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A Literature Review on the Effectiveness of Interactive Media in Elementary School Science Learning

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ABSTRACT

The rapid development of educational technology has encouraged the integration of interactive media in elementary school science learning to enhance students' engagement and learning outcomes. However, a comprehensive analysis of the effectiveness of various interactive media used in science instruction remains limited. This study aims to systematically analyze the effectiveness of interactive media implemented in elementary school science learning over the past five years. A literature review method was employed by examining research articles published between 2019 and 2025, obtained through Google Scholar and Harzing's Publish or Perish databases. From an initial pool of 60 articles, 25 relevant studies indexed in SINTA and international journals were selected through a rigorous inclusion and screening process following the PRISMA framework. The results indicate that interactive media—such as PhET simulations, digital literacy-based multimedia, augmented reality applications, interactive presentations, and animated videos—consistently improve students' conceptual understanding, learning motivation, critical thinking skills, and science process skills. The findings confirm that interactive media are effective tools for enhancing elementary science learning when aligned with appropriate instructional strategies and teacher competence. This study contributes theoretically by synthesizing empirical evidence on interactive media effectiveness and practically by providing guidance for educators in developing innovative, adaptive, and learner-centered science learning media to improve the quality of elementary school science education.

Keywords: Interactive Media, Science Learning, Effectiveness, Elementary School, Educational Technology

INTRODUCTION

21st Century education requires learning that is up to date with the latest technological advances. It demands beyond content mastery, new attitudes and skills in collaboration and critical thinking (Eviota & Liangco, 2020). With such the fast pace of technological advance, the way we currently teach people must change dramatically. This requires that children learn with a greater emphasis on the development of 21 st century skills—including education approaches that focus on active or collaborative

learning, critical thinking skills, and technology integration. This lends itself to a need for schools to promote critical thinking, creative thinking, and collaboration in students. Curricula can be updated to include real-world experiences and a wider array of courses that transcend disciplines, preparing our graduates to not only survive in different settings, but also lead for better.

Elementary schools' education is significant in shaping students' knowledge, attitudes, and skills. This stage lays the foundation for the students to understand basic concepts of different subjects. Natural Science (IPA) as a core subject not only introduces natural phenomena but also develops structured scientific thinking in students. The study of science in elementary school involves a series of learning activities, observations, and experiments in accordance with scientific principles (Sanjaya, Desyandri, Miaz, & Rahmi, 2024). Science education is not only aimed at transferring knowledge but also at developing scientific skills, providing concrete and contextual illustrations for students to implement learning that fosters student activity, and guiding students to conduct practical experiments to understand or prove existing theories and concepts, so it is not just about memorizing a concept (Sulistiawati & Prastowo, 2021). With the rapid development of technology, especially in education, learning media has become an important component of the teaching process in the classroom. The use of science learning media, which includes learning aids, helps present lesson materials more clearly, thereby supporting the achievement of learning objectives according to the needs of the present century.

One effort to address this challenge is the implementation of interactive media in learning, particularly in Natural Science (IPA) subjects. Interactive media is considered capable of accommodating diverse student learning styles, visualizing abstract concepts, and enhancing active student engagement in the classroom. Science education, which has traditionally been theoretical and often monotonous, can be presented more engagingly through media incorporating animations, simulations, and other participatory digital activities (Sulastri, Andriana, & Syachruroji, 2024) Teachers are also expected to be able to use learning media in accordance with the needs of learning in the classroom, by using learning media student will be easy to understand and apply that is taught. Hence the educator needs to be creative and innovative in determining or creating learning media that are suitable and in line with learning process needs. Students' disposition when learning science through interactive media, is an important aspect that influences on the process of learning that occurs with the use of a variety of media learning. Enhanching students' chances to learn the subject. This finding is consistent with research (Choirin Attalina, Jefendi, Niswah., & Nugroho, 2024) the use of interactive media can provide a real increase in the ability to capture the material for students and the students ' interest in learning. In the past five years, there has been a rapid development in the utilization of interactive media, especially science learning media, with the emergence of a variety of technological innovations to improve the quality of teaching and effectiveness of learning media including the use of learning videos, educational websites, interactive applications, and so forth.

Interactive media is very important in science learning for a variety of reasons: Arouse Interest (Interactive media can arouse student interest in science learning, thereby making students interested in learning), Aid Understanding (Interactive media

can help students more easily and effectively understand complex science concepts), Enlarge Participation (Interactive media can enlarge students' participation in the learning process much more than traditional methods and students become more actives in learning activities), Improve Thinking Skills (Interactive media can help students improve their thinking skills through interactive learning activities, such as critical thinking and analytical thinking), Prepare for Digital Age (Interactive media can help students prepare for the digital age through its ability to produce high quality learning outcomes using information and communications technology).

More detailed information from the media such as above, or other media that is appropriate, will also be required to provide a more complete picture of how the effectiveness of science learning media in elementary schools can be maximized for full support in effective science learning. In the elementary level, the study of science includes a variety of/ learning activities, observations and experiments based scientific principle (Widiyanti, Ismaya, & Ermawati, 2024). Science learning is not only oriented to transfer knowledge, but also it needs to develop the science skill, the model is made a concrete and contextual picture based on student life, and portray the study by constructing the student's activity, lead students to do practicums to understand, prove existing theories/the concepts with them not only memorizing what the concept claims (Sulistiawati & Prastowo, 2021). With the rapid advancement of technology, especially in education, learning media is an integral part in the classroom learning process, and the use of science learning media learning tools aid in presenting learning materials more clearly to support achieving learning objectives according to the requirements of the current century. Although there has still been relatively little empirical attention to the effectiveness of interactive media in earlier school gradesin elementary education. In summary, there is a lack of systematic comprehensive investigation into the impact of interactive media on elementary students' science concept learning. This review of the literature therefore attempts to synthesize existing research into the effectiveness of interactive media in elementary science education.

METHODS

The method research used is literature study or literature review that collects and analyzes research articles based on a specific theme of the problem (Juniawan, Salsabila, Prasetya, & Rengga, 2023). The literature sources were obtained from the Google Scholar search engine with the following selection: articles indexed by Google Scholar and SINTA, and high number of citations. Full texts of the 25 articles published from 2019 to 2025 were reviewed. Articles were included if they were relevant to the research scope. The research theme was further developed with reference to existing studies and used to underpin the integration of findings derived from existing research. The procedure of analysis is presented in the PRISMA flowcharts displayed in Figure 1.

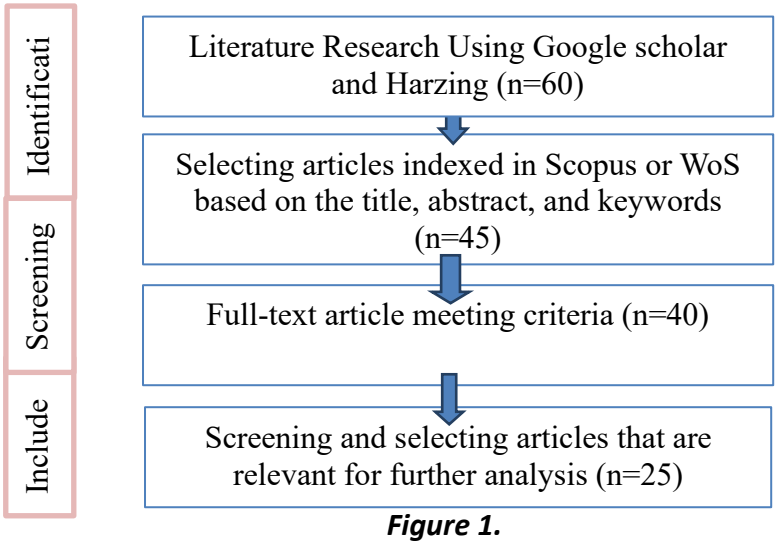

Figure 1.

RESULT AND DISCUSSION

Results

The following table displays the findings of the search for prior research publications that fit the study topic, which is a literature review on the investigation of the efficacy of interactive media in scientific learning in primary schools, published between 2019 and 2025:

Table 1. Research Analysis Results

No	Author	Research Title	Research Results
1	(Wirawan & Gading, 2022)	Interactive powerpoint learning media on science content for fifth grade elementary school	The use of the Problem-Based Learning (PBL) approach-based instructional video positively influences the improvement of students' learning outcomes.
2	(Islamyati & Manuaba, 2021)	Multimedia interactive learning in science subjects for grade fourth elentary school students	Based on these overall results, it can be concluded that the developed interactive multimedia is deemed highly feasible for use in science learning for sixth-grade elementary school students.
3	(Hardiningrum & Agung, 2022)	The Effectiveness of Interactive Multimedia Education Based on on Problem-Based Learning in Science Subjects Material on Animal Locomotion Tools for 5th Grade Elementary School Students.	The results of this study show that interactive multimedia learning relational to problem-based learning is of very good quality and accepted for implementation within the science curriculum for grade 5 elementary school learners.

4	(Yildirim & Seçkin Kapucu, 2020)	The effects of augmented reality applications in science education on academic achievment and retention of 6th grade students	Of these findings, it is highly advised that Augmented Reality (AR) applications be used more often and actively in secondary education across all grade levels and a wider variety of science subjects.
5	(M. A. Putra, Madlazim, & Hariyono, 2024)	Exploring Augmented Reality-Based Media Implementation in Solar System Materials	his study shows that AR-based media enhances understanding of Solar System concepts.
6	Wahidatussyadiah et al., (2024)	Development of Interactive Media SIPERASA (Human Respiratory System) Based on Scratch in Science Material for 5th Grade at SDN Cisengkol	Based on the research results, it shows that the Scratch learning media is effective in improving students' understanding of the human respiratory system material.
7	(Maesaroh & Sutikno, 2025)	Effectiveness of the Phet simulaation assisted by song to improve student's critical thingking skills in electrical circuits	These results confirm the efficacy of combining PhET simulations and music to foster students' critical thinking abilities.
8	Komang Sri Purniasih & I Gusti Ayu Tri Agustiana, (2024)	Interactive Multimedia Based on Digital Literacy with the Topic of Animal Life Cycles to Improve Science Learning Outcomes for Fourth Grade Elementary School.	Research results prove a considerable impact based on interactive multimedia digital literacy concerning the practical nature of independent learning of students.
9	Putra, Aka, & Saidah, (2022)	Development of Interactive Multimedia Based on Microsoft Sway in Science Learning on the Human Circulatory System for Fifth Grade Elementary School	Considering the findings of the study, the Microsoft Sway media in the IPA learning of the Human Circulatory System material expected to enhance students' interest in learning to understand the material, and for teachers to easily explain the material related to the Human Circulatory System.
10.	Sekarwangi, Sartono, Mustadi, & Abdulah, (2021)	The Effectiveness of Problem-Based on Learning-Based Multimedia Interactivity for Elementary School Students	The validation findings received an 80% score. It is possible to draw the conclusion from the research that interactive multimedia focused on problem-based learning is crucial to the success of educational activities.
11.	(Diab, Daher, Rayan, Issa, & Rayan, 2024)	Transforming science education in elementary schools the power of PhET simulation in enchaning student learning	These results highlight the significant benefits of integrating digital resources, such as PhET simulations, into primary science instruction, as they improve students' grasp of key concepts and prepare them more effectively for future scientific learning.
12	Freddy & Olifia, (2019)	The Effectiveness of E-Learning Media to Improve Natural Science Learning Outcomes In Elementary School	These results indicate that students' understanding of science using e-learning media is significant.
13	Sefina, Nur Jannah, & Septiany Rahayu, (2024)	The Effectiveness of PowerPoint-Based Interactive Learning Media	Based on the research findings, it is concluded that student learning outcomes

		on the Science Learning Outcomes of 4th Grade Students at SDN 2 Kerandon, Cirebon Regency	increased following the implementation of PowerPoint-based Interactive Learning Media. Thus, PowerPoint-based Interactive Learning Media is established as effective for enhancing Natural Science (IPA) learning outcomes among fourth-grade students at SDN 2 Kerandon, Talun Subdistrict.
14	Hasanah, Kusumaningrum, & Ramadhani,(2023)	Development of Engaging Education Media Using iSpring Suite 9 Based on Android in Science Learning for 5th Grade at SD Muhammadiyah Malawili, Sorong Regency	The interactive learning materials based on Android have been deemed practicable due to the average feasibility test score by classroom teachers categorized as very good. The feasibility level of the Android-based interactive learning media is deemed suitable because the results of a small-scale As a result, Android-based interactive learning materials are very legitimate and useful for teaching.
15	Khasanah, Marjuki, & Nasution, (2021)	Effectiveness of Using Elmantab Media on Science Learning Outcomes	According to the study's findings, Elmantab's application in distant learning is successful. Students' learning outcomes in the Natural Sciences course were highly rated.
16	(Amalia, Pratama, Pratiwi, & Fujiarti, 2024)	The Influence of Interactive Media on Students' Learning Interest in 4th Grade Elementary School Science Education	The outcomes of this research shows that the percentage of students' interest in learning increased in each cycle, Therefore, after utilizing Interactive Image Media, fourth-grade pupils' interest in studying science has increased, it may be inferred.
17	(Sinambela & Pratiwi, 2024)	The effect of interactive media based on animated video on natural science process skills in elemntary school	alysis results It is concluded that the use of animated video-based interactive media is effective in enhancing process skills abilities among fourth-grade elementary school students in science subjects.
18	Saofah, Uswatun, & Sutisnawati, (2025)	Development of Smart Box Media Based on Science Environment Technology Society (SETS) in Elementary School Science Learning	This SETS-based smart box media falls into the Very Feasible category and can be utilized as a supplemental learning tool for Natural Science (IPA). In order to create educational activities, further study is required using the SETS-based smart box media in science education at elementary schools.
19	Shirajuddin, (2022)	Development of Interactive Learning Media on Solar System Material in Elementary Schools	interactive learning media for elementary school science subjects can be applied to relevant materials in elementary school science education.
20	Putri & Apriza, (2025)	Effectiveness of Using Animation Videos in Science Learning in Elementary Schools: A Systematic Literature Reviews	The use of animated videos has proven to be effective in teaching science in elementary schools. Therefore, educators are recommended to use engaging learning media in science education so that the learning material is conveyed well and effectively.
21	(Ulfa, Mashfufah, Malang, Panas, & Belajar, 2024)	Development of Interactive Multimedia Assisted by iSpring to Improve Cognitive Learning	This indicates an improvement in scores. This research is expected to contribute to the implementation of educational

		Outcomes of Heat Transfer Material in Elementary Schools	technology to raise the standard of instruction in elementary schools.
22	Rayan, Daher, Diab, & Issa, (2023)	Integrating PhET Simulations into Elementary Science Education: A Qualitative Analysis	This research underscores the efficacy of using PhET simulations in scientific instruction in elementary schools, which enhances by encouraging active participation and problem-solving abilities in kids.
23	Diab, Daher, Rayan, Issa, & Rayan, (2024)	Transforming Science Education in Elementary Schools: The Power of PhET Simulations in Enhancing Student Learning	The findings emphasize the substantial benefits of integrating digital tools such as PhET simulations into basic science education, as these tools enhance Conceptual knowledge and better prepare pupils to handle scientific difficulties in the future.
24	Wahyuni & Surikno, (2023)	Development of Audio-Visual Media Using Macromedia Flash 8 Application in Science Lessons at Elementary School	For the effectiveness results, an average score of 86.00% was obtained, with the criterion being very effective. It can be found that the creation of audio-visual materials in fifth-grade primary school utilizing the Macromedia Flash 8 program is very legitimate, useful, and efficient.
25	Barbara & Bayu, (2022)	Powtoon-Based Animated Videos as Learning Media for Science Content for Grade IV Elementary School	The developed media is appropriate and effective in teaching the topic of the animal life cycle for fourth grade and can serve as a reference in addressing the lack of interactive and innovative media.

Discussion

From the review of 25 articles evaluating the role of interactive media in science learning, it emerged that interactive media greatly affects the motivation and learning outcomes of students. In learning science, interactive audiovisual media and website-aided learning, such as Phet, foster effective learning experiences (Ningrum, Widodo, & Sudibyo, 2024). Explains that in the learning process, media can be used either as a teaching aid for the teacher to present the material or as a tool for the students to work on the material by themselves. This type of media which aids the support of content delivery is called media dependent. The effectiveness of media in learning is largely dependent on the teacher's skills and strategies in employing the media. The use of learning resources that provide multiple sensory channels and styles for accessing information and content, actively engage learners, and enable interaction is highly recommended (Guiotto Nai Fovino et al., 2024) Thus, it is important that teachers have great creativity and skill in selecting and using media optimally for teaching and learning activities.

Learning resources are instruments utilized in the teaching and process of learning to help educators convey messages or information to students. According to Learning media is used as an intermediary for materials in the learning process. In line with to clarify, learners with the use of media require intermediaries, or what is referred to as learning media. Teachers are responsible for innovating through the development of

technology-based learning tools, in order to engage students and support their understanding of the material (Khoiriyah, Subali, & Linuwih, 2022) With learning media, educators are able to shift the attention of students so that they do not become bored or fatigued and subsequently lose focus in the course of learning.

Media is as a very important part of this component, and it is the responsibility of educators to attend to this problem because it is vital in facilitating The process of teaching and learning which assists students in learning. The application of interactive multimedia is grounded on the constructivist theory. Meanwhile constructivist theory exposes that learning ought to stem from some initiative on the part of the learner (Aufa et al., 2020) Students have to actively participate in the construction of knowledge through real experiences. There will be fun in class when pupils are taught using interactive educational materials designed to motivate pupils to learn. Consequently, It is hoped that pupils will understand everything the teacher is explaining to them.

Augmented reality applications increase student interest in science subjects by enabling interactive and experiential learning (Amalia et al., 2024). This improves the understanding of learners with different abilities. Interactive multimedia learning media has advantages over other media; this media is a combination of various diverse media such as photos, animations, audio, and video. This will be highly appreciated by the students and will bring a new atmosphere(M. A. Putra et al., 2024). It can be concluded from the literature review that: 1) The interactive media for improving science learning achievement is: Research results show that the interactive sensory media can improve elementary school students' science learning outcomes in an interesting and interactive way. 2) Motivation and interest in learning is improved by interactive media: Interactive media can be helpful to cultivate learners' interest and motivation in science learning, so that they are more motivated and involved in the learning activities. 3) Interactive media help in better learning: Even the interactive media can help understanding some science concept bits better in a nicer and more interactive way. 4) The utilization of interactive media should be adapted to appropriate learning strategy: The utilization of interactive media has to be integrated to the appropriate learning strategy in order to raise the effectiveness in science learning.

CONCLUSION

Based on the findings of the reviewed studies, the use of multimedia in elementary school science learning has a consistently positive effect on students' conceptual understanding, achievement of learning objectives, and interest in science subjects. Interactive multimedia supports more engaging, visual, and meaningful learning experiences, enabling students to better comprehend abstract scientific concepts and actively participate in the learning process. However, the effectiveness of multimedia integration largely depends on teachers' ability to select and adapt learning media that align with students' characteristics, learning needs, and instructional goals. This study highlights several important implications for educational practice and future research. First, there is a need for the development of more innovative, interactive, and contextually relevant science learning media that are aligned with elementary students' cognitive development. Second, continuous teacher training programs are essential to strengthen teachers' pedagogical and technological competencies, enabling them to

effectively integrate interactive multimedia into science instruction. Finally, future research is recommended to conduct comparative and experimental studies that examine the effectiveness of interactive multimedia in comparison with other instructional methods across diverse learning contexts. Such studies will provide stronger empirical evidence to support decision-making in the development and implementation of multimedia-based science learning in elementary schools.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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