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Implementation of Augmented Reality (AR) Technology in English Learning

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A B S T R A C T

This study aim to use of augmented reality-based learning media to improve elementary school students' critical thinking skills and digital literacy. This research method was Research and Development (R&D) with the ADDIE model. The research results showed: (1) the analysis stage was carried out by media, curriculum, and material analyses as guidelines for efficient and effective media design; (2) the design stage was carried out by designing an augmented reality media framework and making research instruments; (3) the development stage was carried out by developing the design of learning media and research instruments, assessments from experts with very decent results and revising the media based on criticism and suggestions; (4) the implementation stage was carried out through AR media development trials and pretest-posttest analysis of critical thinking skills and digital literacy using normality test, N-gain score, and independent t-test; and (5) the evaluation stage was carried out with the final revision and analysis of student response questionnaires which indicated that the level of practicality of the product was categorized as very practical. This research concluded that AR media effectively improved elementary school students' critical thinking skills and digital literacy.
Keywords: *Augmented reality, English Learning*

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INTRODUCTION

The 2013 curriculum, which carries the concept of familiar learning with information and communication technology, involves aspects of students' digital literacy. Digital literacy in elementary schools is the ability to use digital media properly, correctly, and responsibly to obtain learning information, find problem solutions, complete learning assignments, and communicate various learning activities with other learning people. Tang & Chaw (2016) and Chan, Churchill & Chiu (2017) define digital literacy as the use of technology that involves the ability to understand, analyze, and evaluate the information received to find and use information as thought and disseminate that information through digital platforms. It is in line with several expert opinions which state that digital literacy is an individual's awareness, attitude, and ability to use digital components to identify, access, understand, integrate, manage, evaluate, analyze, criticize, and synthesize information to build new knowledge, communicate with others or elicit constructive social action (Durriyah & Zuhdi, 2018; Wright & Wilson, 2011; Soepriyanti et al., 2022). Furthermore, Soepriyanti et al. (2022)

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define seven digital literacy elements: media literacy, information literacy, digital scholarship, learning skills, communication and collaboration skills, career management, and technology and information literacy.

Spires & Bartlett (2012), Rochet (2017), and Lukitasari et al. (2022) describe that digital literacy has three dimensions, namely a technical dimension related to information technology, a cognitive dimension related to one's skills in processing information, and a social-emotional dimension which is an online socialization skill. Digital literacy indicators in this research comprised media literacy, information literacy, communication and collaboration skills, and social-emotional skills.

Furthermore, students' digital literacy was also found to be still very low. It was indicated by the fact that students were still unfamiliar with technology because of point (4) above. Students were only proficient in using technology such as smartphones to play games and social media, so their digital literacy was not channeled for learning purposes. Digital literacy in elementary school students was seen as attitudes, knowledge, and skills to use digital media around to use digital media to find information, entertainment, and learning. However, the field facts showed that many schools prohibited their students from playing digital media in the classroom. Students were asked to accept limited lessons based on the teacher's wishes in applying the media. According to the teacher, information was also obtained based on the interview results. The application of digital media in elementary schools was tricky because students asked many questions about the application of the media and the class was not conducive (Perdana et al., 2019; Nelson et al., 2011).

Based on these problems, it is necessary to have the right solution. One of them is by utilizing technology in learning. The use of technology in learning dramatically affects students' critical thinking and digital literacy skills through learning media. One of the suitable learning media for 21st century learning to improve critical thinking skills and facilitate students' digital literacy is augmented reality. This augmented reality technology can add specific information into the virtual world and display that information in the real world with the help of equipment such as webcams, computers, Android smartphones, or special glasses (Shoutthaboualy, Chatwattana & Piriyasurawong, 2021). Augmented reality can improve students' understanding by displaying 3D objects, text, images, video, and audio, involving students to interact actively with virtual objects and providing fun and exciting learning. AR is also easy to operate by simply pointing the camera at the body, book, or other objects (Nurhasanah, Widodo & Riandi, 2019; Hsu, Wenting & Hughes, 2018).

METHOD

This research used a type of research and development known as the Research and Development (R&D) ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Almelhi, 2021). The first stage was the analysis stage. At this stage, the researcher analyzed the importance of developing learning media to know the initial needs in developing this learning media. The analysis carried out in this stage included media, curriculum, and material analyses. Second, the design stage aimed to produce an initial product (prototype) or product design that was adapted to the analysis that had been carried out. The activities carried out at this stage were the selection of the initial format and framework as well as the selection of research instruments. The third was the development stage. This stage consisted of several steps, including (1) the development of a design framework for learning media and instruments made in the previous stage, which experts then evaluated, and (2) the assessment of media carried out by competent experts in the field of media, material, and language as well as being able to provide criticism and suggestions for better media preparation, and (3) revision of the media that experts have validated based on considerations and suggestions as well as criticism from media, material, and language experts. Fourth, the implementation stage was indicated by the application of learning media products that had been developed and declared worthy of testing by media expert lecturers, linguists, and material experts then tested on research

subjects on a small scale. At this stage, a pretest-posttest was conducted to measure the effectiveness of improving critical thinking skills and digital literacy before and after using media. Then, the evaluation stage was carried out by the final revision of the learning media developed based on student response questionnaires and observation sheets obtained in the field.

The data obtained from this development research consisted of qualitative and quantitative data. The qualitative data in this research were: (1) criticism and suggestions as well as input from material experts, media experts, and language experts; and (2) the results of observations were described in the form of descriptions of responses and learning conditions. The results of the data analysis were used as the basis for revising the product to be developed. The quantitative data in the research included: (1) critical thinking skills test; (2) digital literacy questionnaire; (3) media validation questionnaire; (4) student response questionnaire. Data on critical thinking skills used an open description test instrument, while data for digital literacy was obtained using a questionnaire instrument. The pretest and post-test results to measure the improvement of critical thinking skills and digital literacy before and after the use of the developed learning media were analyzed using statistics in the form of normality test, N-Gain, and independent t-test.

FINDINGS AND DISCUSSION

The product developed was *augmented reality*-based learning media on *android* devices with the *Assembler application* as a support for human motion system material. This learning media was expected to facilitate educators' and students' learning. Students were expected to be able to construct their thoughts by stimulating the materialization of the human motion system material so that learning could improve critical thinking skills and digital literacy in using Android. The first stage of this research was the analysis stage. This analysis stage included media, curriculum, and material analyses. Media analysis was carried out using the observation method. The results of field observations also showed that critical thinking skills were very low due to the following reasons: (1) teachers did not involve students in learning; (2) teachers still dominated learning with lectures; (3) students were more silent and became passive listeners; and (4) teachers only used books in teaching, write learning materials on the blackboard or dictate to students. Furthermore, the learning carried out never used smartphone-based media. Even students were not allowed to bring smartphones. Based on the results of interviews, most students stated that they often use their smartphones to play games, and only a small percentage stated that they used smartphones to look for subject matter that was not in the book. Curriculum and material analysis were also conducted to determine suitable science material combined with AR. Furthermore, some abstract science materials can be concretized with AR in grade 5, namely: (1) the human movement system; (2) the respiratory system of living things; (3) the human digestive system; (4) the human circulatory system; (5) the earth and its surroundings; and (6) the water cycle and natural events.

The results of this analysis stage were supported by the results of Samsudin et al. (2021) and Mariam (2019), which stated that the primary things that must be carried out at the analysis stage were analyzing the problem, determining teaching objectives, analyzing student characteristics, examining the resources used and material analysis. The research results were in line with the theory of Salas-Rueda et al. (2020), which stated that the stages of the ADDIE model analysis analyze students in terms of their needs, problem analysis, and task analysis so that the output of this analysis process is in the form of student characteristics, gap identification, identification of needs and analysis of tasks in the form of solutions to their needs. Trust & Pektas (2018) and Thesalonika et al. (2019) also states that development research departs from existing problems such as current or available products

that are no longer relevant to the needs of the target, learning environment, technology, student characteristics, and so on.

The second stage in this research was the *design* stage. The activities carried out at this stage were the selection of the initial format and framework as well as the selection of instruments. At this stage, researchers began to examine the most effective applications used to create *augmented reality*. The selected application was *Assemblr*. The researcher then downloaded the Assemblr application and tried to make AR according to the material that had been determined. Researchers also designed sentences displayed on AR to be more effective and efficient when AR media was used. At this stage, researchers also began to make assessment instruments in the form of *pretest* and *post-test* questions on critical thinking skills and digital literacy questionnaire instruments. The question instruments were adjusted to the material taught using AR, while the digital literacy instruments were adjusted to the psychological development stage of students. The results of the design stage research were in line with the theory, which stated that design activities in the ADDIE development research model were a systematic process that started from designing the concepts and content in the product. Designs were written for each product's content. Instructions for implementing the design or manufacture of products were sought to be written clearly and in detail. At this stage, the product design was still conceptual and underlie the development process at the next stage (Thesalonika et al., 2019; Samsudin et al., 2021; Ngussa, 2014).

Development stage. This stage consisted of several steps, including a) developing a design framework for learning media and instruments made in the previous stage, which experts then validated, and b) assessing learning media carried out by competent experts in the field of media, materials, and language as well as being able to provide criticism and suggestions for better media preparation, and c) revising the media that experts had validated based on considerations and suggestions and criticisms from media, material and language experts. Development in the ADDIE development research model contained activities to realize product designs that had previously been made (Tu et al., 2021). A conceptual framework for implementing a new product had been developed in the previous stage. The conceptual framework was then realized into a product ready to be implemented (Sarwanto, Laksmi & Chumdari, 2021). Figure 1 below is a design framework for learning media that would be developed.

Figure 1. Design of Augmented Reality about The Part of Body Human

To test the feasibility of the AR, the researchers conducted a series of judgments on related experts and stakeholders, namely media experts, material experts, linguists, and users. Meanwhile, after the judgment process, the researcher revised the media that had been validated by experts based on suggestions and criticisms.

The *implementation* stage was the stage of applying learning media products that had been developed and declared appropriate based on the testing by media expert lecturers and material experts. Then, it was tested on research subjects on a small scale (Priyanka & Selamat, 2021). The application of the product in the ADDIE development research model was intended to obtain *feedback* on the product being made/developed. Initial feedback (early evaluation) can be obtained by asking questions about product development goals (Ismiyani, 2021). At this stage, a pretest- posttest was conducted to measure the effectiveness of students' critical thinking skills and digital literacy. The data from the pretest-posttest results are presented in Figure 2 below:

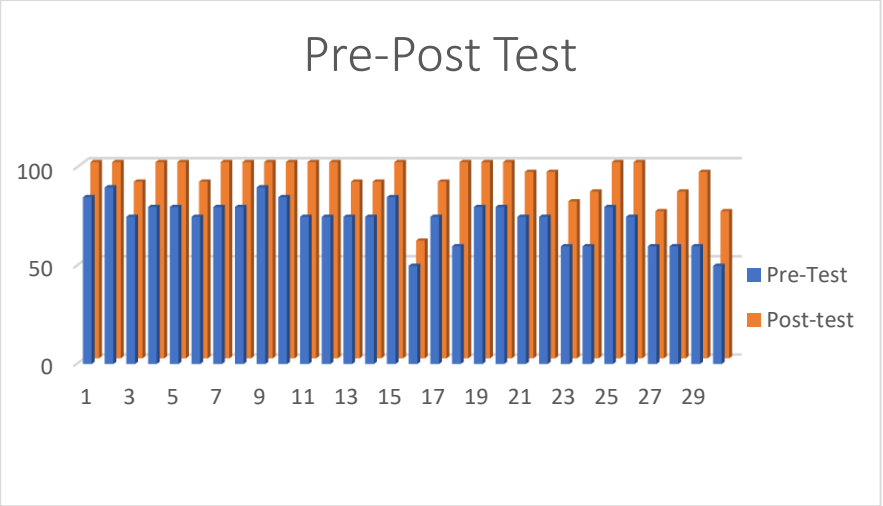

Figure 2. Pretest-Posttest Data for Critical Thinking Skills and digital literacy

Based on Figure 2, information was obtained that visually, there was an increase in the value of students' critical thinking skills in both the experimental and control classes. The post-test scores for the critical thinking skills of the experimental class students were much higher than the pre-test scores for the critical thinking skills of the control class students.

This research strengthened the theory of Hsu, Wenting & Hughes (2018), which states that the introduction of digital-based literacy for elementary school students must be adjusted to the psychological side and abilities of children at that age stage by providing digital literacy through images, videos, animated videos, interactive. animation, and *augmented reality*-based animation. The elementary school students could and wanted to learn actively. They could build knowledge independently, utilizing fun learning to maximize learning outcomes. Furthermore, smartphones were among the primary sources of information that could be used and were familiar to students. The *augmented reality* application in this research required a smartphone to scan QR- AR markers. The use of smartphones in learning was a new and effective step. These digital-based information sources must be used properly and help students to learn to be prepared optimally (Waliyuddin & Sulisworo, 2021). It means that digital-based information must be created by maximizing the potential of technological progress, which is packaged attractively (Shoutthaboualy, Chatwattana & Piriyasurawong, 2021; Nurhasanah, Widodo & Riandi, 2019; Hsu, Wenting & Hughes, 2018).

Figure 3. Pretest-posttest work and implementation of augmented reality

The *evaluation* stage was completed with a final revision of the learning media developed based on criticism and suggestions from experts and users and student response questionnaires to the media. The evaluation stage in the ADDIE model development research was conducted to provide feedback to product users so that revisions were made according to the evaluation results or needs that the product had not met. The final objective of the evaluation was to measure the achievement of development goals (Salas-Reuda et al., 2020; Samsudin et al., 2021). Based on the analysis of the data from the assessments of experts and users, it was concluded that the developed product was appropriate to use without the need for revision, but considering the suggestions and inputs given by material and media experts. Furthermore, the researchers followed up with improvements. Furthermore, after testing the product on students, the product's practicality would be measured through a student response questionnaire sheet.

Conclusion

AR media effectively improved elementary school students' critical thinking skills and digital literacy. Thus, it can be concluded that there was a significant difference in critical thinking skills between experimental class students who used AR media and control class students who used book media. Then, the value of Sig. (2-tailed) digital literacy on the t-test was 0.029 < 0.05. It could be concluded that there was a significant difference in digital literacy between experimental class students who used AR media and control class students who used book media. The last stage was the evaluation stage. It was carried out with a final revision of the learning media developed based on criticism and suggestions from experts and users as well as student response questionnaires to the media by 89% and could be categorized as very practical.

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