	St. D	Min	Max
Eksperimen	30	58,43	8,27	42,00	72,00

Control	28	59,21	7,95	44,00	74,00
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Based on Table 1, the average pretest score of students' critical thinking ability in the experimental group was 58.43 with a standard deviation of 8.27, while in the control group it was 59.21 with a standard deviation of 7.95. The results of the independent t-test showed that there was no significant difference between the initial critical thinking ability of the experimental group and the control group ($t = -0.365$; $p = 0.716 > 0.05$). This shows that both groups have equal initial capabilities before being given treatment. Further analysis of the pretest scores on each aspect of critical thinking skills is presented in Table 2.

Table 2. Average Pretest Score on Each Aspect of Critical Thinking Ability

Aspects of Critical Thinking Ability	Experimental Group	Control Group
Interpretasi	65,33	66,07
Analysis	58,67	57,86
Evaluation	52,00	53,57
Inference	56,00	57,14
Explanation	60,17	61,43

Based on Table 2, the interpretation aspect had the highest average score in both groups,

Tabel 4. Hasil Analisis ANCOVA

Source of Variation	Number of Squares	df	Kuadrat Rerata	F	Itself.
Corrected Model	2342,519	2	1171,260	20,173	0,000
Intercept	3586,275	1	3586,275	61,765	0,000
Pretest	1172,651	1	1172,651	20,198	0,000
Group	1453,308	1	1453,308	25,037	0,000
Error	3192,307	55	58,042		
Total	314526,000	58			
Corrected	5534,827	57			
Total					

Based on the results of ANCOVA's analysis in Table 4, the value of $F = 25.037$ was obtained with a significance value of $0.000 < 0.05$. This shows that there is a significant difference between the critical thinking skills of students who learn using the PBL model with the help of digital pop-up book media and students who learn using the conventional PBL model, after controlling for the influence of the initial ability (pretest).

To determine the magnitude of the increase in critical thinking skills in both groups,

while the evaluation aspect had the lowest average score. This shows that students are better able to understand and interpret information, but still have difficulty in assessing the credibility of statements or arguments. The results of the posttest of students' critical thinking skills in the experimental group and the control group are presented in Table 3.

Table 3. Description of Critical Thinking Ability Posttest Score Statistics

Group	N	Mean	Hours D	Mini	Max
Eksperimen	30	78,67	7,85	64,00	92,00
Control	28	68,57	8,21	54,00	84,00

Based on Table 3, the average posttest score of students' critical thinking ability in the experimental group was 78.67 with a standard deviation of 7.85, while in the control group it was 68.57 with a standard deviation of 8.21. These results showed that the average posttest score of the experimental group was higher than that of the control group.

To determine the significance of these differences, ANCOVA analysis was carried out with a pretest score as a covariate. The results of ANCOVA's analysis are presented in Table 4.

an N-gain score analysis was carried out presented in Table 5.

Table 5. N-gain Score Analysis Results

Group	N	Mean N-gain	Category
Eksperimen	30	0,49	Keep
Control	28	0,23	Low

Based on Table 5, the average N-gain score in the experimental group was 0.49 in the medium category, while in the control group it was 0.23 in the low category. This suggests that the improvement in critical thinking skills in the

experimental group was higher than in the control group.

To identify aspects of critical thinking ability that have significantly increased after the application of the PBL model assisted by digital

pop-up book media, an N-gain score analysis was carried out on each aspect of critical thinking ability. The results of the analysis are presented in Table 6.

Table 6. N-gain Score on Every Aspect of Critical Thinking Ability

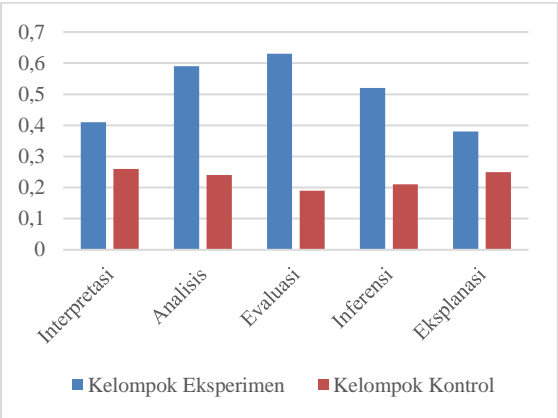
Aspects of Critical Thinking Ability	Experimental Group		Control Group	
	N-gain	Category	N-gain	Category
Interpretasi	0,41	Keep	0,26	Low
Analysis	0,59	Keep	0,24	Low
Evaluation	0,63	Keep	0,19	Low
Inference	0,52	Keep	0,21	Low
Explanation	0,38	Keep	0,25	Low

Based on Table 6, all aspects of critical thinking ability in the experimental group improved in the moderate category, with N-gain values ranging from 0.38 to 0.63. The evaluation aspect experienced the highest increase with an N-gain score of 0.63, followed by the aspects of analysis (0.59), inference (0.52), interpretation (0.41), and explanatory (0.38). In the control group, all aspects of critical thinking skills improved in the low category, with N-gain values ranging from 0.19 to 0.26.

The highest improvement in the evaluation aspect showed that the PBL model assisted by digital pop-up book media was effective in developing students' ability to assess the credibility of statements or arguments, which were previously the lowest-scoring aspects. This can be explained because in the PBL model assisted by digital pop-up book media, students are faced with contextual problems that are presented visually and interactively, so that they can train students to evaluate the information obtained.

To clarify the difference in the improvement of each aspect of critical thinking skills in the two groups, the N-gain score data is presented in the form of a graph in Figure 1.

Figure 1. N-gain Score Graph on Every Aspect of Critical Thinking Ability



Observation of the implementation of learning is carried out to ensure that learning in the experimental group and the control group is carried out in accordance with the learning plan that has been prepared. The results of the observation of the implementation of learning are presented in Table 7.

Table 7. Results of Observation of Learning Implementation

Meeting	Implementation (%)	
	Experimental Group	Control Group
1	85	87,5
2	90	90
3	95	92,5
4	95	95
5	97,5	95
6	100	97,5
Average	93,75	92,92

Based on Table 7, the average learning implementation in the experimental group was 93.75%, while in the control group it was 92.92%. This shows that the learning in both groups is carried out very well in accordance with the learning plan that has been prepared.

Student Response to Learning

Students' responses to learning using the PBL model assisted by digital pop-up book media were measured using questionnaires given to the experimental group after learning was completed. The results of the student response questionnaire are presented in Table 8.

Table 8. Student Response Survey Results

No	Aspects Assessed	mean	Category
1	Interest in learning	3,67	Very Positive
2	Ease of understanding the material	3,43	Positive
3	Ease of use of digital pop-up book media	3,27	Positive
4	Interactivity of digital pop-up book media	3,73	Very Positive
5	Clarity of visualization in digital pop-up book media	3,60	Very Positive
6	Compatibility of the problem with daily life	3,53	Very Positive
7	Ease of solving problems	3,20	Positive
8	Increased motivation to learn	3,57	Very Positive
9	Increased cooperation in groups	3,50	Very Positive
10	Improved ability to analyze problems	3,37	Positive
11	Improved ability to evaluate solutions	3,30	Positive
12	Improved decision-making ability	3,33	Positive
13	Increased learning independence	3,47	Positive
14	Desire to learn in the same way in the future	3,63	Very Positive
15	The Meaning of Learning Experience	3,70	Very Positive
	Overall Average	3,49	Positive

Based on Table 8, the average student response score to learning using the PBL model assisted by digital pop-up book media is 3.49 with a positive category. The aspect that received the most positive response was the interactivity of digital pop-up book media with a score of 3.73 (very positive), followed by the meaning of the learning experience with a score of 3.70 (very positive), and interest in learning with a score of 3.67 (very positive). The aspect that received the lowest response was the ease of solving problems with a score of 3.20, although it was still included in the positive category.

Discussion

The results of the study showed that the PBL model assisted by digital pop-up book media was effective in improving the critical thinking skills of elementary school students. This was evidenced by the significant difference between the students' critical thinking skills in the experimental group and the control group after being given the treatment, with the experimental group showing a higher improvement.

The effectiveness of the PBL model assisted by digital pop-up book media in improving students' critical thinking skills can be explained from several aspects. First, the PBL model provides students with the opportunity to develop critical thinking skills through an authentic problem-solving process. This is in line with the research of Nafiah & Suyanto (2021) which found that the PBL model can improve students' critical thinking skills because it provides hands-on experience in identifying, analyzing, and solving problems.

Second, the use of digital pop-up book media provides a clear and interactive visualization of the problems presented, thereby helping students understand the problem more concretely. This visualization is very important for elementary school students who are still in the concrete operational stage. According to Piaget's theory of cognitive development, students at this stage need concrete representations to understand abstract concepts (Santrock, 2018). Therefore, the use of digital pop-up book media that presents three-dimensional and interactive visualizations can

help students in understanding problems and developing their critical thinking skills.

Third, the integration of the PBL model with digital pop-up book media creates an interactive and engaging learning environment, thereby increasing student engagement in learning. The active involvement of these students contributes to the development of their critical thinking skills. This is in accordance with the research of Rahman et al. (2022) which found that students' active involvement in learning can improve their critical thinking skills.

The results of the analysis of the N-gain score on each aspect of critical thinking ability showed that the evaluation aspect experienced the highest increase after the application of the PBL model assisted by digital pop-up book media. This shows that this learning model is effective in developing students' ability to assess the credibility of statements or arguments. In the digital pop-up book-media-assisted PBL model, students are faced with a situation where they must evaluate various information and arguments to solve problems. This process trains students' evaluation skills which are an important component of critical thinking.

The analysis aspect also experienced a fairly high increase with an N-gain score of 0.59. In learning using the PBL model assisted by digital pop-up book media, students are trained to identify relationships between statements, questions, concepts, descriptions, or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions. This analytical ability is essential in the problem-solving process that is at the core of the PBL model.

Furthermore, the inference aspect increased with an N-gain score of 0.52. In learning using the PBL model assisted by digital pop-up book media, students are trained to identify and acquire the elements necessary to make reasonable conclusions, make conjectures and hypotheses, consider relevant information, and draw consequences from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.

The interpretation and explanatory aspects experienced a lower increase compared to other aspects, although it was still in the medium category. This shows that these two aspects require more attention in learning. The

interpretation aspect deals with the ability of students to understand and express the meaning or significance of various experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria. Meanwhile, the explanatory aspect is related to the student's ability to present the results of reasoning convincingly and coherently.

The positive response of students to learning using the PBL model assisted by digital pop-up book media shows that this learning model can be well accepted by students. The interactivity aspect of digital pop-up book media received the most positive response, which shows that the interactive features in the media have succeeded in attracting students' interest. This is in line with the research of Wijayanti et al. (2019) which found that the interactivity of learning media can increase student motivation and involvement in learning.

The meaning of the learning experience also received a very positive response from students. This shows that learning using the PBL model assisted by digital pop-up book media provides a meaningful learning experience for students. According to Ausubel's theory of meaningful learning, meaningful learning occurs when students can connect new knowledge with knowledge they already have (Santrock, 2018). In the context of this study, the problems presented in the PBL model assisted by digital pop-up book media are relevant to students' daily lives, so that students can relate them to the knowledge and experience they have had.

However, the aspect of ease of solving problems gets a lower response than other aspects. This shows that students still have difficulties in the problem-solving process, even though they have been assisted by digital pop-up book media. These findings are an important note for the development of similar learning models in the future, where there is a need to provide more support to students in the problem-solving process.

Overall, the results of this study show that the integration of the PBL model with digital pop-up book media can be an effective alternative learning model to improve the critical thinking skills of elementary school students. This learning model not only assists students in developing critical thinking skills, but also creates a meaningful and enjoyable learning experience for students.

Conclusion

Based on the results of the research and discussion, it can be concluded that the Problem Based Learning (PBL) model assisted by digital pop-up book media is effective in improving the critical thinking skills of elementary school students. There is a significant difference between the critical thinking skills of students who learn using the PBL model with the help of digital pop-up book media and students who learn using the conventional PBL model. The group that used the PBL model with the help of digital pop-up book media showed a higher increase in critical thinking ability with an N-gain score of 0.49 (medium category), compared to the group using the conventional PBL model with an N-gain score of 0.23 (low category).

All aspects of critical thinking skills in the experimental group increased to moderate categories. The evaluation aspect experienced the highest increase with an N-gain score of 0.63, followed by the aspects of analysis (0.59), inference (0.52), interpretation (0.41), and explanatory (0.38). This shows that the PBL model assisted by digital pop-up book media is effective in developing various aspects of students' critical thinking skills, especially aspects of evaluation, analysis, and inference.

Students responded positively to learning using the PBL model assisted by digital pop-up book media with an average score of 3.49 on a scale of 4. The aspects that received the most positive response were the interactivity of digital pop-up book media, the meaning of learning experiences, and interest in learning. This shows that this learning model is well received by students and creates a meaningful and enjoyable learning experience.

This study has several limitations, including a relatively short research duration (6 meetings) and a limited research sample in two elementary schools in Sukun District, Malang City. Therefore, the results of this study cannot be generalized to all contexts and populations. Further research with a longer duration and a larger, more diverse sample is needed to confirm the findings of this study.

Based on the results of the study, it is recommended for elementary school teachers to integrate the PBL model with digital pop-up book media in learning to improve students' critical thinking skills. In addition, curriculum and learning media developers need to consider the integration of digital technology in the development of learning media to create a more

interactive and meaningful learning experience for students. For further research, it is recommended to examine the effectiveness of the PBL model assisted by digital pop-up book media in improving other cognitive aspects, such as creativity, problem-solving, and metacognition, as well as examine the factors that affect the effectiveness of this learning model in improving students' critical thinking skills.

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