



Development Of Educational Augmented Reality Game as English Language Learning Media With Character Education Values

Elinda Umisara ^{a,1}, Alim Mutaqin ^{b,2}, Siti Ulin Nuril Hidayah ^{c,3}

^{a,c} Pendidikan Bahasa dan Sastra Indonesia Universitas Muhadi Setiabudi, Brebes Indonesia

^b Pendidikan Guru Sekolah Dasar Universitas Muhadi Setiabudi, Brebes Indonesia

✉ email coresponden author : elindasara33@gmail.com

Abstrak

Penelitian ini bertujuan untuk mengembangkan game edukasi *Augmented Reality* sebagai media pembelajaran. Media yang dikembangkan dapat digunakan pada smartphone dengan sistem Android dan dalam pembuatannya menggunakan aplikasi Unity. Penelitian ini merupakan penelitian *research and development* (R&D) dengan menggunakan model pengembangan ADDIE. Tahapan penelitian yang dilakukan antara lain *Analysis* (analisis), *Design* (desain), *Development* (pengembangan), *Implementation* (implementasi) dan *Evaluating* (evaluasi). Validasi dilakukan oleh ahli materi, ahli media, dan ahli bahasa. Uji validasi game edukasi berbasis *Augmented Reality* diperoleh kategori sangat layak dengan persentase kelayakan 96,33%. Teknik pengambilan sampel dilakukan secara purposive sampling dan diujicobakan pada 15 siswa Sekolah Dasar kelas 5. Hasil penilaian game edukasi berbasis *Augmented Reality* pada materi Bahasa Inggris “*part of human body*” direspon positif oleh peserta didik dengan presentase yang diperoleh $\geq 70\%$ pada setiap indikatornya.

Abstract

The primary objective of this research is to create an educational Augmented Reality game as a learning tool. This media can be accessed on Android smartphones and developed using the Unity application. The study adopts a research and development (R&D) approach, following the ADDIE development model, which includes Analysis, Design, Development, Implementation, and Evaluation stages. The validation process involves assessments by subject matter experts, media experts, and language experts, resulting in a highly favorable rating with a validity percentage of 96.33% for the learning media. To conduct the testing, 15 fifth-grade Elementary School students are selected using purposive sampling. The students' responses to the educational game, focusing on the English language topic “part of the human body” and incorporating Augmented Reality, were overwhelmingly positive, with a percentage of $\geq 70\%$ for each assessment indicator.

Sejarah Artikel

Diterima : 23 Nopember 2023

Disetujui : 1 Desember 2023

Kata kunci:

Game Edukasi, Augmented Reality, Pembelajaran Bahasa Inggris, Nilai-Nilai Pendidikan Karakter

Keywords:

Educational Game, Augmented Reality, Learning English, Character Education Values

Introduction

The advancement in the technology sector requires diverse fields to adjust and keep pace with the changing times. The technological developments pose a challenge to educators,

aiming to fortify the role of teachers as facilitator and learning partner for students. The utilization of technology can serve as an alternative solution to enhance students' learning interest in the current digital era (Ahmed, et al, 2020). This has occurred due to the increasingly advanced era of artificial intelligence, which has impacted various aspects of life, including education.

In the context of education, one of the applications of artificial intelligence that can create a more interactive and engaging learning environment is educational games based on Augmented Reality (AR). AR serves as a tangible example of how artificial intelligence (AI) plays a role in the learning process. AR based educational game or educational game represents a form of gaming that integrates AR technology with educational objectives. The aim of educational game providing an interactive, enjoyable, and profound learning experience for students who use it. One of the primary advantages of AR educational game lies in its capacity to create immersive learning experiences (Indarta, et al, 2022). Students can directly engage with digital content overlaid onto the real world through AR devices like smartphone or tablet. This translates learning from a theoretical concept into something more tangible and practical, thus facilitating the students in comprehending the taught concepts (Cahyadi, 2019).

Furthermore, AR as an educational game has the potential to enhance the students' motivation and engagement in learning process. The interactive and visual nature offered by AR can capture students' interest, leading to increased enthusiasm for the learning process. As a result, teaching and learning process become more enjoyable and effective, it has potential to reduce the boredom or monotony that typically occurs in conventional learning situation (Fitria, 2023). These benefits can be considered as an alternative solution to overcome the students' challenges in learning English as a foreign language in elementary school.

Based on the observations, the researchers found that students' low interest in learning English due to some factors, namely limited vocabulary, low motivation, time constraints for learning, lack of self-confidence, and difficulty in translating into their native language. These problems have an impact on students' learning interest and outcomes (Huliatunisa, et al, 2022). According to Gbollie and Keamu (2017), students' low interest in learning will have implications for the quality of education, including decreased motivation, reduced active

participation in the learning process, declining academic achievements, hindrance to the transfer of knowledge, and developing negative attitudes towards learning.

Addressing this issue, the researchers are interested in integrating the use of AR-based educational game while instilling values of character education. Character education can serve as a guide and principle that shapes the behavior and actions of students, seamlessly incorporated into English language learning. Character education is not solely about building students' character within the school environment, but it also significantly impacts students' learning interest and the learning atmosphere (Wiwit, 2016). That can help to create a positive learning environment. According to Rohmah, et al (2021), the quality of education can influence work ethic, discipline, perseverance, and the responsibility of students. Students who are capable of facing challenges in the learning process and are encouraged to overcome obstacles with determination, a positive attitude, and maximum effort will help shape strong character values (Indriarti, et al, 2022).

The utilization of technology in education can lead to increased active engagement and motivation for students to learn (Puspitarini & Hanif, 2019). Various interactive teaching methods, such as the use of educational applications, digitally-based learning materials, and e-learning platforms have proven to enrich students' learning experiences (Tuma, 2021). Moreover, technology also offers the students convenience in accessing learning materials, enabling students to study anytime and anywhere based on their availability. The use of technology can also enhance collaboration between students and educators, enabling online discussions, project-based assignments, and team-based learning (Nuraini, et al, 2023). It highlights the significance of developing AR-based educational game as a language learning tool infused with character education values. This issue is crucial in the current digital era to implement in educational practices, as it aligns with government initiatives promoting digital literacy and technology adaptation. The development of these educational game can be employed to minimize potential moral degradation among students due to the impact of technology use (Sahronih, et al, 2022).

Based on the literature review, AR-based educational game has the capacity to enhance student interaction in learning due to their innovative technological utilization (Amanaditis, 2022). The use of AR as a learning tool enables the customization of learning content tailored to the needs and preferences of students, thus fostering the students' interest and motivation to study (Li, et al, 2017). Furthermore, AR technology can provide a more immersive

experience for users (Mustaqim, 2016). The integration of technology with the incorporation of character education values in English language learning represents an innovative approach. This approach is expected not only to enhance students' English language skills but also to strengthen their character, including values like responsibility, honesty, courage, and teamwork through technology adaptation.

The research questions formulated in this study are: 1. What is the feasibility of AR-based educational game with character education values in English language learning? and 2. How do students respond to AR-based educational game with character education values in English language learning? By integrating AR technology and character education values in the development of educational game, this research is expected to make a significant contribution in creating a more innovative approach to English language learning and positively impacting the development of students' character. Furthermore, this study can also assist educators in providing a more engaging and relevant learning experience that aligns with the current needs of students.

Method

The method used in this research is Research and Development (R&D) with the ADDIE (Analyze, Design, Develop, Implement, Evaluate) development model. The material presented in the development of this educational game is "Part of Human Body". The subjects in the development of the AR-based educational game are subject matter expert, media expert, language expert, and elementary school students in the 5th grade. The purpose of conducting expert testing is to consider whether the AR-based educational game learning media is suitable for testing in elementary schools. The data collection methods used include observation, interviews, documentation, and questionnaires. The data collection instrument uses a questionnaire to measure the quality of the developed media. The product assessment questionnaire uses a Likert scale for subject matter experts, media experts, and language experts, and a Guttman scale for students. The Likert scale is used to measure the quality of the developed product with four response alternatives: strongly agree = 4 points, agree = 3 points, disagree = 2 points, and strongly disagree = 1 point. Meanwhile, the Guttman scale is used to determine students' opinions about the product created using two answers: yes/no, true/false, ever/never, positive/negative. The data used in this research consists of two types: qualitative and quantitative data.

Data collection instruments involved the use of questionnaires or surveys to assess the quality of the developed media. The product evaluation questionnaire employs a Likert scale for subject matter expert, media expert, and language expert. The utilization of a Guttman scale is used for students' response. The Likert scale is employed to gauge the quality of the developed product, with four response options, namely: four point is strongly agree, three point is agree, two points is disagree, and one point is strongly disagree. Conversely, the Guttman scale is used to ascertain students' opinions about the created product, employing binary responses such as yes or no, true or false, ever or never, and positive or negative. The data used in this research comprises both qualitative and quantitative data. Qualitative data is used to understand the process of developing the AR-based educational game, including criticism and suggestions from research subjects, while quantitative data is used as an assessment of the educational game. The flowchart of this research is presented in the following figure.

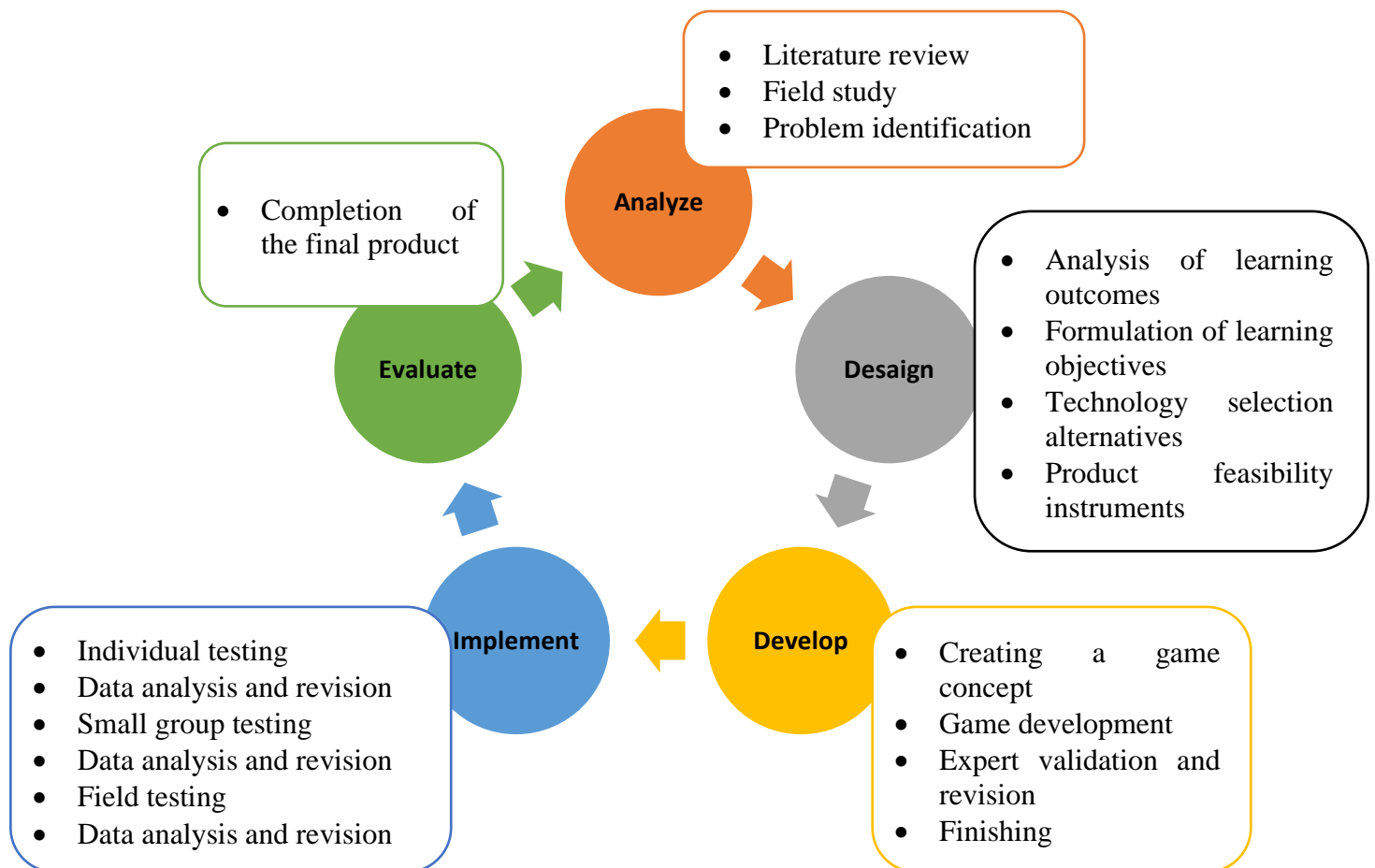


Figure 1. Research Flowchart

Results and Discussion

The research of this study on the development AR-based educational game media can serve as an alternative solution to enhance students' interest in learning English in the current digital age, particularly in 5th-grade elementary school. The process of researching and developing this product is systematically organized, well-directed, and consciously carried out to refine a product that aligns with predefined criteria. The AR-based educational game created stands out due to its incorporation of character education values. The developed product has undergone validation and has been deemed suitable for educational use based on assessments by experts in media, subject matter, and language. This educational media is a non-commercial (open-source) application designed to assist students and foster their interest in learning English while instilling character education values.

The development of AR-based educational game was created using the Unity application with the ADDIE model, developed by Dick and Carey (1996) as described in Mulyatiningsih (2011). This model comprises five stages, namely: Analyze, Design, Develop, Implement, and Evaluate.

1. Analyze

The first stage is the analysis phase. The researchers conducted a literature review, field study, and problem identification. The literature review involved gathering and analyzing relevant literature related to the use of AR technology in education and literature regarding the integration of character education values into learning to establish a strong foundation of information for creating an educational game. Based on the literature reviewed, AR has advantages in visualizing abstract and complex concepts in education, thereby enhancing student interaction and active engagement (Wardhani, et al, 2023). Case studies on the use of AR have been successfully implemented in English and science education (Nadela, et al, 2022; Fathoni, et al, 2020; Mokodompit, et al, 2021). The integration of character education values can have a positive impact on learning through a game, fostering curiosity, resilience, motivation to improve skills, and sportsmanship.

The next step is the field study and problem identification. In this study, the researchers chose the 5th-grade material "part of the human body" for several reasons, there are: 1. The relevance of the material that students need to learn in understanding the parts of the body and important knowledge in various contexts, such as translation in English content; 2. The

educational curriculum aims to develop educational game that focus on helping students remember and understand the material in a more engaging and interactive manner; 3. The appropriate level of material difficulty to be integrated into an AR-based educational game, as students' comprehension can be enhanced through playing and learning through AR game; and 4. The technology and theme selection associated with character education values provide an opportunity to integrate values such as self-confidence, empathy, and a sense of caring for health and body hygiene.

2. Design

The second stage is the design phase, which includes an analysis of learning outcomes and the formulation of learning objectives, the design of the AR-based educational game development concept, alternative technology selection, and feasibility instruments. There are four learning outcomes analyzed in this material, namely; 1. Students can identify different body parts and their functions; 2. Students can describe the functions of body parts in daily activities; 3. Students can write short texts about the use of different body parts; and 4. Students can apply the value of responsibility by taking care of and using their body parts properly. Analyzing these learning outcomes is a crucial component in achieving the expected learning objectives while also considering the affective domain of students in integrating character education values into the presented material. The next step involves the researcher creating the concept for the development of an AR-based educational game. This includes designing the media flowchart, storyboard, and material compilation.

Furthermore, the next stage on design is technology selection. The researchers chose various software and hardware to support the development of the educational game. The software was used, including: 1. Unity 3.5 software with AR plugins and assets; 2. Vuforia for marker and object detection in AR; 3. Blender for 3D modeling, animation, and rendering; 4. Adobe Photoshop, Illustrator, and After Effects for graphic and animation purposes. Regarding hardware, the researchers used the following Operating System: Windows 7 SP1+, 8, 10 (64-bit versions only), Mac OS X 10.9+, 2 GB RAM, and Android OS. The next in this step, the researchers created the development of a media feasibility instrument grid to obtain validation from experts and revisions from subject matter experts, media experts, and language experts. The researchers prepared the product feasibility instrument to be tested by validators, including subject matter expert is 5th-grade elementary

school teacher, media experts is computer science lecturer, and language expert is English language lecturer.

3. Development

The third stage is development. This stage involves the realization of storyboard design created using the designated software tools. Subsequently, the researchers conducted feasibility testing validation with experts selected based on their educational backgrounds. The result of the subject matter expert validation for the development of the AR educational game as an English language learning medium with character education values was carried out by elementary school teacher. The material test yielded an average score of 3.88 with a feasibility percentage of 97.22%, indicating it was highly feasible. This assessment comprised three components: content feasibility, language feasibility, and presentation technique. Content feasibility assessed suitability with curriculum goals and objectives, alignment with student needs, material accuracy, and material currency. Language feasibility evaluated clarity of information, language construction, and grammatical correctness. Presentation technique considered supporting presentation aspects and the delivery of the learning material.

Media validation was conducted on the AR-based educational game by a computer science lecturer. The product assessment was divided into two indicators: software engineering and visual communication. Aspects within software engineering included effectiveness, efficiency, and ease of operation assessment. Meanwhile, in the visual communication indicator, the assessment encompassed display design and AR quality. The results of this media test yielded an average score of 3.5 with a feasibility percentage of 95.45%, indicating high feasibility. In addition to the product assessment results, the researchers also received feedback from the media expert validator, which included: 1. The application sound and video should not overlap automatically, when the video is turned on. The application sound should turn off. 2. In the video section, the buttons are slightly obscured by the screen in the video. The feedback from the validator was taken into account as constructive input, leading the researcher to make revisions with the following changes, as shown below.



Figure 2. Button Fixes

The fixes in Figure 1 involves enhancing the video display, where a button is present to control the video in full screen mode. Therefore, there is a need for enhancement to make the button more visible and facilitate its operation.

Language expert validation was carried out by an English language lecturer. The assessment indicators consisted of six aspects, including clarity, communicativeness, dialogical and interactive, alignment with student developmental levels, coherence and cohesion of thought flow, and lastly, the use of terminology and symbols. Under the clarity assessment indicator, there were three assessment aspects: sentence structure accuracy, sentence effectiveness, and terminological correctness. For the communicativeness assessment indicator, there were two assessment aspects: message readability and the accuracy of language rules usage. In the assessment indicators for dialogic and interactive qualities, there are two aspects considered: the ability to motivate and the ability to promote the embodiment of character education values. For the assessment indicator related to alignment with students' developmental levels, it includes evaluating alignment with students' intellectual development and alignment with their emotional development. Regarding the assessment indicator for coherence and integration of thought flow, it encompasses two aspects: 1. coherence and integration among learning activities and 2. coherence and integration among paragraphs. In the assessment indicator for the use of terminology and symbols, it includes two aspects: consistency in the use of terminology and consistency in the use of symbols or icons. The result obtained from the language expert validation was 94.2%, categorized as highly feasible.

4. Implementation

The fourth stage is implementation. In this stage, several steps were carried out, including individual testing, small group testing, data analysis and revisions, field testing, and

data analysis and revisions for each testing step conducted. In the implementation phase, the first step is individual testing and small-scale testing, which was conducted randomly with five participants. The evaluation from this phase revealed that there were some errors in the menu when used, such as the barcode used for displaying AR not being detected. After receiving improvements, the researcher proceeded with field testing conducted in a 5th-grade classroom with 30 elementary school students as subjects. Before the learning media was implemented, students were asked to install the AR-based educational game application on their smartphones. The distribution was done by *sharing-it* and providing a *Google Drive link* for students to download. During the learning process, students appeared actively engaged in the learning activities. The AR-based educational game facilitated two-way communication between the teacher and students. The results of the implementation of the AR-based educational game showed a positive response with a percentage of $\geq 70\%$. This result was obtained based on a recapitulation of criteria such as clarity of content delivery, clarity of provided examples, clarity of question presentation, language usage clarity, the attractiveness of AR, the game's ability to enhance students' understanding, the ability of the learning media to integrate character education values, and the usefulness of the media in English language learning activities.

5. Evaluation

The fifth stage is evaluation, which involves the completion and final product assessment. AR-based educational game product comprises several components, such as learning materials, AR observations, videos, quizzes, and instructions. Based on the results of validation by media expert, subject matter expert, language expert, and student responses from 5th-grade elementary school, this learning media can be used in the English language learning process. The final product shown below.

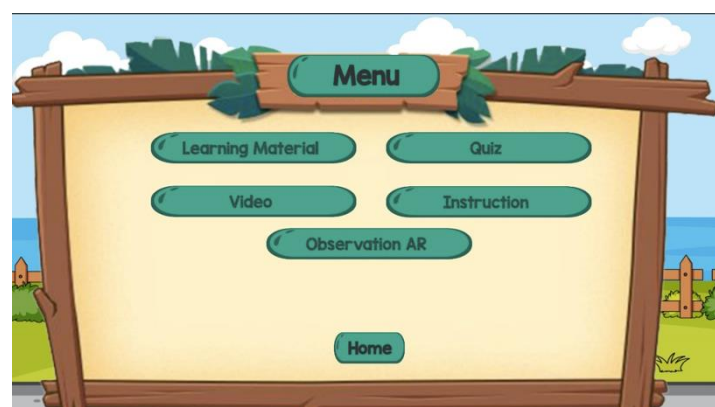


Figure 3. Menu on the Application



Figure 4. Menu on the Application

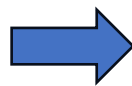


Figure 5. AR observation of the ear

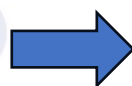


Figure 6. AR observation of the heart

The advantages offered by this learning media, following: The AR-based educational game can be used on Android smartphones; It can be used both inside and outside the

classroom; It helps students better understand the English language material, specifically the topic “part of the human body” by presenting AR observations designed with the integration of character education values; It assists students in mastering vocabulary and the taught material; and it is accessible due to the AR-based educational game does not require an internet connection for its use.

Several aspects of excellences the effectiveness of the AR-based educational game, which had been proven by the improvement in students’ English language abilities when interacting in the classroom. The use of this technology could help students understand the material in a more engaging and interactive manner, fostering curiosity, motivation to improve their skills, sportsmanship, and active engagement in the learning process. Students not only gain language knowledge and vocabulary but also internalize character education values such as cooperation during the observation of body parts through AR. This is evidenced by the enthusiasm of students throughout the learning process, their responsibility, and perseverance in completing tasks provided in the AR-based educational game. The intuitive design and user interface of the game are attractive to students as users. Overall, AR-based educational game product demonstrated significant potential for enhancing English language learning in 5th-grade elementary school.

Conclusion

Based on the research findings, it can be concluded that the development of AR-based educational game as a character education-infused English language learning medium falls into the “highly feasible” category with a feasibility percentage of 96.33%. This feasibility assessment was obtained from media expert, subject matter expert, and language expert. The response from 5th-grade elementary school students, who were the subjects of this study, was positive, with a percentage of $\geq 70\%$ from a total of 30 students. Based on the students’ responses, the development of AR-based educational game for English language learning offers several advantages, such as increased effectiveness in language learning as evidenced by improved English language skills during classroom interactions. The use of this technology can help students understand the material in a more engaging and interactive manner, fostering curiosity, motivation to improve skills, sportsmanship, and active student engagement in the learning process.

Acknowledgments

This study was funded by the Ministry of Education, Culture, Research, and Technology through the national competitive grant program for Penelitian Dosen Pemula (PDP) under research contract number 182/E5/PG.02.00.PL/2023.

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