



Analysis of the Effectiveness of Pop-Up Book Media on Science Learning in Elementary Schools

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ABSTRACT

Objective: Science education in elementary schools provides basic scientific knowledge and skills and develops students' critical and creative thinking abilities. This study aims to analyze the effectiveness of using pop-up books as media in learning science in elementary schools. **Method:** In this study, researchers applied the Systematic Literature Review (SLR) method using the Google Scholar database. The literature search focused on the initial keyword "learning media," restricted from 2019 to 2024, resulting in 86,200 articles. Furthermore, with the addition of the keyword "pop-up book," 4,120 articles were found. Then, adding the last keyword, "science in elementary school," resulted in 318 articles. From this number, data selection and eligibility tests were carried out to obtain suitable articles until 11 appropriate articles were obtained and by the literature review's objectives. **Results:** Based on the study's results, it can be concluded that pop-up book media has proven effective in learning science in elementary schools. **Novelty:** For educators, engaging learning media in learning science is recommended to convey the learning material well and effectively, including pop-up books.

INTRODUCTION

Science education in primary schools plays a vital role in providing students with fundamental scientific knowledge and skills. It was emphasized that literacy in the natural sciences is vital to society, with its significance increasing in the 21st century (Vincentas, 2022). The main goal of natural science education is to provide a systemic study of the natural sciences and develop a person's orientation toward nature (Morgacheva. et al., 2023). Teachers' readiness to organize and implement science education is critical, with the need to improve competencies in research-based learning and practical activities (Hanna & Tymoschuk, 2022). International programs such as TIMSS assess students' scientific literacy globally, highlighting the importance of benchmarking and improving the content of natural science education in primary schools (Tetiana & Mykola, 2023). Therefore, Science Education in primary schools is essential for developing students' scientific literacy as well as skills that are essential for their overall development (Abidin et al., 2021)

Science in elementary school is about learning concepts and theories and developing critical and creative thinking skills. Science in elementary school focuses on fun and meaningful learning for students (Fatmawati et al., 2023; Meirza et al., 2022). Teachers are crucial in creating a conducive learning environment and motivating students to learn Science (Bunyamin, 2023). Science learning in elementary school is an essential foundation for students to continue their education to a higher level and contribute to nation-building (Zakirman et al., 2022). Science is an essential subject in elementary

school that aims to provide students with scientific understanding and skills (Subali et al., 2019).

Effective science learning should attract students' interest and motivation and help them understand scientific concepts better. Teachers need to provide opportunities for students to play an active role in the learning process and use learning media that are interesting and relevant to their lives (Monita & Ikhsan, 2020). The positive effects of effective science learning are not only seen from the improvement of science learning achievement but also from the increase in self-confidence, positive character building, and preparation of students to face various challenges in the future (Nokes, 2023). However, the reality is that many teachers do not have a deep understanding of innovative learning media, resulting in difficulties in planning and implementing learning efficiently (Daryanes et al., 2023; Dita et al., 2021; Elisa et al., 2021; Sofi-Karim et al., 2023; Zaporozhchenko et al., 2022). Many students feel bored and lose interest in science subjects (Yusra et al., 2023).

According to research by Sari et al. (2023), this is caused by several factors, such as a lack of attractiveness in learning methods, subject matter that is too abstract, and a lack of attractive learning media. Therefore, the use of exciting media is needed so that the learning atmosphere becomes more conducive and students can understand the material better by utilizing pop-up books (Suhono et al., 2022). Pop-up books are books that are specifically designed for teaching and learning activities (Dewi et al., 2022; Pratiwi & Subandowo, 2021; Rahmayanti & Setiawan, 2023; Rohmawati & Pahlevi, 2024; Suhono et al., 2022). Uniquely, this book has illustrations that can move or display three-dimensional (3D) elements when the page is opened. With the presence of moving illustrations, pop-up books as learning media become more attractive, help students concretize abstract concepts or subject matter, and can be another creative option to make the learning atmosphere more active (Anjarwati et al., 2023). Despite its challenges, its uniqueness and interactivity can enhance learning effectiveness and make the learning experience more enjoyable for students.

There have been many studies related to pop-up book media in education. One of the studies conducted by Simbolon and Fitriyani (2021) on the application of pop-up book media affects student learning outcomes. An increase in the average value of student learning outcomes indicates this. In addition, research conducted by Hasanah (2019) on applying pop-up book media in science learning shows better student learning outcomes than learning without pop-up book media. The use of pop-up book media in science learning in elementary schools has been the research focus in recent years. These studies show positive results: pop-up books can improve learning motivation, learning outcomes, and student creativity. Research by Ningsih (2020) developing pop-book learning media shows that the pop-up book media developed is very feasible to use and effective in improving student learning outcomes. Furthermore, research by Firman (2021) shows that using pop-up book media can increase student learning independence, outcomes, and responses to learning. Research by Silvia et al. (2021) shows that the developed pop-up book media is very feasible and practical for teachers. Further research needs to be conducted to explore the effectiveness of pop-up books in Science learning on different topics and grade levels.

Previous research on the effectiveness of pop-up books in learning Science in elementary schools showed significant results in improving the quality of student learning. A study by Fadil et al. (2023) found that using pop-up books can significantly increase students' interest and engagement, helping them understand abstract scientific

concepts through visual and interactive elements. The book provides three-dimensional visualizations that attract students' attention and make learning fun. This finding is supported by research by Eliasar and Astuti (2023), which showed that students who used pop-up books had a deeper understanding of science materials and recorded higher scores on comprehension tests than students who used conventional textbooks. The study also noted that pop-up books help reduce boredom in learning, so students are more focused and motivated to learn. Furthermore, research by Nengsi (2021) showed that students who studied with pop-up books significantly increased post-test scores, highlighting that this interactive learning media can increase students' motivation and engagement in learning. Pop-up books are visually appealing and invite students to actively participate in learning, enhancing their cognitive and analytical skills. Nengsih noted that students who use pop-up books tend to be more enthusiastic and show increased confidence in solving scientific problems. This indicates that pop-up books are not only effective learning aids but also a means to develop independent and critical learning skills.

Overall, these studies indicate that pop-up books are an effective learning tool to improve the quality of science education in primary schools. Pop-up books make learning more exciting and interactive and help students understand scientific concepts better and deeper (Akina et al., 2023; Sri & Sigit, 2023). Using three-dimensional visualization and interactive elements, pop-up books can transform the usually boring learning experience into a more dynamic and fun one. Thus, integrating pop-up books in the science curriculum in primary schools can be an effective strategy to improve learning outcomes and create a more positive and productive learning environment. Although pop-up book media has been widely researched, research using Systematic Literature Review (SLR) on science learning at the elementary school level still needs to be widely found. Therefore, this research is essential to analyze the effectiveness of using pop-up books in Science learning in elementary school, which will be analyzed using a literature review.

This research offers novelty and innovation through pop-up book media in elementary school learning approaches. The innovation lies in integrating visual and interactive technology in science learning materials, which is expected to increase students' interest and understanding of complex scientific concepts. This approach helps educators choose more exciting and effective teaching methods and opens up opportunities for developing more creative and innovative learning media in the future. The main contribution of this research is to provide in-depth insight into how pop-up book media can improve understanding of science concepts, motivate students, and make the learning process more interactive and fun. This literature review will discuss the concepts, benefits, and theoretical foundations and analyze previous studies that discuss the use of pop-up books in Science learning in elementary school. A systematic and up-to-date literature review will evaluate how effective the use of pop-up books as learning media is in teaching science to elementary school students. Hopefully, this literature study will provide practitioners and researchers in education with a valuable understanding of how pop-up books as learning media can improve science learning achievement in primary schools and students' learning motivation.

RESEARCH METHOD

In this study, researchers applied the SLR method, which is a research approach applied to find, evaluate, and interpret all relevant research related to specific research

questions, specific topics, or phenomena being studied, while the approach used is descriptive qualitative (Laksmi & Dewi, 2023). According to Suyanti et al. (2022), the research procedures involve several planning, conducting, and reporting stages in Figure 1. The first stage of the research procedure is planning, which begins with formulating clear and specific research questions related to how Pop-Up Book media affects science learning in elementary schools. Next, a comprehensive literature search was conducted using academic databases such as Google Scholar (Cantrell et al., 2024; Gusenbauer & Haddaway, 2020; Harari et al., 2020; Martín-Martín et al., 2021; Mohamed Shaffril et al., 2021). Inclusion and exclusion criteria were set to select relevant studies, including year of publication, topic relevance, and research methodology used.

The second stage is conducting, which involves the process of data selection and extraction. All studies that met the inclusion criteria were identified and analyzed in depth. Extracted data includes information on the research design, sample, data collection methods, and results of the study (Emmanuel et al., 2021; Lobe et al., 2020; Munim et al., 2020; Popenoe et al., 2021; Santoso, 2021). Each study was evaluated for quality using appropriate critical appraisal to ensure the validity and reliability of the findings.

The third stage is reporting, where the findings from the selected studies are synthesized and presented in narrative and tabular form. Analysis was conducted to identify patterns, trends, and gaps in the existing literature. The results are compiled in a comprehensive report, with a discussion linking the findings to the theory and practice of science learning in primary schools. Conclusions and recommendations are presented to guide educators and researchers in implementing and evaluating the use of Pop-Up Book media in science learning.



Figure 1. Research stages SLR method.

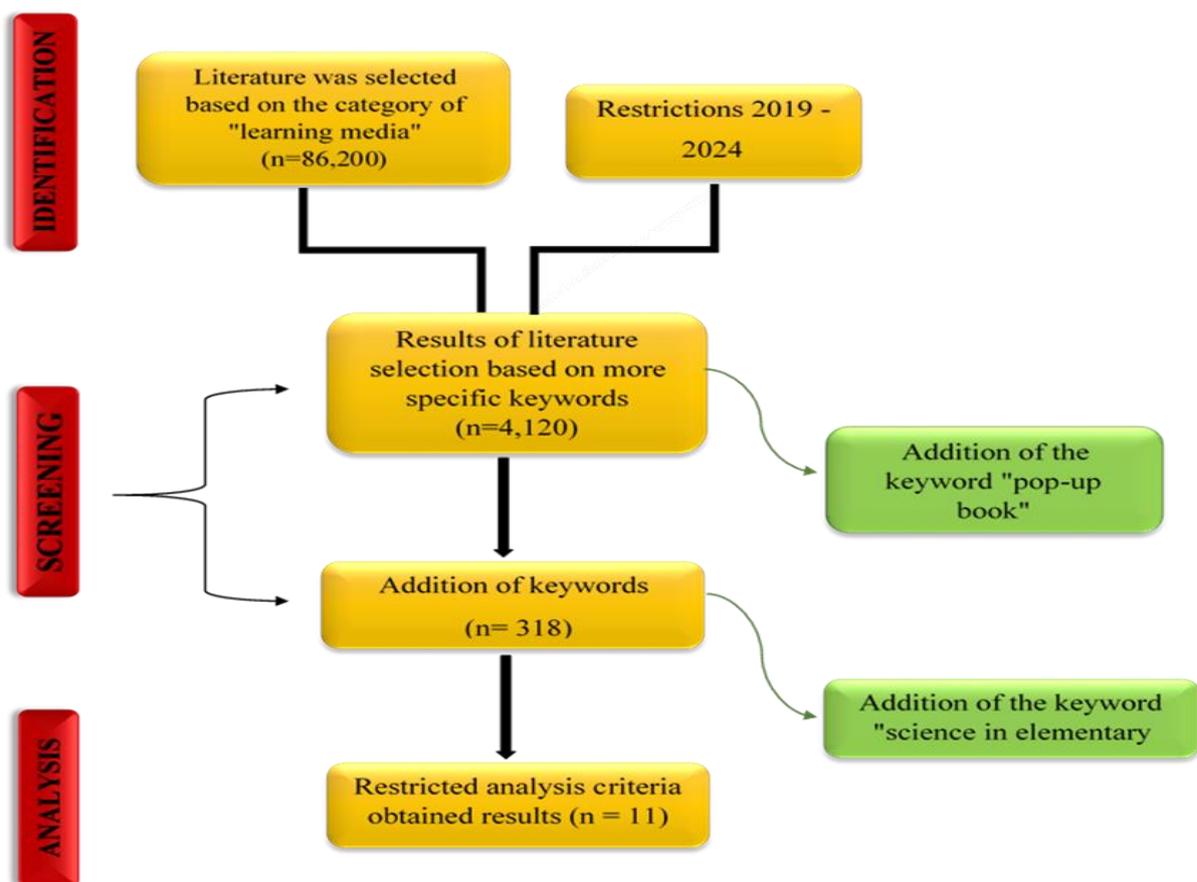


Figure 2. Inclusion criteria analyze the effectiveness of pop-up book media in science learning in elementary schools.

The search for articles related to the research themes reviewed in this study was done using the Google Scholar database. The literature search focused on the initial keyword "learning media," restricted from 2019 to 2024, resulting in 86,200 articles. Furthermore, with the addition of the keyword "pop-up book," 4,120 articles were found. Then, adding the last keyword, "science in elementary school," resulted in 318 articles. From this number, data selection and eligibility tests were carried out to obtain suitable articles until 11 appropriate articles were obtained and by the literature review's objectives. Articles that met the criteria were then analyzed in depth to assess the quality and relevance of their findings. The data obtained from the various studies were coded and synthesized to identify patterns, themes, and principal conclusions regarding the effectiveness of pop-up books in Science learning in primary schools. Then, the analysis results are organized into a systematic report presenting findings, implications, and recommendations for future educational practices, detailed in Figure 2.

RESULTS AND DISCUSSION

Results

The purpose of the literature search on Google Scholar is to explain the research results and analysis verbally and present them in diagrams and tables supplemented by comments and discussion. The results were obtained by identifying subsections relevant to the research problem. From data searches on Google Scholar, the development of articles analyzing the effectiveness of pop-up book media in learning science in elementary schools has varied in the last six years, from 2019 to 2024. This development is represented in Figure 3.

Based on Figure 3, it can be seen that the development of article publications on the use of pop-up book learning media in improving the learning outcomes of elementary school students as a whole has increased, especially in 2023, when the highest number of articles found reached 138 articles, while the lowest number of articles recorded in 2019 and 2020 were only 11 and 13 articles respectively. Furthermore, in 2021, there were 36 articles found, followed by 2022 with 75 articles. For 2024, it is not yet sure how many articles there are still conducted in June, which shows that it is not even one year old; there is a possibility that in 2024, when it is even one year old, there will be another increase in articles discussing the research. Here is the calculation of the average number of articles per year:

$$\tilde{x} = \frac{\text{article count}}{\text{year amount}}$$

$$\tilde{x} = \frac{318 \text{ Article}}{6 \text{ year}} = 53 \text{ article}$$

Based on the equation, the average number of articles published over the last six years is 53. Using the keyword "learning media," the search focused on the most recent years, 2019 to 2024, and found 86,200 articles. After that, an additional search with the keyword "Pop-up book" found 4,120 articles. Then, by adding the keyword "science in elementary school" to the last search, 318 articles were found. Of these, 11 articles can be reviewed and contain the phrase "Pop-Up Book Media in Science Learning in Elementary Schools." Here are the results of the review of the 11 articles, detailed in Table 1.

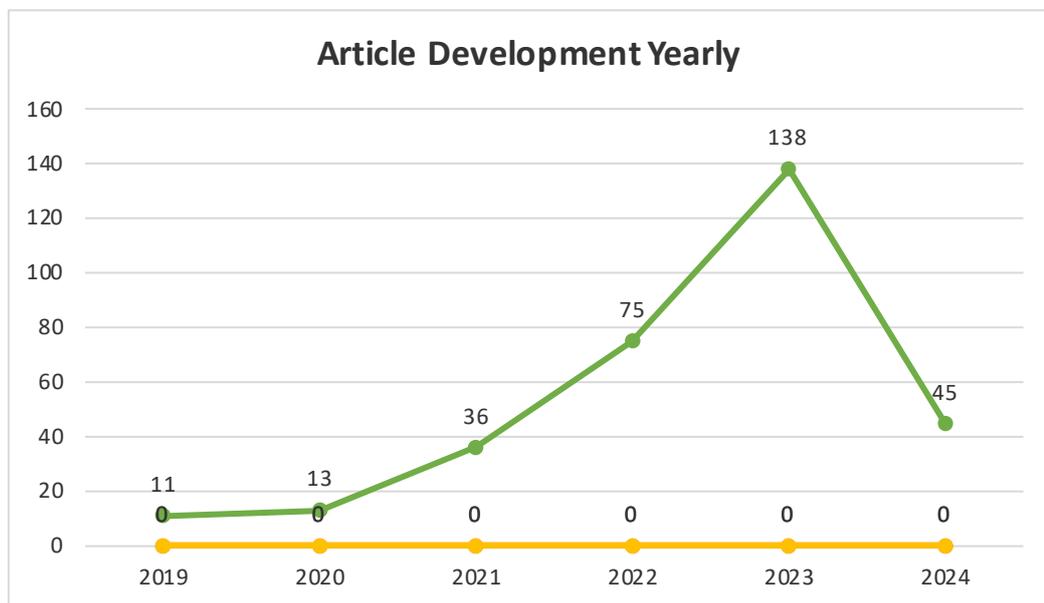


Figure 3. Development of articles in the Google Scholar database regarding analysis of the effectiveness of pop-up book media in Science learning in elementary schools.

Table 1. Results of the analysis of article reviews regarding pop-up book media on science learning in elementary schools.

Article Title	Research Type/Method	Research result
Pop-Up Book Media to	This type of research	Using pop-up book media in learning

Article Title	Research Type/Method	Research result
Improve Student Learning Outcomes in Science Subjects at Elementary School (Arip & Aswat, 2021)	is called CAR (Classroom Action Research)	can improve student achievement in science subjects, especially on Theme 1, Animal and Human Movement Organs, because this can spur students' enthusiasm for learning, positively impacting their academic results.
The Effect of Pop-Up Book Learning Media on Science Learning Outcomes Science Learning Outcomes of Human Digestive System Materials for Fifth Grade Students of Elementary School (Salsabilah & Alyani, 2023)	The research method used was the Quansi experimental type Nonequivalent Control Group Design	The effect of Pop Up Book learning on science learning outcomes, especially the subject of the human digestive system in class V at SDN Sunter. Science learning outcomes, especially the subject of the human digestive system in class V at SDN Sunter Agung 01.
The Effect of Using Pop-Up Book Media Alim (Human Sensory Apparatus) on Science Learning Outcomes of Fourth Grade Students of SD Negeri 4 Tunahan Jepara (Ulfa et al., 2022)	This type of research is called CAR (Classroom Action Research)	The use of pop-up book media about human sensory organs affects the science learning outcomes of fourth-grade students at SD Negeri 4 Tunahan Jepara.
The Effect of Pop-Up Book Learning Media on Science Learning Outcomes of Grade V UPT SPF SDN 184 Palambarae Gantarang District, Bulukumba Regency (Asma et al., 2023)	The type of research is PTK (Class Action Research)	The use of learning media in the form of pop-up books impacts student learning outcomes. This difference is due to the significant difference between the experimental class that used pop-up book media and the control class that did not.
The Effect of Pop-up Book Media Users on Learning Outcomes Learning Outcomes of Grade 5 Elementary School Students (Rizky & Shofiyah, 2023)	This type of research is experimental research.	The results showed that using pop-up books in science learning improved student outcomes. The post-test score after using pop-up books was higher than the pretest score. Interactive and exciting learning media can increase students' motivation to learn more effectively.
The Use of POP-UP Book Learning Media to Improving Science Learning Outcomes of UPTD V Grade Students SD Negeri 111 Barru (Israwaty & Zakina, 2024)	This type of research is qualitative research	Based on the research results discussed, using Pop-Up Book learning media can improve the science learning process on water cycle material for fifth-grade students at UPT SD Negeri 111 Barru. In addition, the use of pop-up book learning media can also improve science learning outcomes regarding water cycle material.
The Effect of Pop-Up Method in Increasing Student Learning Interest in Natural	This research method is a Literature Review	The results show that, according to experts, this medium is very suitable for teaching science at the primary

Article Title	Research Type/Method	Research result
Science Education: A Meta-Analysis (Dina et al., 2023)		school level. In addition to being attractive, this media can increase student response and interest in learning, thus positively affecting student learning outcomes.
The Effect of Pop-Up Book Media Use on IPAS Learning Outcomes of Fourth-Grade Students of SDN 04 Madiun Lor (Afifa & Hanif, 2023)	This research method is quantitative	Pop-up book learning media affects the science learning outcomes of SDN 04 Madiun Lor fourth-grade students.
Improving Science Learning Outcomes on Ecosystem Components through the Application of Pop-up Book Media (Ainiyah et al., 2022)	This type of research is called CAR (Classroom Action Research)	There was an increase in the learning outcomes of fifth-grade students of Ma'arif Al-Fattah Surabaya Elementary School on the material of Ecosystem Components through the application of Pop-up Book media. It is highly recommended because it can increase student motivation and learning outcomes.
The Effect of POP-UP Book Learning Media on Critical Thinking Skills of Students in Learning Science Class V SDN Sungai Bambu 01 (Nurhalimah & Syofyan, 2024)	This research method is a quantitative approach	Based on research on Pop-Up Book learning media's influence on students' critical thinking skills in fifth-grade Science learning at SDN Sungai Bambu 01, it can be concluded that there is a positive and significant influence. This is indicated by the T-count value of 2.538, which is more significant than the T-table of 2.006 (df = 52) and a significant value of 0.014, more diminutive than 0.05.
Application of Pop-Up Media to Improve Learning Outcomes of Second-Grade Students Elementary School Using the CTL Learning Model (Fadilatul, 2024)	This type of research is PTK (Classroom Action Research)	Based on the research and discussion results, applying the CTL learning model using Pop-Up Book media can improve the learning outcomes and responses of Al-Ishlah Sudimampir second-grade students on the material "My Experience at the Playground." This study considers students complete if their learning outcomes reach the KKM score of ≥ 70 and classically 70%. The percentage of student completeness in the pre-research was 32%, increased to 56% in cycle I, and reached 87% in cycle II.

From the 11 articles reviewed, the following findings were found:

1. Pop books have advantages over other learning media, such as conventional books.
2. Pop-up books effectively improve students' enthusiasm and learning outcomes at the primary school level.

3. Students who used the Pop Up Book achieved better learning outcomes compared to students in classes that did not use the learning media.

Discussion

Based on the analysis of 11 articles related to the effectiveness of pop-up book media on science learning in elementary schools, several findings were obtained, namely, the findings of the research conducted by Arip & Aswat (2021), The use of pop-up books in learning can improve student learning achievement in science subjects. This is because pop-up books can trigger students' enthusiasm for learning, affecting their learning outcomes. According to Salsabilah and Alyani (2023), using pop-up book learning media positively impacts science learning outcomes. Meanwhile, Ulfa et al. (2022) said the average score of students increased after using pop-up book learning media, which was 77.79 compared to the previous 56.74.

According to Asma et al. (2023), using pop-up books as learning media impacts student learning outcomes. This was confirmed through the post-test scores, where the experimental class reached a very high level of achievement while the control class was at a moderate level. Furthermore, Rizky and Shofiyah (2023) stated that using pop-up books in science learning has improved student learning achievement. Interactive and exciting learning media can strengthen students' motivation to learn more effectively. Research findings of Israwaty & Zakina (2024) show that the use of Pop-Up Book learning media can improve the science learning process on water cycle material for grade V students at UPT ES Negeri 111 Barru. In addition, the use of Pop-Up Book learning media can also improve science learning outcomes on water cycle material (Hardiansyah & Mulyadi, 2022; Humaira & Ninawati, 2023; Kisworo et al., 2022; Mufidah et al., 2020; Nurlela et al., 2022).

The study's results by Dina et al. (2023) show that pop-up learning media is feasible to implement in science learning in elementary schools. The analysis results show that this media can increase students' interest and response and improve learning achievement in learning Science in elementary school. Then, the findings of Afifa and Hanif (2023) show that using pop-up books in science learning significantly impacts learning outcomes. According to Ainiyah et al. (2022), the use of Pop-up Books is highly recommended because it can increase student motivation and learning achievement, as evidenced by the increase in the percentage of passing student learning outcomes from 43% in the first cycle to 86% in the second cycle.

Analysis conducted by Nurhalimah & Syofyan (2024) found a positive and significant effect of using Pop-Up Book learning media on students' critical thinking skills in science learning. This is indicated by the T-count value of 2.538, which is more significant than the T-table of 2.006 (df = 52), with a significance value of 0.014, which is more diminutive than 0.05. Research conducted by Fadilatul (2024) found that applying the CTL learning model with Pop-Up Book media can improve learning outcomes and responses of Al-Ishlah Sudimampir second-grade students.

Effectiveness of Pop-Up Book Media on Science Learning in Elementary School

Education is essential in shaping an intelligent and competent next generation (Ali et al., 2020). At the elementary school level, learning Science is crucial in introducing children to basic science concepts that will be their foundation in the future (Vincentas, 2022). However, the big challenge faced in learning science is how to make material that is often considered abstract and challenging to be more exciting and easily understood

by students (Akcanca, 2020; Alam, 2020; Chew & Cerbin, 2021; Kartini et al., 2022; Liono et al., 2021). One solution that has been widely applied is using innovative and interactive learning media (Hertina et al., 2024).

One of the more popular learning media is pop-up books. This book displays text and images and is equipped with three-dimensional elements that can attract students' attention and increase their interest in learning (Nurlita et al., 2023). Using pop-up books in Science in elementary schools can make the subject matter more vivid and concrete (Kosasih, 2021), making it easier for students to understand the concepts being taught. In addition, the interactivity offered by pop-up books can stimulate students' curiosity and creativity and increase their engagement in the learning process (Yulia et al., 2022).

Another advantage of pop-up books is their ability to present information visually and kinesthetically, which is very beneficial for students with different learning styles (Sunarti et al., 2023). With attractive visual elements and components that can be touched and moved, students can more easily remember and understand the material being taught. This is in line with multisensory learning theory, which states that learning that involves more than one sense will be more effective in improving student understanding and retention (Khomaeny et al., 2019).

Based on the various advantages offered, pop-up book media has great potential to increase the effectiveness of Science learning in elementary schools. Using pop-up books makes learning more fun and helps students more easily understand the material being taught (Sabitul & Sri, 2022). Therefore, the integration of pop-up book media in science learning in primary schools is an appropriate step to improve the quality of education and better prepare students for future academic challenges.

CONCLUSION

Fundamental Finding: From the analysis of 11 articles relevant to the research title, the use of pop-up books has a beneficial and positive impact on students at the elementary school level. **Implication:** The analysis of the effectiveness of pop-up book media on science learning in elementary schools has significant implications for various stakeholders in the world of education. Especially for teachers and educational practitioners, the results of this systematic study can provide deep insight into the benefits and weaknesses of using Pop-Up Book media in science learning in elementary schools. With this understanding, teachers can be more precise in choosing and implementing innovative and effective teaching methods, which can increase students' interest and understanding of science subjects. **Limitation:** Using pop-up books can create a more conducive and exciting learning atmosphere so students do not experience boredom during the learning process. **Future Research:** So using pop-up books has proven effective in learning Natural Sciences at the elementary school level.

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