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TRENDS IN THE UTILIZATION OF AUGMENTED REALITY AS A LEARNING TOOL FOR STUDENTS IN INDONESIAN ELEMENTARY SCHOOLS

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Abstract: Learners are currently growing up in the digital era, they will meet digital technology in the family environment and even the community. Schools need to strive for technological updates to facilitate learners. The aim of this study is to analyze scientific articles to gather resources related to the use of Augmented Reality as a learning medium for student. The approach employed in this article is a literature review. The literature review analysis method employed is descriptive systematic review. The criteria for scientific articles used are sourced from international journals with the latest 5 years from 2019-2025. This article analyzes six articles from ScienceDirect. The results of the analysis of 6 scientific articles obtained more developed types of research and development research and literature review than other types of research. The analysis of these journals reveals that the use of Augmented Reality as a learning medium has both positive and negative effects on students and educational institutions. Despite its drawbacks or potentional negative impacts, with proper management, Augmented Reality learning media can serve as an effective solution for elementary school education in Indonesia. This is due to the ability of Augmented Reality to enhance students' motivation and interest in learning. Future research is encouraged to explore the use of Augmented Reality as a learning medium for elementary school students in Indonesia through qualitative, quantitative, and research and development metodologies.

Keywords: augmented reality, elementary school, learning media, learning media trends

INTRODUCTION

Indonesia is a developing country. All infrastructure also continues to develop. One aspect that is also developing is education. Education in Indonesia really needs attention. One of the things that must be considered is the reading ability of the community. Reading proficiency plays a fundamental role in teaching and learning activities. In reality, reading proficiency in Indonesia remains quite low. As evidence by direct observation in several Indonesian elementary schools. Some of these elementary schools show the low reading ability of students. From some teacher statements, it also shows that students have a fairly low reading ability. (Rasimin et al., 2024) also states that the reading and literacy skills of students in Indonesia are still very low. Teachers also stated that this happened due to several factors. The factor that most causes the low reading ability of students is the family. Families do not participate in students' learning activities at home. Sometimes parents only accompany learners when learning, not teaching them. Learners also admit that when studying at home they are often read to by parents. This causes learners to be increasingly lazy to read. Learners are too spoiled with various facilities at home, so the interest in reading is very low. This will be carried over to the classroom. Teachers complain that their learners are very slow when reading. Some learners also still need the teacher's help when reading. Some children are fluent in reading, but understanding the reading is still lacking. (Marmoah & Poerwanti, Suharno, 2022) in his research also states that there is a significant increase in the use of certain methods, so it can be concluded that the reading ability of

previous students is still quite low. According to (Gebremeskel et al., 2024) states that reading ability is seen from several aspects such as reading speed, reading accuracy, and reading comprehension.

In recent years, technology-based learning media has developed very rapidly. The presence of technology that continues to grow will also grow together in the lives of learners. Teachers must continue to develop their abilities in the field of technology. This is so that teachers can always adjust the needs and provide appropriate educational resources and tools for students. The existence of parental facilities at home must also be followed by teachers, so that students do not feel bored when learning in the school environment. There are many technologies that can be used as alternatives to support learning in schools. One of these technologies is Augmented Reality. Augmented Reality is learning tool that provides an enganging and interactive educational experience for classroom instruction. This is because Augmented Reality combines visual elements and digital animation at the same time. Augmented Reality will certainly be new and become an interesting learning media for students in elementary schools. According to (Rusli et al., 2022) Augmented Reality has emerged as a tool that enhances human, including applications in games, virtual experiences, and educational media. According to (Alamsyah et al., 2022) in his study, it is mentioned that Augmented Reality technology is a highly effective method to be used as an introductory tool in classroom teaching and learning activities. It is also in accordance with the statement by (Kwangmuang et al., 2024) the finding show that the developed 3D animation series can notably enhance learners' analiytical thinking skills, demonstrating a high level of format suitability and improved quality of analitycal thinking after the intervention. Augmented Reality developed as learning media will be a novelty in learning. This because Augmented Reality becomes a different thing to learning activities for elementary school. This article also reviews scientific articles to gather insights on the use of Augmented Reality in elementary schools education.

Augmented reality technology has become one of the good innovations for the field of education, particularly in enhancing student interest and engangment. Augmented Reality can combine digital objects into the real world directly and same time. According to research carried out by (Negi, 2024) states that Augmented Reality in class can assist in explaining green energy and sustainability topics by providing tangible excamples. In addition, study carried out by (Câmara Olim et al., 2024) states that utilizing Augmented Reality on three learning experiences results in an increase in high learning outcomes and a positive effect on learning. Consistent with this statement, research conducted by (Pujiastuti & Haryadi, 2024) states that learning activities using Augmented Reality in geometry subjects make students more active and more motivated to learn. From some of these studies it is possible to be seen that Augmented Reality technology developed as a studying tool has a significant effect and can improve understanding of concepts in students. Augmented Reality technology not only helps teachers in providing writing, but in its use Augmented Reality can also display concrete objects. This is of course very much needed by students at elementary school age, because at that age students will better understand the material and concepts if learning using concrete media or media that can present visuals concretely.

At the elementary school level, Augmented Reality as a learning tool holds significant potentional in boosting students' interest in reading. The use of Augmented Reality's ability to provide 3D visuals will be a different thing in elementary school learning. (Haahr et al., 2025) his research suggests that utilizing Augmented Reality can enhance the learning process between subject areas such as

music, art, and stories, so that it has the potential to boost students' enthusiasm learning. This will certainly be directly proportional to the increase in students' interest in reading. In addition, a study by (Guzmán et al., 2024) indicates that Augmented Reality provides an interactive learning environment and helps learners explore a variety of complex issues in civic subjects. Augmented Reality is also very suitable for elementary school students because it is easy to use. This is explained in a study by (Eber et al., 2023) suggests that utilizing Augmented Reality only requires relatively little expertise and its use is fast. Teachers as facilitators in educational activities, it can use technology-based educational tools like Augmented Reality. This means that because its use is quite easy. In making it is also relatively easy because currently there are many digital applications and technologies that have developed rapidly. Teachers only need skills in managing and using technology maximally so that they can develop Augmented Reality technology that can serve as an educational tool in schools.

Besides Augmented Reality, there is a learning medium called Mixed Reality. This medium provides an experience in the form of text accompanied by visual displays. This learning medium can also be used in teaching and learning activities in elementary school. This aligns with research conducted by (Annetta et al., 2024) it was found that mixed reality used to improve reading ability had a significant effect. Mixed Reality is a text with an interesting visual image. The Mix Reality media presents text with visual images that learners can see directly, but the visual images presented are not the original form of the concrete object of the word. In this study, it will be seen how the effectiveness of Augmented Reality media that presents text and 3D digital objects in real-time. This study presents an alternative learning medium that can be used to enhance students' learning interest, particularly in improving their reading interest. However, this study employs a Mixed Reality approach, so future research will explore in greater depth the use of Augmented Reality as a learning medium to enhance students' learning interest in elementary school. This research emphasizes the utilization of Augmented Reality as an interactive learning medium. This interactive learning tool is expected to increase students' interest and reading skills in elementary school.

Learning tools can also be used across various subjects, both at the elemtary school level and the secondary school level. In a research conducted by (Løkken et al., 2023) in Norway found that learning with digital olfactory books using olfactory nerve function can increase learner engagement in reading activities. Research on how to increase students' interest in reading was also conducted by (Wang, 2023) , in the results of his research stated that combining learning with current technology can increase students' interest in learning. In that study, the research subjects were from developed countries that already have better digital literacy skills compared to developing countries like Indonesia. Furthermore, subjects of previous studies were also not limited to junior high schools, high schools, and even universities, while this study is aimed at elementary school students in Indonesia. Previous research also tends to produce technical and developmental findings, while this research provides conceptual recommendations and alternatives that can be implemented directly in learning activities in Indonesian elementary schools. Teachers can use the results of this research in their schools to improve the quality of student learning. Of course, with various approaches, for example by conducting interactive activities using digital-based media at school.

This research was conducted by analyzing how the benefits of Augmented Reality to boost students' enthusiasm for reading in elementary school. This research provides recommendations for alternative

educational tools that teachers use to assist students in literacy activities at school. The use of technology-based interactive learning media in the form of Augmented Reality for literacy activities is still very rarely used in elementary schools, so it is expected that the findings of this study can be applied and utilized also in various elementary schools in Indonesia. In addition, the implementation the use of Augmented Reality as a learning tool in elementary schools aims not only to boost atudents' interest in reading and literacy quality, but also to orient students to the digital technology that is developing today and facilitate the needs of 21st century skills that must be possessed by students today. The application of Augmented Reality as an educational tool is also to facilitate learners to explore more technologies that can be used in learning activities. More interesting and fun technology in learning will increase learners' interest in learning. The creation of a pleasant learning environment will foster learners' interest in learning. Learners who are interested and interested in literacy activities will certainly have better reading skills than before. Thus, this research not only supports increasing learners' interest in reading, but also provides alternative innovative learning media that can be used by educators to build an effective and enjoyable learning environment.

RESEARCH METHODS

This article is a conceptual paper. This research is literature research or often known as literature review, which involves a collection of studies that use library-based data collection methods and the research subject is researched and studied through library data. Literature review is a way of exploring data that reviews academics and contributes theoretically to a particular topic. This literature review is also called a Systematic Literature Review (García-López et al., 2025) . The articles used in this study are articles published within the last five years from 2019-2025.

Figure 1. The following are the stages of the literature review.

The data obtained in this study is secondary data. Secondary data is data obtained not through direct research or observation. The data in this study were obtained from research that had been conducted by previous researchers. The secondary source of information is in the form of scientific information taken primarily from journal articles related to the use of Augmented Reality media in learning.

The method for the data collection method used in this study is the documentation method. The documentation method is a technique for the collecting information by searching for information from various scientific articles related to the matters to be discussed in the formulation of the problem. The strategy in searching scientific articles is to use Sciencedirect. The keywords used in the search for scientific articles are learning media, Augmented Reality, reading interest, and elementary school. Scientific articles that match the keywords will be selected, then will be further analyzed. In this

study, the review is conducted with articles that have open access or open access so that they can be analyzed in fulltext with pdf format. Some steps in This literature review research is, looking for a question or problem, the process of searching, and finding articles according to the criteria (GarcíaLópez et al., 2025).

The scientific articles reviewed in this study are scientific articles in English, with the subject of learners. Articles used from various types of research with the theme of Augmented Reality learning media. Scientific articles that are in accordance with the research theme will be collected and summarized in a table that includes the name of the researcher, the puvlication year of the article, the title of the scientific article, the contents of the journal, the results of the research that has been done. To be clearer in analyzing abstracts and fulltext, the scientific articles are read and explored more deeply. The journal summary is then analyzed on the research objectives and findings this study. The analysis method in this research is content analysis of scientific articles.

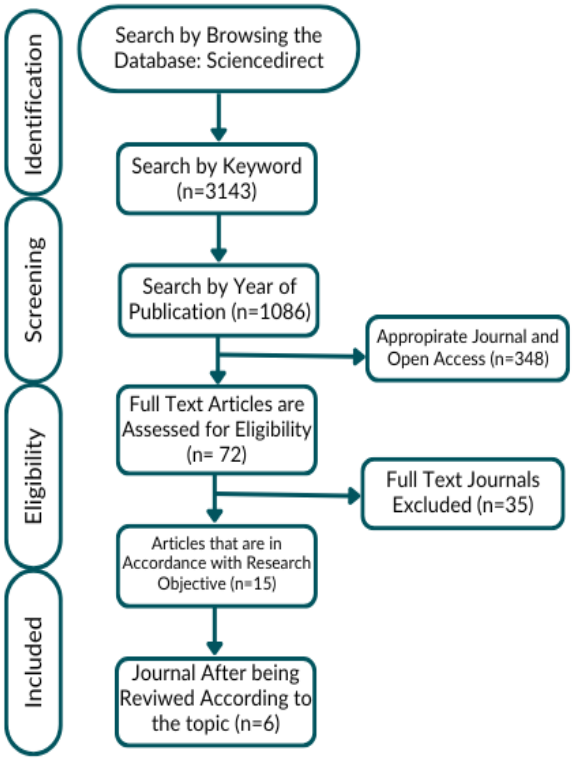

Figure 2. The following is a Prism diagram in obtaining data sources.

The research conducted several steps to obtain articles relevant to the research topic. The first step was identification. Using the keyword search on ScienceDirect, 3143 articles were found. Then, screening based on publication range resulted in 1086 articles. Of these, 348 articles were open access. In the eligibility stage, based on the criterion of full-text availability, 72 articles were deemed eligible, while 35 articles were exclouded. A total of 15 articles matched the research objective. In the inclusion stage, 6 articles were reviewed and found to align with the topic.

RESULTS AND DISCUSSION

Result

Analysis of 6 articles on the utilization of Augmented Reality media in learning in Table 1.

Table 1. Systematic Analysis of Literature Search

No	Authors	Journal	Title	Type of Research	Result
1	Richi Rusli, Darryl	Procedia Computer	Augmented reality for	Qualitati ve	Augmented Reality as an educational tool can allow

	Arkan Nalanda, Antonius Doff Valma Tarmidi, Kristien Margi Suryaningrum, Rezki Yunanda	Science, (2022, Vol. 216, 237-240)	studying hands on the human body for elementary school students	research and literature study	learners to see the environment and concrete objects virtually combined in real life. Consistent the application of Augmented Reality as an educational tool will improve problemsolving skills, motivate learners, and increase student learning outcomes. The implementation of Augmented Reality as a learning tool also increases student enthusiasm by 14%, increases concentration by 31%, confidence by 11%, and increases student satisfaction by 13%. The increase is evidence that learning throuhg the use of Augmented Reality is suitable to be applied in the school environment.
2	Ahmed L ALYOUSIFY, Ramadhan J MSTAFA	Virtual Reality and Intelligent Hardware (2022, Vol. 4, 263-277)	AR-assisted children book for smart teaching and learning of Turkish alphabets	Use of new technologies to solve some problems.	Augmented Reality learning media is very popular with students, because it can display concrete objects visually and in the form of 3D, and can be combined with the real environment in real-life..
3	Muhammad Naufal Sinai Harjana, Hanley Yunanda Saputra, Cuk Tho	Procedia Computer Science (2023, Vol. 227, 734-742)	A Review of the Potential Use of Mixed Reality Learning Methods in Comparison to Traditional Learning Methods	Qualitative research by distributing questionnaires to 100 students	In schools, conventional learning methods, often referred to as traditional teaching methods, are still frequently applied in the tlassroom and are the main method. This method is still relevant for learning to provide concept learning, but it is not effective for explaining abstract concepts to students. The application and implementation of Augmented Reality can certainly be a solution in teaching abstract theory or

					practice, Augmented Reality media can also enhance the experience and have a positive impact on students. In addition, there are negative impacts of using Augmented Reality in learning, namely facilities, funds, human resources, content, and regulations and content.
4	Lin Haomin, Wei Wei	Computers & Education: X Reality (2024, Vol. 4, 1-9)	A systematic review on vocabulary learning in AR and VR gamification context	Systematic review with provisions of the latest PRISMA framework	Technology-based learning media, namely Augmented Reality, is useful for increasing vocabulary knowledge that may be utilized actively. Interactive educational tool such as Augmented Reality can also significantly improve the language skills of individual learners. In addition, there are negative effects of using Augmented Reality for learners, which can cause negative effects and physical, mental, and cognitive health, and impaired concentration.
5	Kharisma Indiarto Putra, Patrick Jeremiah Lere Dawa, Yoss Dewangga Burgos, Fairuz Iqbal Maulana	Procedia Computer Science (2023, Vol. 227, 709-717)	Implementation of Augmented Reality in Study for Human Anatomy	ADDIE research and development model	The implementation of Augmented Reality educational tool has received a fairly good response. The use of Augmented Reality in learning provides an innovative, clear, easy-to-use learning experience.
6	Harun, Neha Tuli, Archana Mantri	Procedia Computer Science (2020, Vol. 172, 660-668)	Experience Fleming's rule in Electromagnetism Using Augmented Reality: Analyzing	Mixed research (qualitative and quantitative)	Augmented reality media used in learning is more effective and efficient in increasing knowledge, and can help students gain a higher level of knowledge and understanding than before.

	Impact on Students Learning

Disscussion

According to the analysis of 6 scientific articles on Augmented Reality as an educational tool trends, it is possible to be explained that the types of research used vary greatly, ranging from qualitative research, quantitative, mixed research, research and development, and literature review. Classroom action research and qualitative research are still very rare, this can allow other research related to Augmented Reality educational tool using the type of classroom action research and quantitative.

The research instruments used are questionnaires, observation forms used to monitor how the influence of Augmented Reality learning media in classroom learning. From study carried out by (Rusli et al., 2022) that in his study shows the percentage impact of applying Augmented Reality as a learning tool in schools. The consistent application and implementation of Augmented Reality as an educational tool will improve critical thinking skills, motivate students, and improve student academic performance. This is in line with (Câmara Olim et al., 2024) which states that through the application of Augmented Reality as a learning tool, students become more motivated and feel interested in learning. In addition, by using Augmented Reality learning tool, students also quickly understand the concept of learning materials.

Other studies also state that utilizing Augmented Reality as a learning tool is very impactful on teaching and learning activities in the classroom. This aligns with the study conducted by (Alyousify & Mstafa, 2022), the study explained that Augmented Reality learning media is very popular with students, because it can display concrete objects visually and in 3D, and can be combined with the real environment in real-life. With an interesting learning atmosphere and favored by students, it will grow the curiosity of students about how the work even the material in the learning media used. This is in accordance with the opinion of (Held & Mori, 2024) in his research states that student learning motivation depends on the teacher. How the teacher can bring a pleasant learning atmosphere, so that it can create active learning and increase students' curiosity about learning.

The application and implementation of Augmented Reality learning tool in schools does not only have a beneficial effect, but also has a negative effect or lack of implementation of Augmented Reality as a learning tool. This is presented by (Harjana et al., 2023) in his research states that, the use of Augmented Reality as a learning tool has both positive and negative effects. The positive impact of using Augmented Reality learning media in schools is to add to the learning experience and provide meaningful learning. In addition, as for the negative impact or shortcomings of the implementation and application of Augmented Reality as a learning tool in schools, namely requiring adequate facilities, the use of larger funds for hardware and software needs, human resources, content mastery, and regulation and context. This is in accordance with the advancement of Augmented Reality as a learning tool described by (Alamsyah et al., 2022) in his study, that in the development of Augmented Reality as a learning tool requires many aspects, such as cameras, applications, expert human resourcesand so on for the development of applications or Augmented Reality learning media.

Apart from the shortcomings in the application and implementation of Augmented Reality learning media, there exist negative impacts on students as users of Augmented Reality as a learning tool ineducational activities. According to

(Haoming & Wei, 2024) in his research states that, the aplication and implementation of Augmented Reality as a learning tool can have positive and negative impacts. The positive impact in the use of an advantage of learning media is that it can enhance students' knowledge of the material taught at school, and can improve students' language skills. As for the negative impact of utilizing Augmented Reality for learning tool on students, namely affecting the physical health, cognition, and even mental students, and can cause concentration problems in students.

Augmented Reality media in educational activities remains an unusual and more contemporary media. It is presented by (Putra et al., 2023) that Augmented Reality as a learning tool is a tool that can convey learning material clearly and easily understood, innovative media and different from usual media such as concrete objects, or power points, and so on. In addition, this educational tool is also simple to use, both by students and teachers in classroom activities. The same thing is also presented by (Harun et al., 2020) in his research states that the use of Augmented Reality in learning can build effective and efficient learning, participants can more easily understand the concepts and materials studied. Learners become easier to understand the material than before using Augmented Reality as a educational tool.

The development of Augmented Reality as a learning tool can display 3D visuals that can be combined with the surrounding environment in real-life. The ability of Augmented Reality can display concrete objects in virtual real-life, so that in the absence of concrete media that can be touched directly, students will still be able to learn by seeing virtually 3D. Thus, Augmented Reality learning media is very suitable for learning students in the elementary school phase. This is because at that age students will learn more easily if they learn directly or by seeing concrete media of the material being studied. This statement is in line with Piaget's theory in research (Rapanta, 2023) which states that children will continue to interact with their environment so that they can construct it into a scheme for the child. Children's cognition will also always change and develop over time and in line with children's growth. At the age of 18-24 months, children's cognitive development at the sensorimotor stage, children are between birth and 2 years old, from 2 to 7 years old, they are in the preoperational stage, from 7 to 11 years old, children experience cognitive development at the concrete operational stage, and at 12 years old and older, they reach the formal operational stage. At the 7 to 11 years old, students will learn more effortlessly by utilizing concrete objects or media for study. The use of educational tool that is interesting and can be seen directly will facilitate atudents' understanding of learning concepts and materials. Morever, Augmented Reality as a learning tool that is still very rarely used, so that the media becomes more interesting and more challenging for students.

CONCLUSION

Conclusion

The trend of using Augmented Reality as learning tool has been widely used in foreign schools. The application of Augmented Reality as a learning tool in elementary schools can greatly affect students. There are various impacts ranging from positive impacts and negative impacts. This learning media trend can boost motivation of students and attract the attention of students because, this media has not been widely used in learning. Augmented Reality learning media can also be combined with various learning methods and models, such as even traditional learning models. The use of this media can also open the views and abilities of students in the use of technology. In addition, there are drawbacks to the application and implementation of Augmented Reality as a learning tool, such as being able to interfere with the psychological, physical, and cognitive

health of learners. Of course, if there is no monitoring from the teacher. So, there needs to be monitoring and assistance from teachers while utilizing Augmented Reality as a learning tool in the elementary school scope. The shortcomings of the use of this media are found in the need for facilities, human resources, and funds. In order for these problems to be resolved properly, it is necessary to have contributions from various parties related to education in Indonesia. Thus, the trend the application of Augmented Reality as a learning tool can be followed for students in Indonesian elementary schools.

Suggestion

Some suggestions that can be conveyed related to the research results in this article are expected to be a consideration in conducting research related to the utilization the implementation of Augmented Reality as a learning tool for elementary school students in Indonesia using qualitative, quantitative, and research and development types. In addition, it is expected to be able to raise variables that are related and important to use, so that they can be applied properly to agencies in schools, especially elementary schools in Indonesia.

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