



The Effectiveness of Strip Story Media in Improving Students' Critical Thinking Skills in Science Subjects in Elementary Schools

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ABSTRACT

Study This aim for analyze the effectiveness of Strip Story media in increase ability think critical students in science learning at school basic research use approach quantitative with quasi-experimental non equivalent pretest–posttest control group design. Subjects study totaling 41 students consisting of over 21 students class experiment and 20 students class control . Class experiment follow science learning using Strip Story media, whereas class control follow learning without using the media . Data capabilities think critical collected use test the description given through pretest and posttest . Improvement ability think critical analyzed use Normalized Gain (N-Gain) score , then normality test was carried out using Shapiro–Wilk, homogeneity test using Levene's Test, and hypothesis testing using Independent Samples t-test. Research results show that the average score ability think critical class experiment increase from 57.29 to 79.14 with N-Gain value of 0.510 is categorized in progress . Meanwhile that , class control increase from 56.70 to 64.75 with N-Gain value of 0.187 is categorized low . Second N-Gain data group normally distributed and homogeneous. Hypothesis test results show mark $t(39) = 13.164$ with $p < 0.001$. With thus, strip story media is effective increase ability think critical student in science learning.

Keywords: critical thinking, science, learning media, Strip Story



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INTRODUCTION

21st-century education requires students not only to master factual and conceptual knowledge but also to possess higher-order thinking skills to address increasingly complex issues. Critical thinking is one of the essential competencies that needs to be cultivated from the primary education level. This skill enables students to analyze information, identify problems, evaluate evidence, connect various pieces of information, and make decisions based on logical and justifiable reasoning. Developing critical thinking skills at the primary school level is crucial because, at this stage, students begin to form their thought patterns and ways of understanding the phenomena occurring in their surroundings. Sarwanto et al. (2021) indicate that critical thinking skills among primary school students tend to remain low, characterized by limitations in analyzing problems, providing reasons, and drawing conclusions based on evidence. Therefore, instruction needs to be designed to be more active and meaningful so that

students do not merely receive information but also engage in the thinking processes required to understand and solve problems.

In the context of science education in elementary schools, critical thinking skills play a crucial role. Science instruction is not merely aimed at concept mastery and rote memorization; rather, it focuses on students' abilities to observe phenomena, ask questions, analyze cause-and-effect relationships, construct arguments, and draw conclusions based on evidence. Research by Sidiq et al. (2021) demonstrates that incorporating learning activities oriented toward higher-order thinking skills can enhance the critical thinking abilities of elementary school students in science lessons. Similarly, Kirk et al. (2023) emphasize that fostering critical thinking in elementary science education requires learning activities that provide students with opportunities to build, evaluate, and refine their understanding through inquiry processes and the representation of various ideas. Consequently, science instruction needs to provide learning experiences that enable students to actively engage with scientific information and phenomena.

However, the development of critical thinking skills in science education still faces various challenges. A frequently encountered issue is the prevalence of teacher-centered instruction, where students tend to act merely as recipients of information. This situation results in a learning process that prioritizes the delivery of content over student engagement in analyzing, questioning, and evaluating information. Research also indicates that science instruction lacking meaningful learning experiences and problem-solving activities can hinder the development of students' critical thinking skills. Therefore, there is a need for instructional strategies capable of presenting science material in a manner that is more concrete, contextual, and engaging, while also aligning with the developmental characteristics of elementary school students.

The results of initial observations carried out on fourth grade students at SD Negeri 2 Sidowaluyo showed that there were problems in the science learning process. Students still tend to be passive listeners when the teacher explains the material, while the learning resources used are dominated by textbooks and the teacher's verbal explanations. The learning material has not been fully linked to students' daily life experiences so that some students have difficulty understanding problems and answering questions that require reasoning. These conditions indicate the need to use learning media that can help students visualize concepts, understand relationships between events, and encourage active involvement in the learning process.

One alternative for creating more engaging and meaningful science learning experiences is the use of visual narrative-based instructional media, such as "Strip Story." Strip Story media presents information through image segments or a sequence of story elements that students must arrange and interpret. These characteristics enable students to move beyond passive information reception; instead, they engage in processes such as observing, connecting information, sequencing events, identifying cause-and-effect relationships, and articulating the reasoning behind their decisions. From a multimedia learning perspective, combining visual and narrative elements can help students grasp complex information through representations that are more concrete and accessible.

Recent studies indicate that the use of comics and visual narrative-based media holds positive potential for science education. Ahmad et al. (2022) explain that the use of comics in STEM education is emerging as an approach capable of supporting concept visualization, enhancing learning engagement, and making complex material easier to understand. Furthermore, Zhang and Yu (2023) demonstrate that comic-based learning in STEM education has the potential to improve conceptual understanding, motivation, student engagement, and higher-order thinking skills. In the context of primary education, a systematic literature review by Fitriyanti et al. (2023) found that comics are widely used at the primary school level and have the potential to boost student motivation, creativity, and interest in grasping learning concepts. More recent systematic research also indicates that using comics in primary science

education can contribute to students' conceptual understanding, motivation, literacy, and critical thinking skills, provided the materials are designed in alignment with learning objectives and learner characteristics (Ismiyanto et al., 2025).

Although various study has show the potential of comic media and visual narratives in learning, some big study previously still focused on media development, improvement results learning, interest, motivation , understanding concept, or skills reading. Research previously there's also more about Strip Story Lots applied to the eyes lesson other than science and not yet specific study the effectiveness of the media in increase ability think critical student school the basis of science learning. Meanwhile that, research about development ability think critical in more science learning Lots use inquiry approach, problem-based learning, STEM, or habituation HOTS questions (Sidiq et al., 2021; Kirk et al., 2023). With however, still there is room study For test the use of simple visual narrative media, especially strip story, as means for facilitate the thinking process critical student in understand science phenomena.

This study introduces a novel approach by utilizing "Strip Story" media for science instruction; this medium serves not only to convey information but also acts as a cognitive stimulus, encouraging students to observe, sequence information, analyze relationships between events, provide justifications, and draw conclusions. Unlike previous studies that focused primarily on learning outcomes or reading skills, this research specifically examines the effectiveness of strip story media in fostering critical thinking skills among elementary school students regarding the topic of energy sources and their transformations.

Based on the foregoing, this study aims to analyze the effectiveness of strip story media in enhancing students' critical thinking skills during science lessons in elementary schools. The findings are expected to provide an empirical contribution to the development of science learning media that are simple, contextual, user-friendly, and suited to the characteristics of elementary school students. Furthermore, this study is expected to offer teachers an alternative approach to creating science lessons that are more active, meaningful, and focused on developing students' critical thinking skills.

RESEARCH METHODS

This study employs a quantitative approach using a quasi-experimental research method. Specifically, it utilizes a non-equivalent pretest-posttest control group design, involving two pre-existing groups: an experimental group and a control group. Both groups were administered a pretest to assess the students' initial critical thinking skills. Subsequently, the experimental group received instruction utilizing the Strip Story medium, while the control group received instruction without it. Following the intervention, both groups were administered a posttest to measure changes in the students' critical thinking skills.

A quasi-experimental design was selected because the study was conducted within a school setting using pre-existing classes, meaning the researcher did not perform full individual randomization. The pretest–posttest control group design enables the researcher to compare students' initial and final abilities and to identify differences in learning outcomes between the group receiving the intervention and the comparison group. Similar designs are frequently employed in educational research to assess the effectiveness of instructional interventions on critical thinking skills, including in science education (Sidiq et al., 2021; Rahmawati et al., 2021; Herlita et al., 2023). The research design is illustrated below.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Class experiment	O ₁	X	O ₃
Class control	O ₂	–	O ₄

Description:

- O₁ = critical thinking skills pretest for the experimental class;
- O₂ = critical thinking skills posttest for the experimental class;
- O₃ = critical thinking skills pretest for the control class;
- O₄ = critical thinking skills posttest for the control class;
- X = science instruction using Strip Story media;
- = instruction without using Strip Story media.

Research Setting, Population, and Sample

The study was conducted at SD Negeri 2 Sidowaluyo, located in Sidowaluyo Village, Belitang Mulya District, East Ogan Komering Ulu Regency. The research focused on science lessons covering the topics of energy sources, energy transformations, and alternative energy sources. The research subjects consisted of 41 students divided into two groups: an experimental group comprising 21 students and a control group comprising 20 students. Existing school classes were utilized as the research groups. The use of pre-existing classes as experimental and control groups is a common characteristic of quasi-experimental research in educational settings, as the random assignment of individuals is often difficult to implement in real-world classroom situations (Sidiq et al., 2021; Rahmawati et al., 2021).

Research Variables

This study involves two variables:

1. Independent variable: the use of Strip Story media in science instruction.
2. Dependent variable: students' critical thinking skills.

Strip Story media serves as the instructional treatment for the experimental class. This medium presents learning material as a series of story segments or visuals, which students use to observe information, sequence events, understand relationships between concepts, and articulate reasoning based on the available information.

Students' critical thinking skills are measured using essay-type tests administered before and after the treatment. The use of essay questions to measure critical thinking skills is appropriate because it allows students to demonstrate their reasoning processes, analysis, argumentation, and conclusion-drawing. Research by Sidiq et al. (2021) also employed essay-based tests to measure the critical thinking skills of elementary school students in science instruction.

Research Procedure

The research procedure was carried out in three main stages: preparation, implementation, and data processing.

1. Preparation Stage

During the preparation stage, the researcher conducted an initial observation of the science learning process at the research site. Subsequently, the researcher prepared instructional materials, the "Strip Story" media, and a critical thinking skills test instrument. The instrument consisted of 10 essay questions tailored to the science learning content.

The test instrument was used to gather data on students' critical thinking skills before and after instruction. In research on critical thinking skills, instruments must be designed based on the specific skill indicators being measured and undergo a review process to ensure alignment between test items, content, and measurement objectives. The use of valid and reliable instruments is crucial in experimental research to ensure that changes in scores can be accurately interpreted as outcomes of the learning process.

2. Implementation Stage

The research implementation was carried out through the following steps:

a. Pre-test administration

Before instruction began, students in both the experimental and control classes were given a pre-test. The pre-test aimed to establish a baseline understanding of the students' critical thinking skills prior to the intervention.

b. Intervention (Treatment)

Following the pre-test, the experimental class received science instruction utilizing the "Strip Story" media. Instruction spanned two sessions, in accordance with the prepared lesson plans. The "Strip Story" media was employed to teach topics regarding energy sources, energy transformations, and alternative energy sources.

During the learning process, students were guided to observe information presented through a narrative sequence, identify science concepts, connect information across images or story segments, and articulate the reasoning behind their answers. These activities were designed to provide students with opportunities to engage actively in analysis and reasoning.

Meanwhile, the control class underwent instruction using the standard classroom teaching method, without the "Strip Story" media intervention.

c. Post-test administration

Upon completion of the entire learning process, students in both groups were administered a post-test. The post-test utilized an instrument identical or equivalent to the pre-test and aimed to measure students' critical thinking skills following the instructional period. The use of pretests and posttests with experimental and control groups is a common procedure in quasi-experimental research for comparing changes in students' abilities following an instructional intervention. This approach has been employed in various studies regarding the development of critical thinking skills through science instructional interventions (Sidiq et al., 2021; Herlita et al., 2023).

Data Collection Techniques and Instruments

The primary research instrument was a critical thinking test consisting of 10 open-ended questions. This test was administered as both a pretest and a posttest to measure students' critical thinking skills within the context of science learning. In this study, critical thinking skills were assessed based on students' abilities to comprehend problems, analyze information, provide reasoning, draw conclusions, and formulate answers grounded in the concepts they had studied. The use of open-ended questions allowed students to respond more freely, thereby enabling the identification of their thought processes through their provided answers. This approach of measuring critical thinking skills via open-ended questions was also employed in a quasi-experimental study on science instruction at the elementary school level (Sidiq et al., 2021).

Data Analysis Techniques

Research data were analyzed using descriptive statistics and inferential statistics. To determine the increase in students' critical thinking skills, both groups were given a pretest before learning and a posttest after treatment. Next, the increase in critical thinking skills is analyzed using the Normalized Gain (N-Gain) score. The N-Gain calculation uses the following formula (Hake, R. R. (1998):

$$N_Gain = \left[\frac{(S_{post} - S_{pre})}{S_{max} - S_{pre}} \right]$$

Information :

N-Gain = normalized gain

S_{post} = *posttest score*

S_{pre} = *pretest score*

S_{max} = *maximum score*

Description:

N-Gain category used is as following .

N-Gain Range	Category
$g \geq 0.70$	Tall
$0.30 \leq g < 0.70$	Currently
$g < 0.30$	Low

1.Descriptive Statistical Analysis

Descriptive analysis was employed to characterize the critical thinking skills of students in both the experimental and control classes. The analysis involved calculating the mean and the distribution of scores from the pretest and posttest.

2.Analysis Prerequisite Tests

Prior to hypothesis testing, the data were examined to determine their distribution characteristics. A normality test was conducted using the Shapiro-Wilk test, as the sample size for each group was fewer than 50 students, while a homogeneity of variance test was performed using Levene's test at a significance level of 0.05.

Prerequisite tests were conducted to determine the appropriate statistical analysis procedure. Normality and homogeneity testing are standard procedures in quantitative research involving group comparisons prior to testing for differences in means (Herlita et al., 2023).

3.Hypothesis Testing

Hypothesis testing was conducted to determine whether there was a difference in critical thinking skills between students who received instruction using the Strip Story medium and those who received instruction without it.

Hypothesis testing was performed using an Independent Samples t-test with the aid of SPSS version 25 software at a significance level of 0.05. If the significance value (p-value) is less than 0.05, a significant difference exists between the critical thinking skills of students in the experimental class and the control class. Conversely, if the significance value is greater than or equal to 0.05, no significant difference exists between the two groups.

RESULTS AND DISCUSSION

This study aims to determine the effectiveness of using Strip Story media on students' critical thinking skills in science learning. The study involved two groups: an experimental class consisting of 21 students and a control class consisting of 20 students. The experimental class received instruction using Strip Story media, whereas the control class underwent instruction without using this medium as the primary intervention. Based on the research findings regarding critical thinking skills, the data is presented in the diagram below.

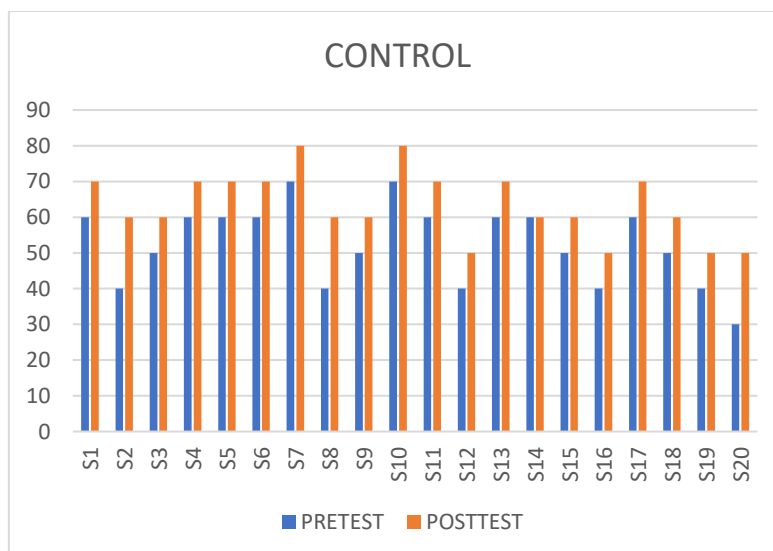


Figure 1. Diagram of Control Class Student Scores

Based on the results of the interval data calculations, a diagram is obtained as below:

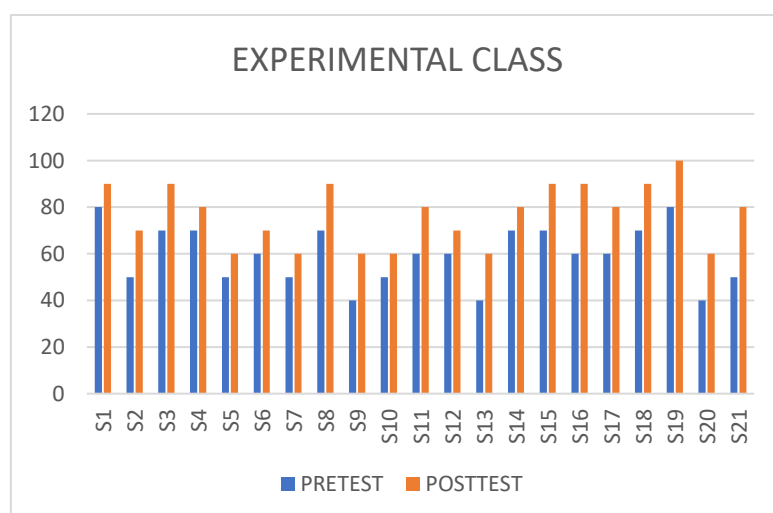


Figure 2. Diagram of Student Values in the Experimental Class

Based on the provided table, it can be observed that no students scored in the 20–36 range; 8 students scored in the 37–53 range; 11 students scored in the 54–70 range; 2 students scored in the 71–87 range; and no students scored in the 88–100 range. Overall, the research results indicate an increase in critical thinking skill scores in both groups. However, the score increase in the experimental class was greater than that in the control class. Based on the calculations, the comparison of average pretest, posttest, and N-Gain scores between the experimental and control classes is presented in Table 2.

Table 2. Comparison of Critical Thinking Skills Results of the Two Groups

Group	N	Pretest Average	Posttest Average	Score Improvement	Average N-Gain	Category
Experiment	21	57.29	79.14	21.85	0.510	Currently
Control	20	56.70	64.75	8.05	0.187	Low

Based on Table 2, the students' initial abilities in both groups were relatively comparable. The mean pretest score for the experimental class was 57.29, while that of the control class was 56.70. Following instruction, the mean posttest score for the experimental class reached 79.14, which was higher than that of the control class (64.75). This difference was also reflected in the mean N-Gain scores; the experimental class achieved an N-Gain score of 0.510 (categorized as medium), whereas the control class obtained a score of 0.187 (categorized as low). Descriptively, these results indicate that the use of Strip Story media led to a greater improvement in critical thinking skills compared to the instruction in the control class.

Normality Test Results

Prior to hypothesis testing, the N-Gain data were tested for normality. The normality test was conducted to determine the data distribution for each group. The Shapiro–Wilk test was used because the sample size for each group was fewer than 50 students; the results are presented in Table 3.

Table 3. Results of the N-Gain Normality Test

Group	Shapiro–Wilk Statistics	df	Sig.	Description
The experiment	0.959	21	0.506	Normal
Control	0.966	20	0.675	Normal

Based on Table 3, the N-Gain significance value for the experimental class is 0.506, while the significance value for the control class is 0.675. Both significance values are greater than 0.05.

N-Gain Data Homogeneity Test

A homogeneity test was conducted to determine whether the N-Gain variances of the experimental and control classes were homogeneous. The test was performed using Levene's Test. The results of the homogeneity test are presented in Table 4.

Table 4. Results of N-Gain Homogeneity Test

Levene Statistics	df1	df2	Sig.	Information
0.013	1	39	0.910	Homogeneous

Based on the results of the homogeneity test, a significance value of 0.910 was obtained. This value is greater than 0.05. Thus, it can be concluded that the variances of the N-Gain data for the experimental and control classes are homogeneous.

Hypothesis Testing

Hypothesis testing was conducted to determine whether there was a difference in the improvement of critical thinking skills between students who participated in instruction using the Strip Story medium and those who participated in instruction without using said medium. The research hypotheses were formulated as follows:

H₀: There is no significant difference in the improvement of critical thinking skills between students who learned using the Strip Story medium and students who learned without using the Strip Story medium.

H₁: There is a significant difference in the improvement of critical thinking skills between students who learned using the Strip Story medium and students who learned without using the Strip Story medium.

Testing was performed using an Independent Samples t-test on the N-Gain scores of both groups at a significance level of 0.05.

Table 5. Results of the Independent Samples t-test on N-Gain

Statistics	Mark
t	13,164
df	39
Sig. (2-tailed)	< 0.001
Average N-Gain of experiments	0.510
Average N-Gain control	0.187

Based on the Independent Samples t-test results, a t-value of 13.164 was obtained with 39 degrees of freedom (df) and a significance value of $p < 0.001$. This significance value is lower than the significance level of 0.05.

Consequently, H_0 is rejected and H_1 is accepted. This indicates a significant difference in the improvement of critical thinking skills between the experimental class and the control class. The mean N-Gain for the experimental class was 0.510, whereas for the control class, it was 0.187. The mean N-Gain difference of 0.323 demonstrates that the improvement in critical thinking skills among students taught using Strip Story media was significantly higher than that of students in the control class.

The research results indicate that the use of Strip Story media led to a greater improvement in students' critical thinking skills compared to instruction in the control class. This finding is evident from a comparison of the pretest, posttest, and N-Gain results for both groups. The average critical thinking score in the experimental class rose from 57.29 on the pretest to 79.14 on the posttest, with an average N-Gain of 0.510, placing it in the medium category. Meanwhile, the average score in the control class increased from 56.70 to 64.75, with an N-Gain of 0.187, falling into the low category. Descriptively, these results demonstrate that students who received instruction using Strip Story media experienced a greater improvement in critical thinking skills than those who received instruction without the use of such media.

The difference in the observed improvement suggests that the Strip Story medium has the potential to provide a more active learning experience compared to instruction that relies solely on the verbal delivery of information. Strip Story presents material through a sequence of images and narratives, helping students observe information, grasp the order of events, connect different pieces of information, and build an understanding of science concepts. This process enables students not merely to receive information but also to engage in cognitive activities involving the interpretation and analysis of the presented material.

These findings align with the research of Sidiq et al. (2021), which demonstrated that incorporating higher-order thinking skills (HOTS)-based questioning into science instruction can enhance the critical thinking abilities of elementary school students. That study employed a quasi-experimental design—featuring both treatment and control groups—and showed that providing learning stimuli requiring analysis and reasoning resulted in superior critical thinking skills compared to conventional instruction.

In this research, Strip Story media can be understood as a form of learning stimulus that supports high-level thinking processes. When students are given a series of pictures or stories related to science concepts, students are not only asked to read or view media, but need to understand the relationship between information. For example, in learning about energy sources and energy changes, students can identify objects or phenomena contained in each image, determine cause-effect relationships, sequence the process by which an event occurs, and provide reasons for the answers chosen. These activities involve processes of interpretation, analysis, evaluation and conclusion which are important parts of critical thinking skills.

The increase in critical thinking skills in the experimental class can also be explained through the characteristics of narrative-based visual media. Presenting concepts in the form of pictures and stories helps elementary school students obtain a more concrete representation of the material being studied. This is important because science concepts often involve phenomena that are not always easy to understand if only conveyed through text or verbal explanations. Systematic review by Ismiyanto et al. (2025) shows that the use of comics in elementary school science education can support conceptual understanding, motivation, literacy and critical thinking skills. The effectiveness of the media is influenced by the suitability of the content to the learning objectives, the quality of the visual representation, and the way the teacher integrates the media into learning activities.

These results are supported by the study conducted by Fitriyanti et al. (2023), which found that comics, as a learning medium, have the potential to enhance students' motivation, creativity, and interest in grasping learning concepts. Their visual and narrative characteristics allow material to be conveyed in a more engaging and accessible manner for learners. In the context of this study, the Strip Story medium shares characteristics with comics, particularly through the use of visual sequences and narratives to convey educational information.

The experimental class's average N-Gain score of 0.510—falling within the moderate category—demonstrates that the use of the Strip Story medium can yield significant improvement, even though it did not reach the high category. This indicates that while learning media can be a crucial factor in enhancing critical thinking skills, its effectiveness is also influenced by how it is utilized during the learning process. Visual media does not automatically boost critical thinking skills if its use is limited merely to information delivery. Improvements in critical thinking are optimized when the media is integrated with activities that require students to observe, question, analyze, compare, provide reasoning, and draw conclusions.

This perspective is supported by research on science-based comics. A systematic review regarding the use of comics in science education indicates that this medium yields positive outcomes in terms of conceptual understanding, motivation, learning engagement, and critical thinking skills. However, its effectiveness hinges on the design of learning activities and the students' active engagement in processing the information presented in the medium. Thus, the advantage of visual media lies not merely in its visual appeal, but in its capacity to provide stimuli that teachers can leverage to foster analytical and problem-solving processes.

Research findings also indicate that the control group experienced an improvement in critical thinking skills, albeit to a lesser extent than the experimental group. The control group's average N-Gain score of 0.187 falls into the low category. This improvement demonstrates that the instructional process still contributed to the students' knowledge and understanding. Nevertheless, instruction that did not utilize the "Strip Story" medium failed to provide a stimulus strong enough to generate the level of improvement in critical thinking skills observed in the experimental group.

The difference between the two groups became increasingly apparent in the post-test results. The experimental class achieved an average score of 79.14, whereas the control class obtained an average of 64.75. This performance gap indicates that students who learned using Strip Story media demonstrated superior ability in answering questions requiring thought processes and reasoning. These findings align with research by Zakiyah et al. (2026), which reported that the use of digital comic media in Natural and Social Sciences (IPAS) instruction—when integrated with problem-solving-oriented learning activities—can enhance the critical thinking skills and learning outcomes of elementary school students.

Consistent findings were also obtained in the study by Achmad et al. (2026). That research demonstrated that guided inquiry-based learning supported by digital comics positively influenced the critical thinking abilities of fourth-grade elementary school students.

These results reinforce the argument that visual and narrative-based media can contribute to the development of critical thinking, provided their use is accompanied by learning activities that encourage students to engage in exploration and reasoning.

The hypothesis test results yielded a t-value of $t(39) = 13.164$ with a significance level of $p < 0.001$. A significance level lower than 0.05 indicates a significant difference in the N-Gain of critical thinking skills between the experimental and control classes. Consequently, the null hypothesis was rejected, and the alternative hypothesis was accepted. Statistically, these results demonstrate that the improvement in critical thinking skills was greater in the group using the Strip Story medium compared to the control group.

This significant difference indicates that the Strip Story medium serves not merely as a visual aid but also as a means to foster students' cognitive activity. The sequence of stories and images allows students to acquire information incrementally. As students attempt to comprehend the relationships between different parts of the story, they must identify relevant information, compare events, link concepts to phenomena, and draw conclusions. This process helps students develop more structured thinking skills.

In science education, the use of media such as Strip Story aligns well with the nature of the subject matter. Science learning emphasizes not only the mastery of facts but also an understanding of the relationships between phenomena and the ability to use evidence to explain events. Story-based visual media can help bridge the gap between scientific concepts and students' concrete experiences. Therefore, such media can be utilized to present problems or phenomena for subsequent analysis by the students.

Recent studies on the use of comics in primary school Natural and Social Sciences (IPAS) instruction indicate that science comics contribute positively to learning outcomes, scientific literacy, motivation, and critical thinking skills. Their effectiveness is particularly evident when the content aligns with curriculum objectives and the use of the medium is accompanied by interaction and teacher guidance. This supports research findings suggesting that "Strip Story" media can serve as a relevant instructional alternative for fostering critical thinking skills at the primary school level.

Furthermore, research on digital media-based instruction in primary schools reveals a similar pattern. The use of media that provides clear visualization and enhances student engagement can lead to greater improvements in critical thinking skills compared to conventional instruction. For instance, research on video-based science instruction in primary schools found a significant increase in critical thinking skills among groups taught using video media. These findings demonstrate that the quality of visualization and active student engagement are two crucial aspects in the development of critical thinking skills.

Theoretically, the findings of this study reinforce the view that developing critical thinking skills depends not merely on the delivery of content but requires learning experiences that enable students to engage in active mental processes. Students need opportunities to encounter information, identify problems, connect concepts, analyze relationships, and justify the decisions they make. Strip Story media provides a visual and narrative context that can serve as a stimulus for carrying out these processes.

However, the N-Gain score for the experimental class falling within the moderate category—indicates that the use of Strip Story media has room for further development. To achieve more optimal improvement, the use of this medium could be combined with instructional models explicitly oriented toward developing higher order thinking skills, such as Problem-Based Learning, guided inquiry, or strategies centered on HOTS (Higher-Order Thinking Skills) questioning. Recent studies on integrating e-comics with Problem-Based Learning among elementary school students also demonstrate that combining visual media with problem-solving activities has the potential to strengthen the development of higher-order thinking skills.

Thus, the results of this study indicate that the Strip Story medium has potential as a science learning tool for enhancing the critical thinking skills of elementary school students. The strength of this medium lies in its ability to present information both visually and narratively, thereby making science concepts more concrete and easier for students to analyze. The use of this medium encourages students to engage in processes such as observing, connecting information, analyzing cause-and-effect relationships, providing reasoning, and drawing conclusions.

Overall, the research findings demonstrate that the use of the Strip Story medium resulted in a greater improvement in critical thinking skills compared to instruction in the control class. This is evidenced by an average N-Gain of 0.510 (moderate category) for the experimental class, whereas the control class achieved an average N-Gain of 0.187 (low category). Statistical test results also reveal a significant difference in improvement between the two groups ($p < 0.001$). Therefore, the Strip Story medium can be considered a viable alternative for science instruction in elementary schools, particularly for fostering active learning and supporting the development of students' critical thinking skills.

CONCLUSION

Based on the research findings, it can be concluded that the use of Strip Story media is effective in enhancing students' critical thinking skills in elementary school science lessons. This is evidenced by the increase in the average critical thinking score in the experimental class from 57.29 in the pretest to 79.14 in the posttest, with a mean N-Gain score of 0.510, falling into the medium category. Meanwhile, the control class showed an increase from 56.70 to 64.75, with an N-Gain score of 0.187, placing it in the low category.

Prerequisite test results indicate that the N-Gain data for both groups are normally distributed and possess homogeneous variances. Furthermore, the Independent Samples t-test results show a significance value of $p < 0.001$, indicating a significant difference in the improvement of critical thinking skills between students in the experimental class and those in the control class. Thus, science instruction utilizing Strip Story media yields a greater improvement in critical thinking skills compared to instruction in the control class.

Strip Story media serves as a viable alternative for science instruction in elementary schools because it presents concepts through visual and narrative representations that encourage students to observe, connect information, analyze cause-and-effect relationships, provide reasoning, and draw conclusions. Therefore, the use of Strip Story media is recommended as an alternative to support science learning that is more active and oriented toward developing students' critical thinking skills.

Conflict Of Interest

The authors declare no conflict of interest

Generative AI Statement

In the preparation of this manuscript, AI-assisted tools were employed solely for limited linguistic refinement and stylistic enhancement. The development of the conceptual framework, data interpretation, methodological design, and all substantive scholarly content was independently undertaken and critically reviewed by the authors. The authors assume full responsibility for the accuracy, integrity, and final content of the manuscript.

Author Contribution Statement

Widi Fadila Utari: Conceptualization, methodology, instrument development, data collection, data analysis, interpretation of results, writing original draft, and revision of the manuscript.

Oktavia: Conceptualization, research design, methodology validation, supervision, data interpretation, writing review and editing, and final manuscript validation. All authors contributed substantially to the development of the study, critically reviewed and approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

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