

Systematic Literature Review of Fairy Tale-Based Literacy Interactive Flashcard Media in Elementary Science Learning

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Abstract

Scientific literacy is an essential competency that should be developed from the elementary school level; however, numerous studies indicate that Indonesian students' scientific literacy remains relatively low. Therefore, innovative learning media that integrate visual, narrative, and digital technology elements are needed. This study aims to synthesize research findings on flashcards, storytelling, fairy tales, and scientific literacy, as well as to identify opportunities for developing Fairy Tale-Based Literacy Interactive Flashcards (Litraflash) in elementary science education. This study employed a Systematic Literature Review (SLR) following the PRISMA guidelines. Data were collected from Google Scholar, ERIC, DOAJ, and national and international journals published between 2020 and 2026. Of the 56 articles initially identified, 27 met the inclusion criteria and were analyzed using thematic analysis. The findings revealed that flashcards have evolved into interactive digital media, storytelling and fairy tales contribute to student engagement, and visual-interactive learning media have the potential to support scientific literacy development. The review also indicates that integrating visual media, contextual narratives, and interactive technology through Litraflash offers a promising innovation for elementary science learning. However, its effectiveness still requires further empirical investigation, so further research on this topic is crucial to pursue, as it makes a tangible contribution to the relevant fields of study.

Keywords:

Fairy Tales, Flashcards, Litraflash, Scientific Literacy, Storytelling

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Info Artikel	Abstrak
<i>Riwayat Artikel</i> Dikirim: 04 Mei 2026 Diterima: 15 Juni 2026 Diterbitkan: 20 Juni 2026	Literasi sains merupakan kompetensi penting yang perlu dikembangkan sejak sekolah dasar, namun berbagai penelitian menunjukkan bahwa kemampuan literasi sains siswa Indonesia masih relatif rendah. Oleh karena itu, diperlukan inovasi media pembelajaran yang mampu mengintegrasikan unsur visual, naratif, dan teknologi digital. Penelitian ini bertujuan untuk mensintesis hasil penelitian mengenai flashcard, storytelling, fairy tale, dan literasi sains serta mengidentifikasi peluang pengembangan Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) dalam pembelajaran IPA sekolah dasar. Penelitian menggunakan metode Systematic Literature Review (SLR) dengan pedoman PRISMA. Data diperoleh dari Google Scholar, ERIC, DOAJ, serta jurnal nasional dan internasional periode 2020–2026. Dari 56 artikel yang teridentifikasi, sebanyak 27 artikel memenuhi kriteria inklusi dan dianalisis menggunakan analisis tematik. Hasil kajian menunjukkan bahwa flashcard berkembang menjadi media digital interaktif, storytelling dan fairy tale berkontribusi terhadap keterlibatan belajar siswa, serta media pembelajaran berbasis visual dan interaktif berpotensi mendukung pengembangan literasi sains. Temuan penelitian juga menunjukkan bahwa integrasi media visual, narasi kontekstual, dan teknologi interaktif dalam Litraflash berpotensi menjadi inovasi pembelajaran IPA yang mendukung pengembangan literasi sains siswa sekolah dasar. Namun, efektivitasnya masih memerlukan pengujian empiris lebih lanjut, sehingga penelitian lanjut pada topik ini sangat penting untuk dikembangkan karena memiliki kontribusi nyata pada keilmuan terkait.
Kata Kunci:	Dongeng, Flashcards, Litraflash, Literasi Sains, Storytelling
Cara mengutip:	Raharjo, R. B., Widiarti, N., & Widiyatmoko, A. (2026). Systematic literature review of fairy tale-based literacy interactive flashcard media in elementary science learning. <i>Didaktika</i> , 6(2), 151-167.

INTRODUCTION

Scientific literacy is an essential competency that needs to be developed from elementary school. Scientific literacy encompasses not only mastery of scientific concepts but also the ability to understand natural phenomena, interpret evidence-based information, and use scientific knowledge in everyday decision-making. These skills are becoming increasingly important in the 21st century as students face a variety of issues that require critical thinking, problem-solving, and responsible decision-making. However, various studies indicate that the scientific literacy skills of elementary school students in Indonesia still need to be improved, necessitating more effective and contextual learning innovations (Naresti & Suratmi, 2024).

Science learning in elementary schools plays a crucial role in building the foundation of students' scientific literacy. Through science learning, students are expected to understand scientific concepts and connect them to phenomena they encounter in everyday life. However, the science learning process still faces various challenges. One frequently encountered problem is the use of learning media that cannot visualize scientific concepts concretely, resulting in students having difficulty understanding abstract material. This condition results in low student engagement during learning and less than optimal achievement of scientific literacy competencies (Zahara et al., 2024).

To address these issues, various studies have developed visual-based learning media tailored to the characteristics of elementary school students. One widely used medium is flashcards. This medium is considered capable of presenting information in a simple, engaging, and easy-to-understand manner through a combination of text and images. Sari et al. (2023) reported that flashcards are suitable for use in science learning because they help students understand the material through engaging visual representations. The results of a study conducted by Maulida et al. (2026) also showed that the use of flashcards has a positive impact on elementary school students' understanding of science concepts and learning outcomes.

The development of digital technology has driven the transformation of flashcards from conventional media into more interactive learning media. Various innovations have been developed, such as QR Code Flashcards, website-based e-flashcards, and augmented reality flashcards. Annastasya and Fathurrahman (2024) demonstrated that QR Code Flashcards can improve student learning outcomes through more flexible access to materials. Meanwhile, Arsyafa et al. (2022) developed website-based e-flashcards that are effective for use in elementary school science learning. In a more recent development, Setiawan et al. (2022) found that augmented reality flashcards can improve students' scientific literacy through more concrete visualizations of scientific objects and phenomena.

In addition to visual media, narrative-based approaches also show significant potential in supporting science learning. Storytelling allows learning materials to be conveyed through engaging storylines, making them easier for students to understand. Gürsoy (2021) explains that digital storytelling can increase learning motivation and conceptual understanding in science learning. These statements are supported by Nasir et al. (2024), who concluded that storytelling has a positive impact on students' cognitive, affective, and social aspects. Thus, storytelling not only conveys information but also creates a more meaningful learning experience. In the context of storytelling, fairy tales have characteristics that are appropriate for the cognitive development of elementary school students. Fairy tales present stories that are close to children's world, thus increasing attention, imagination, and emotional engagement during the learning process. Xu et al. (2022) explain that fairy tales can help students understand narrative structures and develop the ability to comprehend information presented in story form. This potential shows that fairy

tales can be used as a supporting medium in presenting science concepts in a more contextual and easy-to-understand manner.

Although research on flashcards, storytelling, and scientific literacy has grown rapidly in recent years, most studies still examine each component separately. Research on flashcards generally focuses on improving learning outcomes and understanding of science concepts. On the other hand, research on storytelling is more directed at improving student motivation, literacy skills, and engagement. Sofiana et al. (2025) showed that interactive flashcards have the potential to improve learning outcomes and scientific literacy in elementary school students. However, studies specifically integrating elements of interactive flashcards, storytelling, and scientific literacy orientation within a single learning framework are still very limited.

Furthermore, no systematic study has been found specifically synthesizing research findings related to the potential integration of these three components in elementary school science learning. However, combining visual media, storytelling, and interactive technology has the potential to provide a multisensory learning experience that can optimally support the development of students' scientific literacy. The lack of a comprehensive synthesis on this topic indicates a research gap that requires further attention.

Based on these gaps, this study was conducted using a Systematic Literature Review (SLR) approach to identify, analyze, and synthesize various research findings related to flashcards, storytelling, fairy tales, and scientific literacy at the elementary school level. This study aims to analyze the development of interactive flashcard media, identify the contribution of storytelling and fairy tales in science learning, evaluate their contribution to elementary school students' scientific literacy, and formulate opportunities for developing Fairy Tale-Based Literacy Interactive Flashcards (Litrafash) as an innovative science learning media in elementary schools.

METHODS

Research Design

This study used the Systematic Literature Review (SLR) method to identify, evaluate, and synthesize research findings related to flashcard media, storytelling, fairy tales, and scientific literacy in elementary school science learning. The SLR method was chosen because it allows researchers to obtain a comprehensive overview of the development of a research topic through a systematic process of identifying, evaluating, and synthesizing literature (Deslis et al., 2025). Furthermore, this approach helps researchers identify research trends, research gaps, and opportunities for future research development (Safitri et al., 2026). This study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA aims to ensure the article selection process is transparent, systematic, and replicable by other researchers (Deslis et al., 2025). The steps involved include identification, screening, eligibility, and inclusion of studies.

Research data were obtained through article searches in Google Scholar, ERIC, and DOAJ databases, as well as various national and international journals relevant to basic education, learning media, and scientific literacy. Multiple data sources were used to obtain a broader scope of the literature and thus improve the quality of the research synthesis (Chourio-Acevedo et al., 2024). The search was conducted on articles published between 2020 and 2026. The search used a combination of keywords and Boolean operators as follows: ("interactive flashcard" OR "digital flashcard" OR flashcard) AND (storytelling OR "digital storytelling" OR "fairy tale") AND ("scientific literacy" OR "science literacy") AND ("elementary school" OR "primary school")

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were established to ensure that the articles analyzed were relevant to the research objectives and met the quality standards required for the literature synthesis process. The criteria used in this study are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published in the period 2020–2026	Articles published before 2020
Articles are available in full text form	Articles available only in abstract form
Articles in Indonesian or English	Articles other than Indonesian and English
Articles discussing flashcards, interactive flashcards, storytelling, fairy tales, scientific literacy, or elementary school science learning	Articles that are not related to the research focus
Empirical research articles, research and development (R&D), experiments, mixed methods, reviews, and relevant conceptual studies	Duplicate articles found in more than one database
The article has findings that can support the conceptual synthesis of Litraflash development.	Articles that do not present relevant research results or findings

Articles that met all inclusion criteria and did not fall under the exclusion criteria were retained for the eligibility assessment stage. Furthermore, articles that passed the selection process were used as the primary data source for thematic synthesis and analysis. This approach was chosen because the study aimed to build a conceptual synthesis of Fairy Tale-Based Literacy Interactive Flashcards (Litraflash) that integrates visual media, a narrative approach, and a scientific literacy orientation in elementary school science learning.

Quality Assessment

To improve the quality of the synthesis and reduce the potential for bias, each article that meets the inclusion criteria is evaluated using Quality Assessment (QA). The assessment is based on five indicators, namely: (1) the research objectives are clearly explained, (2) the research methods are in accordance with the research objectives, (3) the subjects or data sources are adequately explained, (4) the research procedures or instruments are clearly explained, and (5) the research results are relevant to the focus of the study.

Table 2. Quality Assessment Criteria

Code	Criteria
QA1	The research objectives are clearly explained
QA2	Research methods are in accordance with research objectives
QA3	The subject or source of the data is adequately described
QA4	Research instruments or procedures are clearly explained
QA5	The research results are relevant to the focus of the study

Each criterion was given a score of 1 if met and 0 if not. Articles that received a score of at least 4 were retained for the synthesis process. The assessment results showed that all articles used received scores between 4 and 5, thus being deemed of sufficient quality to support the development of a conceptual synthesis of Fairy Tale-Based Literacy Interactive Flashcard (Litraflash).

Table 3. Summary of Quality Assessment Results

Score Range	Number of Articles
5	16
4	11
< 4	0
Total	27

The Quality Assessment results showed that all articles used in the synthesis received scores between 4 and 5. Sixteen articles received a score of 5 and 11 articles received a score of 4; thus all articles were deemed to meet the established quality standards.

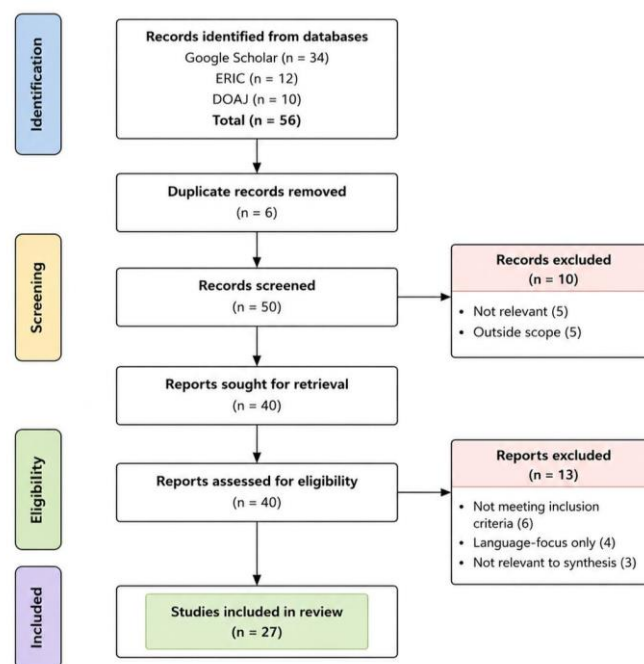


Figure 1. PRISMA Diagram

Data and Data Analysis

Based on the literature search results, 56 articles were obtained from Google Scholar (n = 34), ERIC (n = 12), and DOAJ (n = 10). After the identification process, 6 duplicate articles were removed, leaving 50 articles for the screening stage. In the screening stage based on title and abstract, 10 articles were excluded because they were not relevant to the research focus. Next, 40 articles entered the eligibility stage and were reviewed in full (full-text review). The review results showed that 13 articles did not meet the inclusion criteria because they did not have adequate

links to flashcard media, storytelling, scientific literacy, or elementary school science learning. Thus, 27 articles met all inclusion criteria and were used in the final synthesis.

The assessment results showed that 27 articles met all inclusion criteria and were used in the synthesis process. The articles included research on flashcards, interactive flashcards, storytelling, fairy tales, digital learning media, and scientific literacy relevant to the research objectives. The selected articles had a conceptual link to one or more components of Litraflash, namely flashcards, storytelling/fairy tales, scientific literacy, and elementary school science learning. The selection of articles was carried out to obtain a comprehensive synthesis regarding the integration of visual media, narrative approaches, and strengthening scientific literacy as the conceptual basis for the development of Fairy Tale-Based Literacy Interactive Flashcards (Litraflash).

In addition to the articles used in the main synthesis, several other articles were used as supporting references to strengthen the theoretical foundation and discussion of the research. Articles that did not meet the inclusion criteria or were identified as duplicates were excluded from the analysis process. Data were analyzed using a thematic analysis approach to identify patterns, trends, and relationships among research findings. The analysis process involved identifying key findings, coding the data, grouping the findings into categories with similar meanings, and developing key themes that emerged repeatedly across the studies (Deslis et al., 2025).

RESULTS AND DISCUSSION

Based on a selection process using the PRISMA guidelines, 27 articles met the inclusion criteria and were used as the primary data sources in the literature synthesis. The articles were published between 2020 and 2026 and come from various national and international journals covering flashcard media, interactive flashcards, storytelling, fairy tales, scientific literacy, and elementary school science learning.

The results of the thematic analysis show that the research reviewed can be grouped into four main themes, namely: (1) the development of flashcard and interactive flashcard media in elementary school learning; (2) the contribution of storytelling and fairy tales in student learning and literacy; (3) the contribution of learning media to improving elementary school students' scientific literacy; and (4) opportunities for developing Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) in elementary school science learning. These four themes are interrelated and show the direction of learning media development that increasingly emphasizes the integration of visual, narrative, and digital technology elements.

Table 4. Characteristics of Articles that Support Litraflash Conceptual Synthesis (2020–2026)

No	Author (Year)	Research Title	Method	Key Findings
1	Nasir et al. (2024)	Digital Storytelling Learning Outcomes and Critical Factors: A Scoping Review	Scoping Review	Digital storytelling improves students' cognitive, affective, and social learning outcomes.
2	Sari et al. (2023)	Flashcard Media Innovation in Thematic Science Lessons Growth and Development of Living Creatures in Elementary Schools	R&D	Flashcards are suitable for use in elementary school science learning.

3	Sofiana et al. (2025)	Analysis of the Application of Interactive Flashcard Learning Media to Improve Learning Outcomes and Science Literacy in Elementary Schools	Literature Review	Interactive flashcards improve students' learning outcomes and science literacy.
4	Setiawan et al. (2025)	Developing Augmented Reality-Based Flashcards to Enhance Science Literacy in Elementary Schools	R&D (ADDIE)	AR Flashcard improves elementary school students' scientific literacy skills.
5	Zainuri et al. (2025)	Digital Literacy and Science Literacy: A Correlational Review of Elementary School Students	SLR	Digital literacy and scientific literacy have a positive and mutually reinforcing relationship.
6	Puteri & Maarif (2025)	Development of SIAR (Water Cycle) Augmented Reality Learning Media to Improve Students' Science Literacy	R&D (4D)	AR media effectively improves students' scientific literacy on the water cycle material.
7	Muhammad & Laelasari (2025)	Parijoto Syrup as a Literacy of Students' Local Wisdom: An Innovation of Ethnoscience Flashcards in Science Learning	R&D	Ethnoscience flashcards based on local wisdom are effective in improving scientific literacy, understanding of science concepts, and recognition of local culture in elementary school students.
8	Utami et al. (2025)	Canva-Based Interactive Flashcard Development Needs Analysis to Optimize Early Reading Learning in Elementary Schools	Needs Analysis	Canva-based flashcards support early literacy in elementary school students.
9	Mulbar et al. (2025)	Scientific-Based Digital Storytelling to Enhance Science Literacy and Environmental Awareness	Development Research	Science-based digital storytelling improves students' scientific literacy, data interpretation, and environmental awareness.
10	Annastasya & Fathurrahman (2024)	Development of QR Code-Based Flash Card Media to Improve Learning Outcomes of Grade IV Students	R&D (ADDIE)	QR Flashcards improve student learning outcomes.
11	Lestari et al. (2020)	The Effectiveness of PBL Assisted by Digital Storytelling Media towards Science Literacy and Critical Thinking Skills	Mixed Methods	Digital storytelling in science learning improves scientific literacy and critical thinking of elementary school students.
12	Setiawan et al. (2022)	Flashcard-Based Augmented Reality to Increase Students' Scientific Literacy	Quasi Experiment	Students' scientific literacy is improved through AR Flashcards.
13	Sevim & Denizhan (2025)	The Effect of Scientific Digital Storytelling on Students' Scientific Process Skills and Attitudes Towards Science	Experimental Study	Scientific digital storytelling improves science process skills and positive attitudes towards science learning.
14	Putri et al. (2024)	Interactive Learning Media Loaded with Human Growth and Development Materials in Science Learning in	R&D (ADDIE)	Valid and practical interactive media for use in science.

		Elementary Schools that is Decent and Practical		
15	Naresti & Suratmi (2024)	Developing Digital Storybooks to Enhance Primary School Students' Scientific Literacy: A Needs Analysis	Needs Analysis	Digital storybooks support the development of scientific literacy.
16	Gürsoy (2021)	Digital Storytelling in Science Education: A Review of the Literature	Literature Review	Digital storytelling supports students' understanding of science concepts, motivation to learn, and engagement in learning.
17	Ulfa & Fadilah (2025)	Development of Augmented Reality-Based Flashcard Instructional Media for Natural Science Learning in Madrasah Ibtidaiyah	R&D (ADDIE)	AR Flashcards improve understanding of science concepts.
18	Barus et al. (2026)	Development of Science Learning Media Based on Scientific Literacy for Elementary School Students	R&D (ADDIE)	Valid and effective science literacy-based media improve elementary school students' understanding of science concepts.
19	Muzdalifah & Sutisna (2026)	The Development of Interactive Digital Magazine Media on the Scientific Literacy Skills of Fifth Grade Elementary School Students	R&D and Quasi-Experiment	Media improves elementary school students' scientific literacy.
20	Zahara et al. (2024)	Development of Flashcard Learning Media in Science Learning for Class V	R&D (4D)	Flashcards are valid, practical, and effective to use.
21	Fasihah et al. (2026)	The Impact of Using Problem-Based Learning (PBL) with Augmented Reality Flashcards on Elementary School Students' Scientific Literacy	Quasi Experimental	AR Flashcards significantly improve elementary school students' scientific literacy and problem-solving skills.
22	Safitri et al. (2026)	Trends and Strategies for Improving Elementary School Students' Scientific Literacy in Science Learning	SLR (PRISMA)	Digital media, STEM, and educational games dominate the increase in science literacy.
23	Eldo & Najmi (2025)	Design and Implementation of an Interactive Science Educational Game to Improve Science Literacy of Elementary Students in Grades 3–6	Design and Development	Educational games improve understanding of science concepts and scientific literacy.
24	Nurwidiyanti & Sari (2022)	Development of Flipbook Learning Media Based on Scientific Literacy in Elementary School Science Learning	R&D (ADDIE)	Scientific literacy-based flipbooks improve students' scientific literacy skills.
25	Maulida et al. (2026)	The Effectiveness of Flashcards Media on Elementary School Students' Science Learning Outcomes on Animal Grouping Material: A Literature Review	Literature Review	Flashcards effectively improve elementary school students' science learning outcomes.

26	Arsyafa et al. (2022)	Development of Website-Based e-Flashcard Learning Media for Elementary School Science Learning	R&D (ADDIE)	Website-based e-flashcards are valid, practical, and effective.
27	Rusydiana, Widodo, & Suprpto (2023)	The Development of Picture Story Book to Improve the Science Literacy Skills of Grade 4 Elementary School Students	Development Research	Picture story books effectively improve the scientific literacy skills of elementary school students.

To enhance the suitability of the article corpus to the research focus, articles that focused solely on general language skills or social issues in fairy tales without adequate links to science learning, scientific literacy, or flashcard media were excluded from the final synthesis. Therefore, the articles used in this study have a stronger relevance to the development of the Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) concept.

Table 5. Example of Thematic Analysis Process

Initial Findings	Code	Category	Theme
QR Code Flashcards improve learning outcomes	Digital Flashcard	Visual Media Innovation	The Development of Flashcard Media
Augmented Reality Flashcards Improve Science Literacy	AR Flashcard	Visual Media Innovation	The Development of Flashcard Media
Digital storytelling increases learning motivation	Storytelling	Learning Narrative	Storytelling and Fairy Tale Contributions
Fairy tales increase students' emotional involvement	Fairy Tale	Learning Narrative	Storytelling and Fairy Tale Contributions
Digital storybooks support science literacy	Science Literacy Media	Science Literacy	Media Contribution to Scientific Literacy
Integration of visuals, stories, and digital technology	Litraflash Concept	Conceptual Synthesis	Litraflash Development Opportunities

The thematic analysis process is carried out in four stages: identifying the main findings of each article, coding, grouping codes into categories with similar meanings, and compiling main themes that form the basis for synthesizing research results.

Discussion

The Development of Flashcard Media in Elementary School Learning

The synthesis results show that flashcards have undergone significant development in recent years. Initially, flashcards were used as a simple visual medium to help students recognize concepts and remember information through a combination of images and text. However, advances in digital technology have transformed flashcards into a more interactive and adaptive learning medium suited to the needs of 21st-century learning. Most research published after 2022 shows a trend toward integrating digital technology into flashcards. Developments found include QR Code Flashcards, website-based e-flashcards, Canva Interactive Flashcards, and Augmented Reality Flashcards (Annastasya & Fathurrahman, 2024). These findings demonstrate that flashcards are no longer limited to memory aids but are evolving into a medium capable of facilitating more interactive concept exploration.

Although all studies report a positive impact of flashcard use on learning outcomes, their effectiveness tends to be higher for concrete science materials, such as animal classification,

growth, and the water cycle (Sari et al., 2023). Conversely, evidence regarding the effectiveness of flashcards for explaining more abstract concepts is relatively limited. These findings indicate that the visualizations provided by flashcards are more effective when students can connect the visual representations to easily observable objects or phenomena. In addition to improving learning outcomes, research also shows that flashcards contribute to increased student motivation and engagement. Integrating interactive features such as video, QR codes, and augmented reality makes students more active in the learning process than using conventional flashcards (Setiawan et al., 2022). Thus, the development of flashcards demonstrates a shift from static visual media to interactive learning media that support multisensory learning experiences.

The Contribution of Storytelling and Fairy Tales to Learning

An analysis of the reviewed articles shows that storytelling plays a significant role in improving the quality of the learning process. Unlike visual media, which emphasize conceptual representation, storytelling helps students understand material through a contextual storyline that relates to their experiences. Several studies have reported that storytelling can increase student motivation, engagement, and conceptual understanding (Gürsoy, 2021). The development of digital storytelling expands the role of stories as a learning medium. The integration of text, images, audio, and video allows students to gain a richer learning experience than conventional stories (Sevim & Denizhan, 2025). In the context of science learning, storytelling helps bridge scientific concepts with situations that are easier for elementary school students to understand. However, most research still focuses on literacy and learning motivation. Empirical evidence directly testing the use of storytelling to improve science literacy is still relatively limited. These findings suggest opportunities for further research into the use of storytelling as a means of conveying science concepts contextually.

Contribution of Learning Media to Improving Elementary School Students' Science Literacy

Scientific literacy is the ability to understand scientific concepts, explain phenomena based on evidence, and use scientific knowledge in everyday decision-making. A synthesis of the analyzed articles indicates that the use of learning media plays a crucial role in supporting the development of elementary school students' scientific literacy. Several studies have reported that learning media that integrate visual, interactive, and contextual elements tend to have a positive impact on conceptual understanding, the ability to interpret scientific information, and student engagement in the learning process (Naresti & Suratmi, 2024; Safitri et al., 2026).

One of the most prominent patterns is the increasing use of digital media to develop scientific literacy. Digital-based media allows for a more concrete presentation of science concepts through a combination of text, images, animation, audio, and video. Naresti et al. (2024) demonstrated that digital storybooks can help students understand science concepts through a more contextual and engaging presentation of the material. Similar findings were reported by Nurwidiyanti and Sari (2022), who found that scientific literacy-based flipbooks improved students' ability to understand and interpret scientific information.

In addition to digital story-based media, research also shows that interactive visual media significantly contribute to improving scientific literacy. Setiawan et al. (2022) reported that the use of augmented reality flashcards helped students understand scientific objects and phenomena that are difficult to observe directly. Similar results were found by Puteri and Maarif (2025), who showed that augmented reality media in the water cycle improved students' understanding of the relationships between concepts in the scientific process. These findings indicate that concrete visualization is an important factor in developing scientific literacy at the elementary school level.

Another trend identified is the increasing use of media that encourages active student participation during learning. Eldo and Najmi (2025) demonstrated that science-based educational games can increase student engagement in the learning process while helping them understand scientific concepts more deeply. Meanwhile, Fasihah et al. (2026) reported that integrating problem-based learning with augmented reality flashcards not only improves scientific literacy but also strengthens students' problem-solving skills. These findings suggest that scientific literacy develops more optimally when students not only receive information but also engage in the process of exploration, observation, and problem-solving.

Although most studies show positive results, several limitations need to be considered. Most of the studies reviewed still focus on measuring learning outcomes and conceptual understanding, while comprehensive measurements of scientific literacy are still relatively limited. Furthermore, most studies were conducted over a short period and used a research and development (R&D) design, so evidence regarding the long-term impact of learning media on scientific literacy remains inadequate. This situation indicates that the effectiveness of learning media on scientific literacy cannot be broadly generalized without further research. Overall, the synthesis results indicate that learning media that combine concept visualization, interactivity, and real-life contexts tend to make a stronger contribution to the development of scientific literacy than media that focus solely on information delivery. These findings suggest that future development of science learning media needs to integrate these various elements to more optimally support the achievement of scientific literacy in elementary school students.

Opportunities for Developing Fairy Tale-Based Literacy Interactive Flashcards (Litraflash) in Elementary School Science Learning

The synthesis results show that research on flashcards, storytelling, fairy tales, and scientific literacy has grown significantly during the 2020–2026 period. However, most studies still examine these components separately. Research on flashcards generally focuses on improving learning outcomes and conceptual understanding through visual media, while research on storytelling and fairy tales is more directed at improving student motivation, literacy skills, and engagement in the learning process. On the other hand, research on scientific literacy tends to emphasize the importance of using learning media that are contextual, interactive, and close to students' experiences (Naresti & Suratmi, 2024; Safitri et al., 2026). These findings suggest an opportunity to integrate the various strengths identified in previous research into a more comprehensive learning medium. Litraflash offers an integrated concept of interactive flashcards, storytelling, and a scientific literacy orientation. Within this framework, flashcards serve as visual media that help students understand science concepts concretely; storytelling conveys concepts through narratives that are relatable to children; and digital technology enables more active interaction during the learning process.

Based on the synthesis results, visual media has been proven to help students understand concrete science concepts through pictorial and illustrative representations (Zahara et al., 2024). At the same time, storytelling can increase student learning motivation and engagement because the material is presented in a more engaging and understandable story form (Nasir et al., 2024). Research on digital storytelling also shows that integrating multimedia elements can create a richer learning experience than using conventional media (Sevim & Denizhan, 2025). Therefore, the combination of these three elements has the potential to produce learning media that not only improves conceptual understanding but also strengthens student engagement and learning experiences.

In addition to supporting conceptual understanding, Litraflash also has the potential to bridge the gap between science concepts and students' real-life experiences. One of the main challenges in elementary school science learning is students' difficulty grasping abstract concepts. Through storytelling, scientific concepts can be presented in more contextual situations that are closer to everyday life. When these narratives are combined with visualizations on flashcards and digital interactive features, students have the opportunity to build stronger connections between scientific concepts and the phenomena they encounter in real life. However, the synthesis results also indicate that the effectiveness of integrating flashcards, storytelling, and scientific literacy into a single learning medium has not been extensively empirically studied. Most of the studies reviewed tested only one component separately, so there is insufficient evidence to conclude that combining the three components will always produce a better impact than using the media individually. Therefore, the potential for developing Litraflash still requires further testing through experimental research and developmental research on various science materials and elementary school grade levels. Based on these findings, Litraflash can be positioned as a new conceptual framework that integrates visual representation, contextual narrative, and interactive technology to support the development of elementary school students' scientific literacy. This concept not only addresses the need for more engaging and relevant learning media, but also opens up new research opportunities regarding the effectiveness of integrating various learning approaches in improving scientific literacy.

Implications, Research Gaps, and Future Research Agenda

The synthesis of results indicates that visual-based learning media, storytelling, and digital technology have significant potential to support science learning and develop elementary school students' scientific literacy. However, analysis of the reviewed articles reveals several research gaps that still require attention. First, most research still focuses on media development and measuring short-term learning outcomes. Most studies use a Research and Development (R&D) approach that emphasizes the validity, practicality, and effectiveness of media on a limited scale. Consequently, evidence regarding the long-term impact of media use on the development of scientific literacy remains relatively limited. This situation highlights the need for longitudinal research capable of evaluating the sustainability of the impact of learning media on students' scientific literacy skills. Second, most of the studies reviewed primarily measured learning outcomes and conceptual understanding rather than comprehensive scientific literacy skills. However, scientific literacy encompasses not only conceptual mastery but also the ability to explain scientific phenomena, evaluate evidence-based information, and make decisions based on scientific reasoning. Therefore, future research needs to use instruments that specifically measure the dimensions of scientific literacy so that the impact of learning media can be more comprehensively evaluated.

Third, the synthesis results indicate that flashcards tend to be more effective for science materials that are concrete and easy to visualize. Evidence regarding their effectiveness for more abstract materials is limited. These findings highlight the need for research examining how visual and interactive media can be used to help students understand science concepts that require more complex reasoning. Fourth, although storytelling and fairy tales have been shown to increase student motivation and engagement, research specifically examining their contribution to scientific literacy is still relatively limited. Most studies position fairy tales as a means of developing general literacy or language skills. Consequently, empirical evidence regarding the effectiveness of fairy tales as a medium for building understanding of scientific concepts still requires further research. The most important finding of this study is the lack of research that

comprehensively integrates interactive flashcards, fairy tales, and scientific literacy orientation into a single, cohesive learning medium. Most studies only develop or test one component separately. This gap indicates that the Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) concept remains an open area of research with significant development potential.

Based on these findings, future research is recommended to develop and empirically test Litraflash through experimental designs involving various science materials, grade levels, and learning contexts. Research should also compare the effectiveness of Litraflash with conventional flashcards and other digital media to obtain stronger evidence regarding its advantages and limitations. Thus, the development of Litraflash not only provides innovation in the learning media aspect but also contributes to strengthening elementary school students' scientific literacy more systematically. This research integrates articles from several interrelated fields of study, namely flashcards, storytelling, fairy tales, and scientific literacy. This approach was chosen because the Litraflash concept is integrative and has not been widely studied directly. Consequently, some of the synthesized findings are still conceptual and require further empirical validation through experimental research.

This study has several limitations. First, the articles analyzed were obtained only from Google Scholar, ERIC, and DOAJ databases, so relevant research may have been overlooked. Second, this study used a systematic literature review approach without meta-analysis, so the results emphasize conceptual synthesis rather than statistical effect size estimation. Third, the Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) concept is still a conceptual synthesis based on research on flashcards, storytelling, fairy tales, and scientific literacy, most of which have been studied separately. Therefore, the effectiveness of integrating these three components still requires further empirical testing. Fourth, most of the articles analyzed used research and development (R&D) designs and short-term evaluations, so evidence regarding long-term impacts on students' scientific literacy is still limited. Future research should test the effectiveness of Litraflash through experimental designs and longitudinal studies across various science materials and elementary school grade levels.

CONCLUSION

This systematic literature review identified four main themes related to the development of Fairy Tale-Based Literacy Interactive Flashcard (Litraflash) in elementary school science learning, namely the development of flashcards towards interactive digital media, the contribution of storytelling and fairy tales to student engagement and literacy, the role of learning media in supporting scientific literacy, and opportunities for integrating these three components into one learning framework. The results of the synthesis indicate that visual media, contextual narratives, and interactive technology each have important contributions in supporting science learning and the development of elementary school students' scientific literacy.

This study contributes a conceptual synthesis that integrates flashcards, storytelling, fairy tales, and scientific literacy as the foundation for developing Litraflash. The study's findings indicate that integrating these three components has the potential to create a more meaningful, contextual learning experience tailored to the characteristics of elementary school students. However, empirical evidence regarding the effectiveness of Litraflash as an integrated learning medium is still limited. Therefore, further research is needed to develop and empirically test Litraflash across various science materials, grade levels, and learning contexts to obtain stronger evidence regarding its contribution to improving elementary school students' scientific literacy.

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