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AUGMENTED REALITY: ITS EFFECT ON SATISFACTION AND INTEREST IN LEARNING NATURAL SCIENCE FOR ELEMENTARY SCHOOL CHILDREN

ONNY FRANSINATA ANGGARA[1,*], ZAENAL ABIDIN[1,2], ACEP OVEL NOVARI BENY[1], SUJARWANTO[1], WAGINO[1], HIRNANDA DIMAS PRADANA[1], NOVIA RESTU WINDAYANI[1], DIAH ANGGRAENY[1]

[1]Universitas Negeri Surabaya, Surabaya, Indonesia
[2]Universitas Pendidikan Indonesia, Bandung, Indonesia
*Corresponding Author: onnyanggara@unesa.ac.id

Abstract

This research aim to investigated students' perceptions and the impact of Augmented Reality (AR) on learning Natural Sciences, specifically focusing on the topic of metamorphosis. Science education emphasizes systematic observation and experimentation to comprehend the physical and natural world, gradually transitioning from abstract concepts to concrete understanding, particularly in elementary school settings. AR is explored as a potential educational tool to enhance comprehension of scientific concepts by overlaying virtual information onto the real world. The choice of "Metamorphosis" as the theme is motivated by its relevance to students' anatomy and its potential to stimulate interest in science. The study employs the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model to assess the impact of AR on student satisfaction and interest in the science learning process. Data on student achievement and science process skills were gathered through a final test, while student interest was gauged using a questionnaire. The analysis utilizes descriptive statistics to interpret the findings. The research underscores AR's capacity to enrich science education by providing opportunities for meaningful learning experiences. Ultimately, the study demonstrates that AR yields significant advantages in enhancing students' engagement and understanding of science concepts.

Keywords: Augmented reality, Learning interest, Learning satisfaction, Metamorphosis, Natural science.

1. Introduction

One of the technological innovations currently developing is Augmented Reality (AR), which allows the integration of virtual information with the real world. AR has been used in various fields, including education, to create more interactive and engaging learning experiences [1]. Science education, especially at the elementary school level, often faces challenges in conveying abstract concepts to students [2]. Recent studies in social learning theory emphasize the role of digital media in observational learning and the development of self-efficacy through online platforms [3]. Therefore, the use of AR, which allows students to Experiential learning theory continues to inform the development of immersive learning experiences, particularly through the use of virtual reality and AR technologies [4].

Several studies have shown the use of AR in education has improved students' academic performance [5-7]. For example, research found several students who used AR in learning showed significant improvements in concept understanding and academic achievement compared to students who learned through conventional methods. This shows not only helps in visualizing difficult concepts but also improves learning outcomes [8].

Within the instructive environment, AR is displayed in completely different ways. There were five sorts of AR bearings utilized in instructive situations [9]. To begin with, discovery-based learning, where clients are given data from almost real-world places intrigues them. For illustration, AR is frequently utilized in galleries, authentic destinations, and space science reenactments, to show data outwardly. Moment, protest modelling, which permits clients to recognize the appearance of certain things in numerous settings. Third, there are AR Books, which offer 3D introductions and intelligently learning encounters for clients. Fourth, there are aptitudes preparing that require combined visual reenactment. Lastly, AR recreations increment the control of gaming in instructive settings.

From an educational psychology perspective, the use of AR is linked to the connectivism theory pioneered by Siemens [10], which emphasizes the importance of networks and connections in the learning process. AR as a tool to expand student’s ability to understand and explore science concepts through deeper and more meaningful interactions with subject matter. The research aims to explore the effect of using AR on elementary school students' satisfaction and interest in natural science lessons. The novelties of this study are (i) using AR technology for natural science learning, (ii) learning becoming more interactive, and (iii) enhancing students' learning experiences and achieving better learning outcomes on natural science.

2. Literature Review

AR frameworks coordinate virtual data into the user's physical environment therefore data is seen as existing within the environment [11]. The elemental qualification between increased reality and virtual reality is given by the reality, within the case of AR, the virtual substance is superimposed on a genuine environment, while within the case of VR, the environment is virtual.

AR innovation has rapidly ended up reasonable for commercial and investigative ventures over the past decade due to the predominance of head-mounted gadgets (HMD) and smart gadgets such as phones, tablets, and handheld amusement supports, which are presently naturally woven into existence [12]. AR innovation is pertinent in different areas, such as medication, instruction, and recreated preparation among others [13], and well-being sciences [14].

The urgency of implementing AR in education is underscored by its potential to transform learning experiences through increased engagement, interactivity, and personalized learning. AR enhances student's motivation and participation by creating immersive learning environments that blend digital content with the real world [15]. This technology supports experiential learning, allowing students to visualize and manipulate complex concepts, and improve their understanding and retention of material [16]. Moreover, AR offers the opportunity for differentiated instruction tailored to individual learning styles and paces, addressing diverse education more effectively.

In addition to these pedagogical benefits, AR prepares students for a future where digital literacy and technology integration are essential skills. AR also fosters collaboration and problem-solving skills by enabling interactive and cooperative learning experiences [17]. However, the successful implementation of AR in education requires addressing challenges such as the cost of technology, the need for teacher training, and the development of high-quality content [18]. Despite these challenges, the potential benefits of AR make it a critical innovation for modernizing educational practices and enhancing student learning outcomes.

3.Method

The ADDIE methodology in developed AR applications for education includes five main stages (analysis, development design, implementation, and evaluation). Then to find out the effectiveness of the AR application through feedback from students, as well as analysis of learning result data for further improvement. This methodology ensures AR applications are developed systematically and effectively to enhance students' learning experience. The research object is all students of UNESA Labschool amount of 60 students. This research uses a questionnaire as a research instrument measured with a Likert scale. The questionnaire used consists of 30 questions, divided into 4 dimensions, as in the feasibility test carried out is validity, to find out whether the questionnaire is valid or not. In this context, AR is considered a tool to expand students' abilities to understand and explore concepts through deeper and more meaningful interactions with course material. AR development is based on the following stages in the Fig. 1.

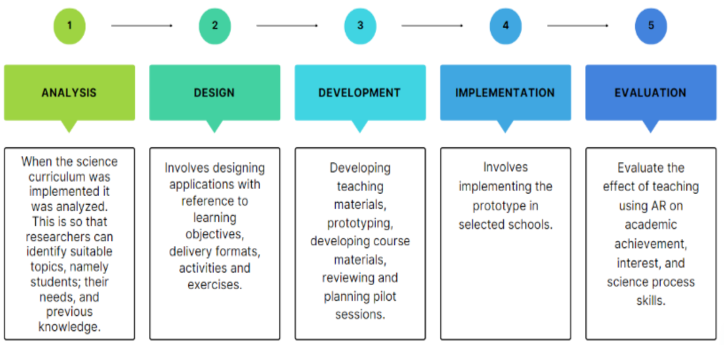

Fig. 1. AR development phase.

To find out whether the questionnaire is reliable, a reliability test was used. The questionnaire is suitable for use as a research instrument. In analysis testing, ordinary descriptive statistical analysis is used for data analysis.

4. Results and Discussions

In the educational context, AR has become an innovative tool that offers a more interactive and immersive learning experience compared to conventional learning methods [15]. There are several symbols in describing diagrams, namely actors, use cases, and interaction. An actor is a human entity, process, or machine that interacts with a system, subsystem, or class. It is a model to describe the behavior of the system created in Fig. 2.

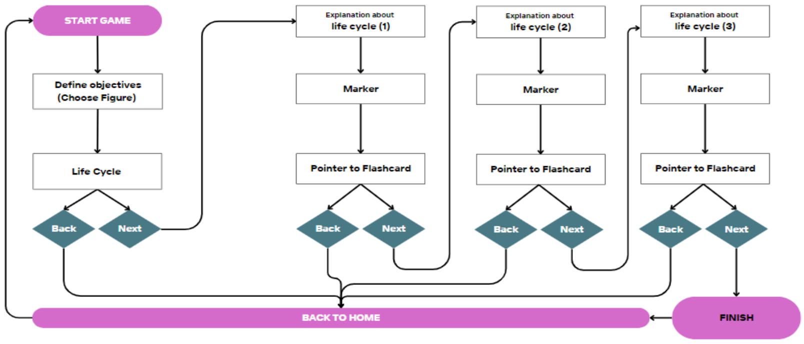

Fig. 2. Flowchart AR "metamorphosis".

The general principle of AR influences the user's cognitive load in dealing with information presented in an extended physical environment is still the same as virtual reality. In contrast to virtual reality which combines real objects (users) into a virtual environment, AR combines virtual objects in a real environment. This technological approach not only supports the retention of knowledge but also fosters a deeper understanding of complex subjects through visualization and interactive exploration [19, 20]. Thus, AR in education serves as a powerful tool to boost student engagement, making learning both fun and effective [21-23]. Figure 3 is the display of flashcards used for the AR marker.

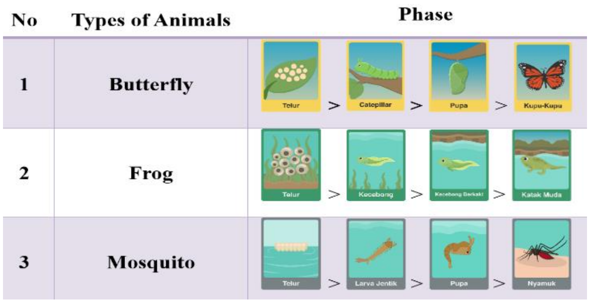

Fig. 3. Flashcard marker.

The function of the application created is the application able to display 3D virtual housing objects on markers and it is had been detected by the webcam on the monitor screen. The interactive nature of AR not only aids in comprehension but also fosters a more engaging and enjoyable learning experience, thereby encouraging students to take a more active role in their education [21]. Additionally, AR also helps visualize abstract concepts that are difficult to understand through traditional learning methods. For example, he use of 3D molecular models in chemistry education helps students visualize and understand molecular structures and interactions, thereby enhancing their comprehension of complex concepts [22]. The AR display is in Fig. 4.

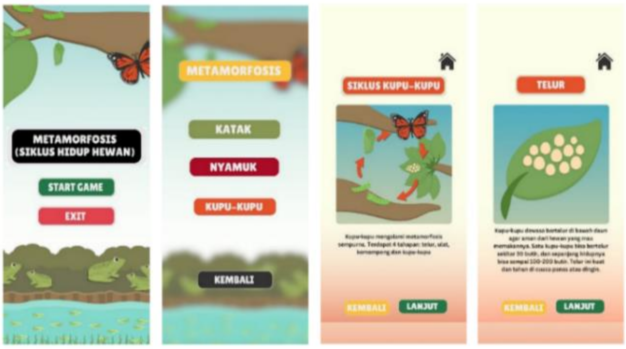

Fig. 4. Menu interface.

At the Universitas Negeri Surabaya (UNESA) Labschool, the application of AR in Natural Sciences learning for elementary school students has become the focus of recent research. Science learning at the elementary school level is often challenging because it requires understanding abstract and complex concepts. In this discussion, we explore various aspects of using AR at UNESA Labschool, including implementation methods, student responses, and the impact of this technology on learning effectiveness. It is hoped the research results provide valuable insight into the potential of AR as innovative learning, as well as how this technology runs optimally to be integrated into the basic education curriculum.

The questionnaire consists of 30 statements, divided into 4 dimensions, namely ease, usefulness, satisfaction, and interest in learning. A validity Test is carried out to find out whether the instrument is valid or invalid. There are 30 questions in the questionnaire, if the r-table value is smaller than the calculated r-value, it means the instrument is valid. The results of the validity test on the questionnaire instrument calculation the r-table (0,254) smaller than r-value (0,854). This mean the questionnaire are valid to implemented to the subject.

After validity, the next step is reliability, to determine the Cronbach consistency of the questionnaire used. Taking Cronbach in the reliability test is based on whether the Cronbach alpha value is 0.6, the questionnaire is declared reliable or consistent, based on the results score shown 0,968. Descriptive analysis was carried out to determine the level of usefulness of AR among elementary school students. The result show students satisfaction with AR is at a high level with an average value of M= 3.861. The constructivist learning theory pioneered emphasizes the importance of social interaction and the use of assistive devices in the learning process. Vygotsky's theory emphasizes the importance of social interaction and cultural tools in the learning process, suggesting that these elements enable learners to build upon their existing knowledge and develop new cognitive structures [24].

Descriptive analysis was carried out to determine the level of student interest in science using the Augmented-Reality application. The result show students interest in using AR is at a high level with an average value of M= 3.714. Children in the concrete operational stage (ages 7-11 years) learn most effectively through direct manipulation and interaction with their environment. AR allows students to view and interact with visual representations of abstract concepts, which improve their understanding of course material. Research [20], by the integration of AR into science education is proving to be an effective tool for helping students understand complex concepts, making learning more accessible and enjoyable. Finally, this study adds new information regarding how to teach science education, as reported elsewhere [25-31].

5. Conclusion

The use of AR in learning Natural Sciences for elementary school students has great potential to increase students' achievement, satisfaction, and interest in these subjects. The use of AR in science education can help students understand abstract concepts in a more concrete and real way, as well as facilitate deeper understanding through active and critical interaction with the subject matter. By utilizing AR technology, students can gain a more interactive, interesting, and enjoyable learning experience. The use of AR also expands the possibilities of innovative teaching and learning methods, such as inquiry, project, or experience-based learning, thereby enriching students' learning experiences. In the context of educational psychology, AR also be considered as a tool that supports constructivist learning theories, which emphasize the importance of social interaction and the use of tools in the learning process. However, further research is still needed to better understand the impact and effectiveness of using AR in science learning, as well as to identify the most effective teaching strategies for integrating AR technology into the science education curriculum.

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