Effectiveness of Using Interactive Multimedia
For Early Childhood Learning

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Abstrak – Multimedia interaktif merupakan salah satu media yang dapat diterapkan dalam pembelajaran anak usia dini dan sejalan dengan perkembangan teknologi di era digital saat ini. Tujuan penelitian ini adalah untuk menganalisis efektivitas penggunaan multimedia interaktif dalam pembelajaran anak usia dini berdasarkan kajian sistematis. Masalah yang diangkat adalah apakah multimedia merupakan media pembelajaran yang efektif untuk anak usia dini. Penelitian ini menggunakan pendekatan *Systematic Literature Review* yang melalui tiga tahapan seperti perencanaan, pelaksanaan dan pelaporan penelitian. Penelitian ini mengumpulkan berbagai literatur melalui Google Scholar, Open Knowledge dan Sage, setelah itu diseleksi berdasarkan kriteria inklusi dan eksklusi sehingga mendapatkan literatur yang relevan, kuat dan kredibel. Temuan utama menunjukkan bahwa multimedia interaktif termasuk PowerPoint berbasis permainan, kartu flash, dan video animasi dapat secara efektif meningkatkan kemampuan akademis seperti membaca, penalaran matematika dan pemikiran logis sekaligus meningkatkan motivasi belajar serta pertumbuhan kemampuan untuk menyuarakan pendapat sendiri dan moderasi dalam beragama. Selain itu, media ini efektif dan memfasilitasi pembelajaran mandiri anak sesuai dengan tahap perkembangan mereka. Implikasi penelitian ini adalah multimedia interaktif tidak efektif jika tidak disesuaikan dengan tahap perkembangan anak, selain itu mendidik orang tua dan guru dalam literasi digital dan menggabungkan media ini ke dalam kurikulum merupakan cara yang menarik dan kreatif untuk meningkatkan perkembangan anak secara keseluruhan.

Kata kunci - Anak Usia Dini; Efektivitas; Interaktif; Pembelajaran; Multimedia

Abstract – Interactive multimedia is one of the media that can be applied in early childhood learning and is in line with technological developments in the current digital era. The purpose of this study is to analyze the effectiveness of the use of interactive multimedia in early childhood learning based on a systematic review. The issue raised is whether multimedia is an effective learning media for early childhood. This study uses a Systematic Literature Review approach which goes through three stages such as planning, implementation, and reporting of research. This study collects various literature through Google Scholar, Open Knowledge, and Sage, after which it is selected based on inclusion and exclusion criteria so as to obtain relevant, strong, and credible literature. The main findings show that interactive multimedia including game-based PowerPoint, flash cards, and animated videos can effectively improve academic abilities such as reading, mathematical reasoning and logical thingking while increasing learning motivation and the growth of the ability to voice one's own opinions and moderation in religion. In addition, this media is effective and facilitates children's independent learning according to their developmental stage. The implication of this study is that interactive multimedia is ineffective if it is not adjusted to the child's development stage, in addition educating parents and teachers in digital literacy and incorporating thid media into the curriculum is an interesting and creative way to improve overall child development.

Keywords - Early Childhood; Effectiveness; Interactive; Learning; Multimedia

INTRODUCTION

A critical period that establishes the groundwork for kids' social, emotional, and cognitive development is early childhood education (Wardhani, Iriyanto, & Maningtyas, 2024)(Wardhani et al., 2024). Effective teaching methods and resources are crucial at this point to promote kids' overall development and get them ready for further schooling (Ikhwan et al., 2024). Finding strategies to interest kids and improve their comprehension is one of the biggest problems (Juannita & Mahyuddin, 2022)(Juannita & Mahyuddin, 2022). A clever and practical answer to this problem is multimedia. Multimedia offers a lot of potentials to grab kids' attention, support active learning styles, and produce engaging learning experience as compared to traditional educational media (Rohmah, Yusuf, Azizah, & M, 2023)(Rohmah et al. 2023; Wang et al. 2019)

The use of technology in early childhood education has grown along with the advancement of the digital era (Fajar & Aeni, 2024). Modern educational methods heavily rely on multimedia, which is described as the blending of different components including text, pictures, music, animation, and video to convey learning experiences (Mayer, 2009)(Mayer, 2009). Interactive multimedia is one of the learning advances that dynamically blends kinesthetic, auditory, and visual components. Children's creativity must be encouraged and unstructured play must be encouraged to accomplish (Yamada-rice, 2021; Strouse et al., 2019).

This is by the needs of young children who learn through activities and direct experiences to attract the attention of their various senses (Sun, Loh, & Roberts, 2019). Interactive multimedia-based media has recently begun to be in demand as a potential substitute for improving early childhood education. Children's motivation, involvement, and understanding of various learning topics can be improved through interactive multimedia (Syafrizal, Andika, Panggabean, & Level, 2018). For example, a study by Halimah, Amanah, and Brigitha (2023) showed that when compared to traditional learning, the use of interactive multimedia greatly improves children's learning outcomes. In addition, research by Al-fahmi and Wijaya (2024) demonstrates that, in contrast to generally utilized methods, interactive multimedia may capture children's attention. This high level of interest will encourage them to learn. Nevertheless, certain results still show variances, particularly about media design, implementation, setting, and student characteristics, even though numerous research has demonstrated the efficacy of interactive multimedia. This suggests that a more thorough examination and attention to the early childhood learning context are required.

This study emphasizes the value of interactive multimedia in early childhood education and fills the gap in the current literature. It will employ the Systematic Literature Review approach to find, assess, and summarise pertinent research findings, giving a thorough picture of the main elements influencing how well interactive multimedia supports learning (Nafisah, 2022). A systematic, fact-based, and pertinent synthesis of recent advancements in early childhood education is made possible by this method. In addition to assessing cognitive learning outcomes, this study takes into account children's emotional involvement and drive to learn as success factors.

This study's primary goals are to deepen our understanding of the effectiveness of interactive multimedia in early childhood education and formulate useful suggestions for its advancement. The evidence-based synthesis strategy, which incorporates prior research findings with an emphasis on early childhood education, is what makes this study distinctive. Therefore, this is anticipated to substantially contribute to developing an innovative and pertinent interactive multimedia-based learning method for early children in this digital age.

METHOD

This study used the Systematic Literature Review (SLR) methodology, to collect, assess, and analyze relevant literature on a particular subject, this study used based on existing empirical data, and the SLR technique was chosen to offer a comprehensive summary of the efficacy of interactive multimedia in early childhood education. Research planning, evaluating the research implementation, and

reporting the findings are the procedures used in the literature review (Firdaus, Rohmah, & Munastiwi, 2024).

The researcher began the three-stages SLR procedure by locating relevant material, using the keywords "multimedia interaktif untuk pembelajaran anak usia dini", "efektivitas multimedia interaktif dalam pendidikan anak usia dini" and "interactive multimedia early childhood". The literature was taken from data search sources used by academics with search results using Google Scholar, Open Knowledge, and Sage. A further selection is the second step, papers that pass the first round will be carefully examined, and their suitability to the research objectives will be verified. Reporting the findings of the analysis of the articles that made it past the second stage is the third step. After that, the researcher will begin reviewing to draw findings that will be utilized as study outputs. Researchers will use the following table of inclusion and exclusion criteria as filters for articles:

Table. 1 Inclusion and Exclusion Categories

Aspect	Inclusion	Exclusion
Population	Early childhood educators and parents participated in the study	The early childhood field was not the study's primary emphasis
Intervention	Talked about interactive multimedia as a teaching tool	Non-interactive multimedia that isn't utilized in early childhood education
Results	Measuring cognitive, affective, or child engagement components and assessing the growth in early childhood understanding	Not closing learning objectives and having nothing to do with early childhood education
Method	Case studies, SLR, experimental	Opinion pieces devoid of empirical
	or quasi-experimental research, or pertinent meta-analyses	research and studies with insufficient information
Document Type	Full-text publications	Non-full-text and non-scientific articles
Years	2018-2024	Before 2018

Source: Modification from Hakam et al., (2022) and Maryam et al., (2021)

The inclusion and exclusion criteria for early childhood education studies are listed in this table. Measures of cognitive, emotional, and child involvement, as well as educators and parents, are the main topics. Only full-text empirical studies were allowed; studies with inadequate data or those that were irrelevant were not.

RESULT and DISCUSSION

The purpose of this study was to determine the extent to which interactive multimedia is beneficial in early childhood learning. According to systematic observation findings, the use of interactive multimedia can have a significant positive impact on learning in various areas, such as reading, mathematics, and language skills, as well as children's motivation, attitudes, and cognitive development. This media not only provides an interesting, fun, and efficient learning environment but also allows students to learn independently or collectively through interactive elements.

Interactive multimedia can also be used to promote cultural and social learning relevant to children's lives. As a result, the success of interactive multimedia can be measured by increasing learning outcomes, child engagement, and the ease of realizing abstract concepts. Based on the findings of the first stage's article search, the researcher started looking for references using predefined keywords. The researcher looked for the keywords in three different data search sources and found 137 items that matched the keywords. Twenty-one articles that fit the inclusion and exclusion criteria were found after the researcher started analyzing the data gathered in the second stage. To get a conclusion that would serve as a research output, the researcher started

reviewing in the third stage.

Through the summarization of data from a variety of literature sources, researchers will help to create a clearer understanding of the extent to which effective interactive multimedia may be implemented in early childhood learning. The outcomes of the articles gathered are described as follows:

Table. 2 Article Filtering Results

Author (Years)	Results
Estu Miyarso (2018)	Interactive karaoke multimedia works well for enhancing early childhood vocal communication skills such as identifying writing.
Edi Elimelech and Dorit Aram (2019)	Computer or multimedia games that use sound and pictures well can enhance children's spelling abilities without the need for adult help. Additionally, children can grow freely based on their literacy level and save time and money by learning how to use a computer.
W. Quin Yow and Sridhar Priyashri (2019)	The use bilingual e-books with suitable multimedia features supports children's early literacy skills. These e-books also have a favorable impact on children's literacy, graphophone mic knowledge, and metalinguistic awareness. Through the use of multilingual e-books with multimedia capabilities children can learn to read on their own with the help of clear printed references.
Andriyani, Happy Indira Dewi and Zulfitria (2020)	When combined, multimedia and interactive animation have the potential to significantly and favorably impact young readers' abilities.
Priawan Ardi	Children's reading
Putra and Isabella Hasiana (2020)	skills improve as a result of interactive multimedia since it makes them more eager to participate in teaching and learning activities and finds them more engaging.
Lilis Lisnawati and Abdul Karim Halim (2021)	Interactive multimedia-based learning tools based on PowerPoint reveal a considerable rise in children's interest in learning, making youngsters brave enough to ask questions and share their ideas. Interactive PowerPoint media can promote understanding and strengthen children's memory because it includes game characteristics that stimulate youngsters to think concretely.
Hidayatu Munawaroh, Afifah Eka Yulia Widiyani, and Rifqi Muntaqo (2021)	Interactive multimedia improves children's reading skills because it makes them more eager to participate in teaching and learning activities and makes them more engaging to be effective in the classroom, as evidenced by learning outcomes completion rates that have increased to 80% and a significant improvement from an initial average value of 2,07 to 2,73.
Efi Norita and Hadiyanto (2021)	Children's numeracy abilities can be enhanced by interactive multimedia-based content.
Elena Himma Nizrina, Isti Rusdiyani and Fadlullah (2022)	Interactive multimedia can greatly enhance children's language skills, and the assessment scale meets the high level of effectiveness criteria because the results increased by 41%, from 54% to 95%.
Luthfia Karimah,	An early literacy culture

Raeh Nikan Baghiroh and Dewi Anggraeni (2022)	based on local knowledge is successfully fostered via interactive multimedia learning, as evidenced by an experimental class's n-gain score of 0,84%, which is in the high category.
Farah Fahrun Nisak (2022)	Interactive multimedia is quite effective in encouraging attitudes of religious moderation, as seen by its 79% n-gain score.
Eka Juannita and Nenny Mahyuddin (2022)	Thanks to interactive multimedia, children can benefit from learning experiences, particularly in the area of listening skills, and from more varied and engaging learning.
Upik Elok Endang Rasmani, Siti Wahyuningsih, Novita Eka Nujanah, Jumiatmoko, Yuanita Kristiani Wahyu Widiastuti, Putri Agustina and Milla Diah Putri Nazidah (2022)	Implementing learning objectives, choosing applications, creating material, evaluating it, and distributing it are the five primary steps in the production of interactive multimedia. When used as an early childhood learning tool, interactive multimedia improves the effectiveness, efficiency, diversity, scope, significance, and enjoyment of teaching and learning activities for young learners.
Rina Nurasyiah, Luluk Asmawati, Fadlullah and Cucu Atikah (2023)	Teachers may utilize interactive multimedia flashcards as a teaching tool to help kids become better readers.
Rika Rahmawati and Farida Mayar (2023)	Interactive multimedia is quite effective for improving early childhood measurement skills, with an average of 87%.
Tami Aspi Zahda Hidayah, Nandhini Hudha Anggarasari and Fajar Nugraha	Interactive PowerPoint-based multimedia may effectively enhance children's mathematical reasoning intelligence.

(2023)	
Ahmad Fuadin, Befita Puti Aprita, Mohammad Rasya Sathia, Nayla Syifa Effendi and Zaima Mahirotul Azza (2023)	Interactively presented animated videos can successfully enhance children's comprehension.
Aisya Dinda Suci, Dhea Salsabila, Rika Helmalia, Rosita, Syifa Faujiah, Lizza Suzanti (2023)	Interactive PowerPoint can be stimulate the cognitive ability to classify items rationally by type and color. Furthermore digital media can help children's cognitive growth while also facilitating enjoyable and engaging learning.
Puji Yulianti and Sella Oktania (2023)	Students learning motivation is assessed as strong at 80,3% and interactive flash-based multimedia may improve children's learning results by 76,58% when used with appropriate criteria.
Hirjati, Nurul Mughniy, Heliati Fajriah, Dina Amalia and Saptiani (2024)	Children's logistical skills in grouping, sorting patterns, building puzzles, and categorizing names, sizes, and functions may all be enhanced by playing PowerPoint games.
Ajeng Octatya Dwiyani, Hendra Sofyan and Nyimas Muazzomi (2024)	Children who play interactive multimedia games based on PowerPoint can become passionate learners who pay attention to the game's look, actively ask and answer questions, and enjoy the learning process.

Source: Modification from Nugraha & Novaliyosi, (2023) and Al Ghifari et al., (2022)

This table contains articles that have gone through the inclusion and exclusion criteria screening stage so that the 23 articles can be used as research data and can proceed to the next stage.

Effectiveness of Interactive Multimedia in Supporting Reading and Language Skills

The use of interactive multimedia can improve early reading skills in children. Andriyani et al., (2020) found that the use of interactive multimedia and animation can significantly improve children's early reading skills. In addition, multimedia flashcards are useful as learning materials to improve reading skills (Nurasyiah, Asmawati, Fadlullah, & Atikah, 2023)(Nurasyiah et al., 2023). This effectiveness is supported by the findings Munawaroh et al., (2020) which found that the use of interactive multimedia in classroom learning can improve learning completeness with an average initial score of 2,07 to 2,73. Multimedia, with features such as animation and interactive narration, allows children to learn language in a fun and effective way.

According to research, multimedia such as interactive karaoke (Miyarso, 2018) and multilingual e-books (Yow & Priyashri, 2019) help children improve their metalinguistic awareness, spelling skills, and early reading skills. These media stimulate children's brains by combining visual and audio aspects, in line with the dual processing theory. Furthermore, research by Rasmani et al., (2022) shows that interactive multimedia flashcards can help children develop their reading skills, making literacy more fun and effective. These studies show that audiovisual multimedia can engage children's brains intensely through the use of sight, sound, and text.

Interactive multimedia in language components has been shown to help develop listening and speaking skills. According to Nizrina et al., (2022), the use of multimedia can improve language skills by up to 95%. Furthermore, Fuadin et al., (2023) stated that interactive animated films help toddlers understand linguistic topics effectively through attractive visual presentations. This finding is consistent with the findings of Juannita & Mahyuddin, (2022), who found that multimedia-based learning experiences improve children's listening skills. An interactive learning approach, which includes animated visuals, allows students to actively participate in their learning. This strategy also helps children understand more complex language ideas, such as basic grammar and narrative comprehension.

Contribution of Interactive Multimedia to Cognition and Conceptual Understanding

Interactive multimedia plays an important role in cognitive development by fostering the ability to reason logically and understand fundamental ideas. According to Suci et al., (2023), interactive PowerPoint can help children categorize objects by type and color, which improves their cognitive capacity. This is by research by Yanuarsari et al., (2023) and (Ristyadewi & Fitria, 2023), who found that interactive PowerPoint materials that incorporate game aspects can help children understand abstract ideas, improve their memory, and inspire them to think concretely.

It has also been proven that interactive multimedia can improve early childhood logic and mathematical abilities. While Hidayah et al., (2023) found that interactive PowerPoint is useful in improving logical-mathematical intelligence, Norita, (2021) found that interactive visual-based multimedia helps children better understand the concept of counting through concrete methods. According to research Rahmawati & Mayar, (2023), multimedia also helps children's understanding of measurement, which was previously considered abstract. This efficacy shows how visually appealing and well-structured techniques can significantly accelerate children's learning while improving overall learning outcomes. In addition, through a visual and interactive approach that is appropriate to their developmental stage, multimedia can offer a rich learning experience and help children understand abstract concepts.

Increasing Motivation and Enthusiasm for Learning

Children's motivation and joy in learning increase significantly through interactive multimedia. According to research by Dwiyani et al., (2024), PowerPoint-based multimedia games can increase enthusiasm, interest in the appearance of the game, and children's willingness to ask and answer questions. According to Lisnawati & Halim, (2021), PowerPoint-based media makes children more enthusiastic about learning and encourages them

to voice their thoughts and ask questions. This shows how interactive multimedia can be used to make learning fun while encouraging children to play an active role in their education. Thus, multimedia functions as a tool for education and increases children's self-esteem.

Another area where interactive multimedia greatly enhances learning motivation is in this area. According to research, children who use multimedia become more enthusiastic about learning to read (Putra & Hasiana, 2020). According to another study, children's learning motivation increased by 80,3% after using flash-based interactive multimedia (Yulianti & Oktania, 2023). When information is presented in an interactive format, children are happier and more engaged, making learning fun and meaningful. The intrinsic motivation hypothesis, which highlights how an engaging learning environment can increase children's engagement in the process, is supported by this condition.

Supporting Value and Attitude Learning

Interactive multimedia has a major influence on value and attitude learning in addition to cognitive and motivational factors. With an n-gain score of 79% Nisak, (2022) observed that this media is very effective in fostering various moderate attitudes in early childhood; this shows that interactive media helps with academic skills and develops constructive attitudes consistent with the principles taught. It has also been proven that the development of value-based learning is supported by interactive multimedia combining social and cultural components. According to Karimah et al., (2022), interactive media that incorporates local knowledge helps children learn in a way that is more in line with their daily experiences, making learning, attitudes, and values more meaningful.

Interpretation of Findings and Theory Development

The constructivist theory, which emphasizes the importance of active experiences in children's learning, is supported by these findings. Children actively participated in interactive multimedia by exploring interactive elements such as animations and simulations, in addition

to being consumers of information (Fitriani, Sianturi, & Mulyana, 2023). The findings of this study also lend credence to the dual processing or dual coding theory, which states that children are better able to understand and remember information when it is presented to them verbally and visually at the same time (Nurannisaa, 2017). These components work together to create a rich learning environment that helps children learn more efficiently and with greater purpose. The conventional view of the teacher's function as the primary facilitator is also questioned by this study (Afriani, Soegiarto, Suyuti, Amarullah, & Aristanto, 2024). According to research by Elimelech & Aram, (2019), interactive multimedia allows children to learn on their own with minimal assistance from adults or teachers. Combining the function of multimedia as a "self-paced learning companion" that increases instructor participation, creates the potential to change learning theory. In this scenario, the instructor plays more of a guide and friend and multimedia turns into an independent and flexible learning tool that can be adjusted to the developmental needs of early childhood.

The study's findings suggest that one of the primary strategies for early childhood education should be interactive multimedia. It has been demonstrated that interactive multimedia including animation features, interactive stories, and gamification components may improve children's reading numeracy, and motivation to study. It is required of teachers to be able to use this technology in their regular lessons, particularly when presenting abstract ideas like measurement, logic, or regional cultural values. To maximize the potential of interactive multimedia in promoting enjoyable and meaningful learning, instructors' training on how to utilize this technology also has to be strengthened.

It is recommended that school principals and other education stakeholders encourage the widespread adoption of interactive multimedia by providing adequate infrastructure, and facilities, especially in schools located in places with poor access to technology. Using interactive media that is relevant to children, parents can also play an important role in home learning. In addition, students and education researchers can build on this research by

creating more inventive technology-based learning materials or applications, such as augmented reality (AR) and investigating how this affect children's social-emotional development. Or they can utilize low-cost technology such as using PowerPoint or Canva as tools to create interactive multimedia-based learning media. The findings of this study should significantly improve the standard of early childhood education in the digital age with the help of several stakeholders.

CONCLUSION and SUGGESTIONS

To determine how this media can aid learning and offer development recommendations, this study concludes that interactive multimedia is highly beneficial in early childhood education. Children's academic skills, including reading comprehension, mathematical reasoning, and logical thinking, can be enhanced via interactive multimedia, including game-based PowerPoint, flashcards, and animated films. This media's integration of visual components tales and animations makes the learning process more engaging tangible and understandable. Additionally, interactive multimedia boosts children's drive and excitement for learning while fostering the development of positive qualities like the courage to voice one's thoughts and the moderation of religion.

The effectiveness of interactive multimedia is another benefit that makes learning more efficient with time and resources and facilitates children's ability to study independently. Digital literacy training for educators and parents, interactive integration components that enhance learning, and designs pertinent to children's needs are some suggestions for its development. In addition, to improving knowledge of multimedia's efficacy, this study offers helpful advice for creating it as a cutting-edge instrument to promote early childhood development.

The usefulness of interactive multimedia in enhancing early childhood abilities might be investigated further, particularly in subjects that call for comprehension of abstract ideas like values, computations, or decision making. To Maximise children's engagement and comprehension, interactive multimedia designs may be tailored to the age and learning preferences of the kids. Additionally, it's critical to provide content that promotes good qualities like emotional control and sound decision making in addition to cognitive development. The use of this medium in schools with limited technology might be the subject of future studies.

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