ENHANCING CRITICAL THINKING IN PRIMARY EDUCATION: A LITERATURE REVIEW ON EFFECTIVE LEARNING MEDIA

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Abstract

The enhancement of students' critical thinking skills has become an essential priority across all educational levels, particularly in primary schools. This study analyzes the use of learning media to improve critical thinking skills among primary school students. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology was employed to address the research questions systematically. A total of 18 articles from various countries, including Indonesia, Taiwan, Thailand, Hong Kong, Malaysia, Jordan, Vietnam, and Kazakhstan, were reviewed. Indonesia contributed the highest number of studies, with nine articles, followed by Taiwan with two articles. The learning media identified in these studies were classified into four main categories: (1) multimedia and interactive visual media, (2) interactive digital applications and platforms, (3) flipped learning and hybrid learning, and (4) game-based and gamified applications. The findings indicate that multimedia and interactive visual media are the most frequently used and effective in enhancing critical thinking skills, as they support visualization, interactivity, and problem-solving. Interactive digital applications, flipped learning, and digital games were also found to improve critical thinking through independent learning, hypothesis formulation, analysis, and gamification mechanisms. These results underscore the importance of selecting appropriate learning media to support the development of critical thinking skills among primary school students in the era of digital learning technologies.

Keywords: Critical Thinking, Educational Technology, Interactive, Learning Media, Primary School.

INTRODUCTION

The development of 21st-century education requires students not only to master factual knowledge but also to acquire higher-order thinking skills, particularly critical thinking. This skill serves as a foundation for elementary school students to analyze information, evaluate arguments, and make sound decisions in their daily lives. However, in many cases, the instructional media currently employed in classrooms do not adequately foster critical thinking. For instance, a study reported that the instructional media used in mathematics learning was ineffective in enhancing students' critical thinking skills (Cahyani & Irwan, 2020). This gap provides the rationale for conducting a systematic literature review to examine appropriate learning media that can strengthen critical thinking in elementary education.

Investigating this issue is crucial because elementary school represents the initial phase of developing children's thinking abilities. At this stage, students are in Piaget's concrete operational stage of cognitive development, during which they acquire essential skills such as conservation, classification, and seriation competencies that are fundamental to problem-solving and reasoning (Garvis, 2020; Meadows, 2017; Olorunfemi-Olabisi & Tayo-Olajubutu, 2013). Consequently, they require appropriate learning media to bridge abstract concepts and facilitate comprehension. Well-designed instructional media should not merely function as visual aids but also promote active engagement, stimulate discussions, and challenge students to explore ideas. Thus, the strategic use of instructional media has significant potential to foster the development of critical thinking skills from an early age.

From an educational perspective, the lack of critical thinking skills negatively impacts students' learning outcomes. Learners who develop strong critical thinking abilities tend to perform better academically because they can analyze and interpret information more effectively, which in turn leads to higher-quality work and improved academic achievement (D'Alessio et al., 2019; Kulamikhina et al.,

2018; Meadows, 2017). Teachers often struggle to cultivate active student engagement when the learning media employed are monotonous and rely heavily on rote memorization. From the students' standpoint, limited critical thinking skills may hinder their ability to meet the challenges of the 21st century, which emphasizes the 4Cs: Critical thinking, Creativity, Collaboration, and Communication. From a policy perspective, this limitation may obstruct the achievement of curriculum goals. Therefore, identifying effective strategies through the integration of appropriate learning media is essential to improving the quality of elementary education.

Recent studies have demonstrated the potential of various digital, interactive, and conventional learning media in supporting critical thinking. Tools such as videos, animations, digital modules, and interactive applications have shown positive impacts on students' critical thinking abilities (Gao, 2003; Suci R. et al, 2025). Nevertheless, despite the growing body of research, there has not been a comprehensive synthesis of knowledge across studies, making it difficult for teachers and practitioners to determine the most effective media for elementary school contexts. Moreover, existing studies often focus on media innovation without assessing the long-term impact on students' critical thinking development. This creates a research gap that warrants further investigation through systematic literature reviews based on international databases such as Scopus.

This study, therefore, aims to: (1) map the distribution of research by country, (2) categorize the types of instructional media that can enhance students' critical thinking skills, and (3) identify media proven effective in improving critical thinking at the elementary level. By conducting a systematic literature analysis using Scopus, this study is expected to provide a comprehensive overview of global research trends, highlight existing gaps, and propose evidence-based recommendations for the use of instructional media that truly support the advancement of critical thinking in elementary education.

METHODS

This literature review examines various studies on the use of instructional media in elementary schools, focusing on the development of critical thinking skills from a global perspective. The methodology employed follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Takkouche & Norman, 2011). Article searches were conducted using the Scopus database as the primary reference, given its extensive collection of peer-reviewed academic journals. Subsequently, the reference lists of relevant articles were screened using appropriate Boolean logic to identify additional studies eligible for inclusion in the research database. The search process was carried out by applying Boolean operators formulated from the following keywords: ("elementary school" OR "primary school") AND ("learning media" OR "digital media" OR "multimedia" OR "interactive media" OR "educational technology") AND ("critical thinking" OR "higher order thinking" OR "thinking skills").

Inclusion Criteria

The criteria established for screening and specifying articles relevant to the research topic were as follows:

1. Articles published within the last ten years (2015–2025),
2. Document type limited to journal articles,
3. Source type restricted to peer-reviewed journals, and
4. Studies focusing on the use of instructional media that stimulate critical thinking among elementary school students.

Screening and Selection

The selection of sources was focused exclusively on articles published in academic journals. The literature search on instructional media that enhance critical thinking among elementary school students in a global context was conducted through the subscription-based Scopus database. The search employed predetermined Boolean keywords, which initially identified 94 documents. After applying inclusion criteria 1 to 3, the number of documents was reduced to 37. The next step involved screening the titles and abstracts to identify studies specifically addressing the use of instructional media that stimulate critical thinking among elementary school students (Inclusion Criterion 4), resulting in 18 documents. Several articles were excluded because the research samples did not involve elementary school students or did not explicitly examine the role of instructional media in developing critical thinking at this level. The final set of documents was then classified by extracting essential data, including: (1) title and authors,

(2) year of publication, (3) research focus, (4) media employed, (5) methodology, (6) key findings, (7) country, and (8) research limitations (Assad et al., 2025).

FINDINGS AND DISCUSSION

The results from the 18 selected articles were systematically analyzed using the PRISMA method. The complete process is illustrated in Figure 1, the PRISMA Flow.

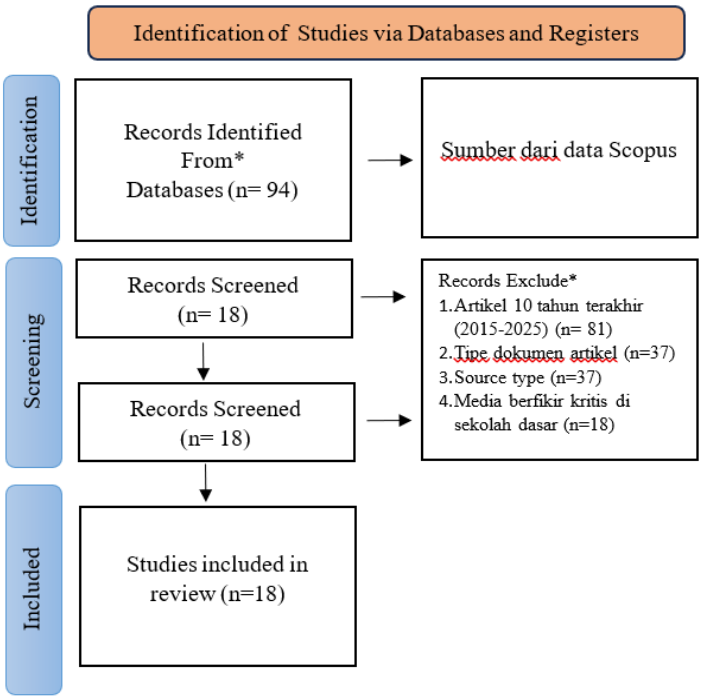

Figure 1. PRISMA Flow Diagram

Distribution of Research on Instructional Media for Critical Thinking Skills by Country

Research on the development of instructional media to enhance critical thinking skills in elementary schools shows that Indonesia is the primary contributor, accounting for 10 of the 18 reviewed articles. Studies conducted in Indonesia focus on a wide range of technology-based learning media, including interactive multimedia, digital student worksheets (LKS), problem-based learning (PBL) e-books, adaptive hybrid media, local wisdom–based modules, and STEM-oriented applications. This reflects the strong commitment of Indonesian researchers to integrating technology in education to foster students' critical and creative thinking skills (Fajari et al., 2020; Hasanah et al., 2023; Hermita et al., 2023; Kumala et al., 2019; Sulistyanto et al., 2023; Susanto et al., 2022; Uslan et al., 2024; Utaminingsih et al., 2024).

Beyond Indonesia, several other countries have also contributed to research on technology-based learning media, albeit on a smaller scale. Taiwan contributed two studies, one on the integration of Augmented Reality (AR) in flipped learning and another on interactive problem-posing e-books to enhance science project performance and higher-order thinking skills among elementary students (Chang & Hwang, 2018; Sung et al., 2019). Other countries each contributed one study: Thailand with the use of an Angry Birds game application in a STEM context (Tannirat, 2020); Hong Kong with an online WebQuest designed to develop students' critical thinking (Liang & Fung, 2020); Malaysia with an inquiry-based AIBASE application (Ruzaman & Rosli, 2020); Jordan with a gamification-based digital learning application (Al-Barakat et al., 2025); Vietnam with an AR-based flipped classroom model (Tiep & Huong, 2025); and Kazakhstan with a digital design platform to support the recognition of artistic techniques (Anapiyayeva et al., 2025).

This distribution indicates that although technology-based instructional media research is conducted in various countries, Indonesia demonstrates clear dominance in both the number of studies and the diversity of media employed. This highlights the significance of local context and technological adaptation in the development of elementary education.

Tabel 1. Distribution of Research on Instructional Media for Critical Thinking Skills in Elementary Schools by Country

Country	Number of Studies	Examples of Focus/Media Used
Indonesia	10	Interactive multimedia, digital worksheets (LKS), PBL-based e-books, adaptive hybrid media, local wisdom–based modules, STEM applications
Taiwan	2	AR integration in flipped learning; interactive problem-posing e-books
Thailand	1	Angry Birds game application in STEM learning
Hong Kong	1	Online WebQuest for critical thinking
Malaysia	1	Inquiry-based AIBASE application
Jordan	1	Gamification-based digital learning application
Vietnam	1	AR-based flipped classroom model
Kazakhstan	1	Digital design platform for recognizing artistic techniques
Mean	18	

Grouping of Instructional Media Used to Enhance Students' Critical Thinking Skills

Instructional media employed to enhance critical thinking skills among elementary school students can be grouped into four main categories. The first is multimedia and interactive visual media, which includes various forms of digital visualization such as Problem-Based Learning (PBL)-based multimedia, Prezi, ethnomathematics multimedia, and Science Learning Multimedia (SLM). These media enable students to learn through visualization, interactivity, simulation, and narrative, thereby effectively fostering critical and creative thinking skills. Research has shown that the use of PBL multimedia and image-based media can improve elementary students' critical thinking abilities (Fajari et al., 2020), while PBL-based Prezi has also been proven to support critical thinking skills (Kumala et al., 2019). Interactive ethnomathematics multimedia has been found to enhance students' creativity and motivation (Ilma et al., 2024), whereas interactive Science Learning Multimedia (SLM) grounded in scientific inquiry is also considered essential by teachers to support critical thinking (Hasanah et al., 2023).

The second category is game applications and gamification, which are designed to improve systematic, creative, and mathematical thinking through game-based mechanisms. For instance, the Angry Birds application in the STEM context has been used to train systematic thinking and 21st-century skills among elementary students(Tannirat, 2020), while gamification-based digital game applications have proven effective in enhancing mathematical thinking skills (Al-Barakat et al., 2025). Game-based applications facilitate experimental and trial-and-error learning, motivating students to think critically through play-based experiences.

The third category is interactive digital applications and platforms, which include interactive e-books, WebQuest, the AIBASE application, and digital design platforms such as Canva, Popplet, and Padlet. These media enable students to engage in self-directed learning, explore content, and practice critical thinking through interactive activities. Problem-posing–based e-books have been shown to foster higher-order thinking tendencies among elementary students (Sung et al., 2019), online WebQuest has been effective in training critical thinking in English language learning (Liang & Fung, 2020), the AIBASE application has supported students in formulating hypotheses during science experiments (Ruzaman & Rosli, 2020), and digital design platforms have helped students recognize artistic techniques in literary texts (Anapiyayeva et al., 2025).

The fourth category is flipped learning and hybrid learning, which combine flipped classroom or hybrid learning approaches with technologies such as Augmented Reality (AR) and adaptive media tailored to learning styles. This approach emphasizes a blend of online and face-to-face learning as well as personalization according to students' characteristics. The use of AR in flipped learning has been shown to improve science project performance and students' perceptions (Chang & Hwang, 2018), AR-based flipped classroom models have enhanced effectiveness, motivation, and conceptual understanding in science and social studies (Tiep & Huong, 2025), and adaptive hybrid learning media aligned with the VARK learning styles have also supported the development of critical thinking skills (Sulistyanto et al., 2023).

Table 2. Classification of Media Categories for Enhancing Critical Thinking Skills

Category of Media	Examples of Media/Applications
Multimedia and Interactive Visuals	PBL-based multimedia, Prezi, ethnomathematics multimedia, Science Learning Multimedia (SLM)
Game Applications and Gamification	Angry Birds STEM application, gamification-based digital games
Interactive Digital Platforms	Interactive e-books, WebQuest, AIBASE application, Canva, Popplet, Padlet, digital design platforms
Flipped and Hybrid Learning	AR-based flipped classroom, AR in science projects, adaptive hybrid learning media tailored to learning styles

Media with the Greatest Impact on Students' Critical Thinking

Multimedia-based and interactive visual media represent the most widely used group of media in studies aimed at enhancing elementary school students' critical thinking skills. Of the 18 articles reviewed, four employed this type of media, including PBL-based multimedia, Prezi, ethnomathematics multimedia, and Science Learning Multimedia (SLM) (Fajari et al., 2020; Hasanah et al., 2023; Ilma et al., 2024; Kumala et al., 2019). These media are not only frequently used but have also been proven effective in fostering critical thinking skills, as they provide visual stimuli, narratives, interactive simulations, and problem-solving activities that encourage students to analyze, evaluate, and generate solutions. For example, (Fajari et al., 2020) reported a significant improvement in critical thinking through the use of PBL-based multimedia, while (Ilma et al., 2024), demonstrated that ethnomathematics-based multimedia enhanced elementary students' creativity and learning motivation.

Interactive digital applications and platforms constitute the second most widely utilized group of media, with four studies also employing this type (Anapiyayeva et al., 2025; Liang & Fung, 2020; Ruzaman & Rosli, 2020; Sung et al., 2019). These media support self-directed learning, interactive exploration of content, and the development of higher-order thinking skills such as problem-posing, hypothesis experimentation, and text analysis. Their effectiveness is evident in studies such as Sung et al. (2019), which showed that problem-posing–based interactive e-books enhanced students' higher-order thinking dispositions, and Anapiyayeva et al. (2025), which confirmed that digital platforms improved students' ability to recognize artistic techniques in literary texts.

Flipped learning and hybrid learning, along with game-based applications and gamification, were less frequently examined (three and two articles, respectively), yet both demonstrated considerable potential in enhancing critical thinking. For instance, AR in flipped classrooms improved science project performance, motivation, and conceptual understanding in science and social studies (Chang & Hwang, 2018; Tiep & Huong, 2025), while adaptive hybrid learning media tailored to VARK learning styles effectively strengthened critical thinking skills (Sulistyanto et al., 2023). Similarly, gamification-based digital game applications, such as Angry Birds (Tannirat, 2020) and mathematics gamification tools(Al-Barakat et al., 2025), were shown to promote systematic, creative, and problem-solving thinking through trial-and-error mechanisms, thereby actively fostering critical thinking skills.

Based on this review, multimedia and interactive visual media emerge as the most widely adopted and consistently effective type of media in improving elementary school students' critical thinking skills. This can be attributed to their ability to present information in visual and interactive formats, making it easier for students to grasp concepts, analyze problems, and develop creative solutions (Fajari et al., 2020; Hasanah et al., 2023; Ilma et al., 2024; Kumala et al., 2019).

CONCLUSION

The article search across various countries revealed that Indonesia contributed the largest number of research documents, with 10 studies, followed by Taiwan with 2 studies. The learning media identified were classified into four main categories: (1) multimedia and interactive visual media, (2) interactive digital applications and platforms, (3) flipped learning and hybrid learning, and (4) game-based applications and gamification. Among these, multimedia and interactive visual media emerged as the

most frequently used and effective in enhancing critical thinking skills, as they support visualization, interactivity, and problem-solving activities. These findings underscore the importance of selecting appropriate learning media to foster the development of critical thinking skills among elementary school students in the era of digital learning technologies.

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