

Interactive Learning Media for English Subjects Using AR-Based Mobile Applications

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Abstract—Education has an important role and is a significant aspect in improving the quality of a country's human resources. One of the fields of education that contributes to the progress of the nation is English education. It is crucial to recognize and master English from an early age because English is a tool to develop science, ICT, and culture in facing the nation's competitiveness in the national and international arena. However, in reality, there are still problems with the learning styles of students and the learning media used. Therefore, educators need to be able to integrate learning with learning media by combining these two elements. This research aims to create interactive learning media and stimulate maximum learning outcomes for students in class XI SMA in the English language suggestion subject. This learning media, called ARCALIS, is a mobile-based learning media combined with Augmented Reality. The development research method used is R&D with the Plomp model. The study results show that the ARCALIS application is ready to be distributed to users and is suitable for use as an interactive learning media, and can make students think critically (HOTS). This can be seen from the results of the SUS trial, which obtained a score of 68.86%, the results of critical thinking trials with a score of 84.25%, the media validation with a score of 93.54% , and the results of material validation with a score of 93.61% average the average of the three validation results get a valid category without revision.

Keywords—Learning media, mobile learning, augmented reality, plomp

I. INTRODUCTION

Education has an important role and is a major aspect in improving the quality of a country's human resources. Indonesia is a developing country and strives to be better in all fields, especially in the field of education. One of the fields of education that contributes to the progress of the nation is English education. English is one of the compulsory subjects in

high school. Pronunciation, vocabulary, and grammar are basic elements in learning English, both spoken and written. It is very important to recognize and master writing grammar, pronunciation, listening, and reading in English from an early age because English is a tool to develop science, technology, information, and culture in facing the nation's competitiveness in the national and international arena. However, in reality there are still many people who make mistakes in writing grammar, pronunciation, listening, and reading. In fact, generally English has been introduced to children since they were in kindergarten or elementary school (elementary school). This is probably caused by internal and external factors.

Internal factors include the characteristics of students, learning styles, level of concentration, ability to explore learning outcomes, self-confidence, and processing learning materials. At the same time, external factors include environmental factors, teacher factors, school curriculum, and learning infrastructure [1]. Among the factors above that often become problems are learning styles and infrastructure in the form of learning media. Some children tend to learn by reading, using visuals, and some using audio. With variations and differences in learning styles, it is important for educators to be able to integrate learning with learning media (as infrastructure). Teachers technological knowledge both directly and indirectly contribute to the integration of ICT [2].

Integration can be done by combining learning methods with learning media to create an interactive learning environment and stimulate maximum learning outcomes. As technology develops, knowledge, understanding of learning styles become important to create the types of students who enter higher education [3]. Usage of learning media that supports the creation of an interactive learning environment has an important role [4], one example of interactive learning media is to use AR (Augmented Reality)-based mobile devices. AR is

a technology that combines 2D or 3D virtual objects that are displayed in real terms [5]. AR technology can provide direct exposure to the learning material being studied by visualizing the object's shape being observed [6]. According to Khaled, "AR can be an effective learning media, but its application is still receiving less attention" [7]. During the Covid-19 pandemic, the use of AR technology is also one of the solutions to carry out effective distance learning.

The Covid-19 pandemic is an outbreak of an infectious disease caused by a virus that attacks the respiratory system. The pandemic, it causes obstacles, and even activities stop not running according to the plans that have been made. One of them is education which causes the KBM process to be carried out online/remotely.

Based on the problems above, several studies have been carried out, from UI/UX design, application/product development to application effectiveness, to prove that AR as a learning medium can help students understand the material more easily. One of them is research on the development of augmented reality mobile applications as a medium for learning the basic introduction of hijaiyah letters. Learning with AR can increase student learning outcomes by 11.19% [8].

In order to prove that mobile learning combined with AR can improve students' understanding, higher-order thinking skills, and spoken and written English skills, especially students of class XI SMA, researchers developed interactive learning media in English subjects using mobile learning applications based on AR. The development method for this application is R&D. The R&D development method is a research method that focuses on the purpose of developing, expanding, and exploring a theory [9]. There are several models in R&D, including Waterfall, Plomp, Sugiyono, Dick & Carey, and Borg & Gall. In this study, researchers chose the Plomp model. In its implementation, the Plomp model is easy to understand, has systematic development, and is based on the theoretical foundation of the developed learning design [10].

II. LITERATURE REVIEW

A. Interactive Learning Media Mobile Learning

Learning media are everything that is used in the learning process both physically and technically to help and facilitate teachers in delivering material to students so that learning objectives are achieved in accordance with those that have been formulated [11]. Mobile learning is information technology devices used for mobility-based learning, which utilize mobile devices such as smartphones and tablets. Mobile learning is very suitable for the millennial generation because smartphones and internet media are getting better and better, and mobile cannot be separated from the hands of millennials, especially in the current state of the Covid-19 pandemic. It is predicted that 5 billion people will access the internet on mobile devices by 2025, this is based on mobile device usage and evolution to 5G technology [12]. Mobile Learning is very helpful for students in accessing learning materials, taking quizzes easily by anyone, anywhere, and anytime. Mobile Learning is an interactive learning medium and is one of the solutions for

online learning during the pandemic. The ARCALIS application is an interactive English learning media that is accessed online by utilizing mobile technology that uses the Android system platform.

B. Augmented Reality

Augmented Reality (AR) is a technology that allows users to interact in real-time [13] from 2D or 3D virtual objects. AR is a technology that can simplify the process of visualizing objects where users usually only see abstract images; it becomes easier to see and understand 2D or 3D objects that are displayed because they are real-time. In addition, AR allows users to interact directly with the surrounding environment through Smartphone/mobile devices equipped with cameras and screens [14]. In its implementation, AR consists of two types: markerless, which uses position data, and marker-based, using a camera and visual markers (markers). The ARCALIS application uses a marker-based augmented reality type to display virtual assets.

C. English Subjects

English is one of the adaptive subjects taught in high school (SMA) to improve the student's language skills in spoken and written form. English is a tool for developing science, technology, information, and student culture. English is given as early as possible as a provision to face the nation's competitiveness in the national and international arena. The focus of the development of learning English in the ARCALIS Application is Suggestion material. Sub-chapters of Suggestion are Expression of offers, Expression of suggestions, Accepting and declining offers, and Response of suggestions (accepting and refusing) [15]. Visualization of material using optimal learning media can make learning more interactive and make it easier for students to understand the material presented. In accordance with the previous explanation, in ARCALIS, problems related to suggestions are presented in the form of AR, and users/students are asked to provide appropriate problem-solving solutions and according to the problem.

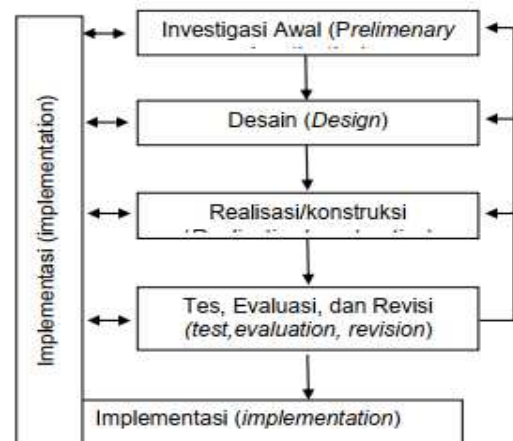


Fig. 1. Plomp R&D Stages

D. R&D Plomp

The system in ARCALIS was developed using the R&D method with the Plomp model. The basis for choosing the Plomp model is because in its implementation, this model is

easier to use by developing a theoretical-based system from a developed and more systematic learning design. The Plomp model is designed to be systematic and more flexible because each step in solving learning problems is in accordance with the needs and character of the students to be studied (Fig.1). The Plomp model has a development design with 5 phases, namely initial investigation, design, realization, evaluation & revision, and implementation [16].

III. METHOD

The method used in the development of interactive English learning media using Augmented Reality-based mobile is R&D. R&D is one of the research and development methods that can be used for product development and validating the product to be developed. R&D is often used to develop educational products such as learning media. R&D was chosen as the research method for the development of ARCALIS because it is able to produce products with high validity through a series of field trials and validated by media and material experts. From the R&D method, the model used is Plomp with the initial investigation stage, the researcher sees the problem directly, which includes student and material analysts and then looks for problem-solving ideas. Student analysis is used to find out students who have problems and material analysis is carried out by interviewing teachers to find out material that is difficult for students to understand. The second stage designs. Problem-solving ideas found are then developed and product designs are made. The design of the idea is in the form of a storyboard to produce a product that is in accordance with the results of the initial investigation to be a solution in problem-solving. The third stage is realization, where researchers begin to develop products to be realized. The fourth stage is related to tests and evaluations and revisions are used to identify whether the product is suitable for widespread use or revision is still needed according to the validation results from media experts and material experts. At this stage, Researchers will get suggestions and constructive input for the creation of good learning media. The fifth stage is the implementation of the finished product to the user for use in learning.

The evaluation phase is carried out using the results of the System Usability Scale (SUS) trial, the results of the Critical Thinking test, validation of media experts and material experts. The results of the SUS trial are used to determine the scale/level of usability of the ARCALIS system. The results of the Critical Thinking trial to determine the level of critical thinking of students in solving problems when using ARCALIS. Media expert validation is used to validate the product/media developed, while the material expert is used to validate the material used in the product/media. The indicators used in the fourth stage include:

1. The results of the SUS trial (covering the ease and understanding of using media and materials)
2. The results of the critical thinking test (including interpretation, analysis, conclusion, evaluation, explanation, and self-regulation)

3. Media validation (covering the technical quality of the media, the quality of education, and the appearance of the program)
4. Material validation (covering the relevance of the material, evaluation, language, and implementation).

The instrument was distributed to respondents (class XI SMA LAB UM), media experts, material experts in the form of a questionnaire given via google form with a rating scale of 1-5 ranging from strongly agree to strongly disagree. The validity results obtained are then analyzed to see the shortcomings of a product so that appropriate learning media can be created in schools. The following are the levels of media eligibility and validity:

TABLE I. TEST CRITERIA

Percentage (%)	Feasibility Level
76% - 100%	Valid without revision
51% - 75%	Valid with minor revisions
26% - 50%	Not yet valid with many revisions
< 26%	Invalid

IV. RESULTS AND DISCUSSIONS

Researchers develop a media with the aim of creating English-based learning media *mobile* with fashion *Augmented Reality* (AR). This media is named ARCALIS, which will help students in solving related problem *suggestions*. The use of this learning media is to create interactive learning by increasing students' interest in learning English and helping make it easier for students to understand the material *suggestions*. The development method used is R&D with the Plomp model. The following is a discussion of the results of the ARCALIS media in terms of validity as a learning medium.

The first stage is the initial investigation. At this stage, analysis of students and materials is carried out to obtain valid supporting data on the ARCALIS system. Student analysis was carried out by observing and interviewing students and English teachers of class XI SMA Lab. UM. The results of the analysis found several problems, including conditions and learning media. As we know, during the pandemic, learning is carried out remotely / online. Online learning with less attractive learning media causes students to have a low interest in learning, so it is difficult to understand the material provided pronunciation, writing, *vocabulary*, and problem-solving stories about *suggestions* on English. Analysis of the material that appears in learning English related to the material *suggestions* KD 3.1 "Applying social functions, text structures, and linguistic elements of spoken and written transactional interaction texts involving the act of giving and asking for information related to suggestions and offers, according to the context of their use". Suggestion material is one of the materials in the English subject. Suggestion is very important to learn because it can be a provision in life. Every day we always interact with other humans and as long as we interact, we can't be separated from helping each other, reminding each other, and giving advice. It's all in the material *Suggestion* starting from *Expression of offers* until *Response of suggestions*.

The second stage is design. At this stage, a product design is made to be developed into a product that is in accordance with the results of the initial investigation so that the problem is solved. The product design is a storyboard from the ARCALIS system. Here's the storyboard from ARCALIS:

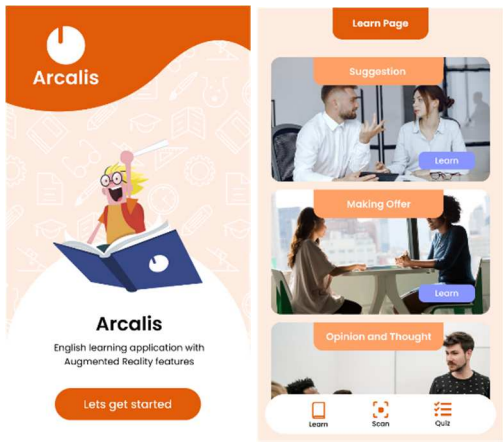


Fig. 2. Splash Screen And Learn Page

The Splash Screen (Fig. 2) is a loading page that displays the logo and brief information from ARCALIS. The Learn Page menu (Fig. 2) contains a series of English learning materials. Swipe down or up to see all topics. Press the “Learn” button to start learning the related topic.

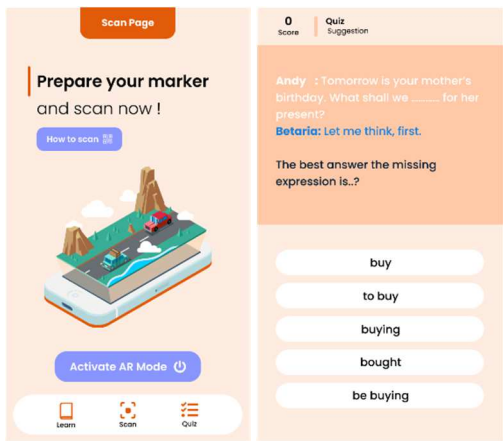


Fig. 3. Scan And Quiz

The Scan Page menu (Fig. 3) is used to display AR components with scan markers. To find out how to scan markers, users simply press the “How to scan” button. While the “Activate AR Mode” button is used to start entering scan mode. Then point the camera at the marker until the AR object appears. Slide the zoom toggle to enlarge the object and the rotate button to rotate the object.

The Quiz Page menu (Fig. 3) contains English questions that the user can do directly by pressing the “Play” button, then when finished working on the quiz, press the “Save” button to save the quiz scores. There are 10 questions in each quiz and each question has 5 answer choices, and there is only 1 correct answer choice.

The third stage is realization. At this stage, the researchers began to develop applications to be realized into interactive learning media and can solve problems according to the initial investigation. In addition, at this stage, the media is ready to be validated by experts so that the resulting media can be used in classroom learning and distributed to students.

The next stage is evaluation and revision. After the ARCALIS media is realized, then validation and revision are carried out in this fourth stage. The validations carried out consisted of SUS trials, critical thinking trials, media validation, and materials. This stage is done to find out whether the media is suitable for use or still needs to be revised to produce good media. In the evaluation stage, researchers will get suggestions and constructive input for the creation of learning media according to the design. The evaluation stage of the SUS trial and critical thinking was carried out by distributing questionnaires online (google form) to respondents, namely students of class XI SMA Lab. There are 99 UMs, and 1 English teacher from SMA Lab UM named Mr. Adam Zakaria. Meanwhile, material validation and media validation were carried out by lecturers at the State University of Malang. The following is the data on the results of the trials and validations that have been carried out.

The data from the SUS trial on the ARCALIS application shows that it is valid with a slight revision with an average value of 68.86.

TABLE II. SUS TRIAL RESULT DATA

No	Indicator	Score
1	I will love to use this app	89.4
2	I think this application is too complex (contains a lot of unnecessary things)	45.4
3	I rate this application easy to use	90
4	I need technical assistance to use this app	56
5	I think the functions/features provided in this application are well designed and prepared	92.8
6	I rate too many inconsistent things on this app	40.2
7	I feel most people will find it easy to use/browse this app quickly	87.4
8	I find this application very complicated to use	37.4
9	I feel very confident using this app	84.2
10	I need to learn many things before I can explore this app well	65.8
Total		68.86

Data from critical thinking trials with 15 questions consisting of 6 indicators, namely interpretation, analysis, conclusion, evaluation, explanation, and self-regulation. The critical thinking test results show that ARCALIS can improve students' higher-order thinking skills with an average of 84.25% and a valid category without revision.

TABLE III. CRITICAL THINKING RESULT DATA

No	Indicator	Score
1	Interpretation	85.68
2	Analysis	87.5
3	Conclusion	83.4
4	Evaluation	85.3
5	Explanation	80.2
6	Self-Regulation	83.4
Total		84.25

The data from the media validation conducted by an expert judgment obtained a very valid category without revision with an average value of 93.54%. Media validation consists of 40 questions divided into three indicators. The following are the results of media validation:

TABLE IV. MEDIA VALIDATION RESULT DATA

No	Indicator	Score
1	Media Technical Quality	92.11
2	Education quality	94.1
3	Program View	94.4
Total		93.54

Experts in their fields carry out material validation data to state that the material used is valid or not contained in the ARCALIS application. Material validation consists of 4 indicators with 23 questions. The results of material validation show that the material used in the ARCALIS application has a valid category without revision with an average score of 93.61%.

TABLE V. DATA RESULTS OF MATERIAL VALIDATION

No	Indicator	Score
1	Material Relevance	92.31
2	Evaluation	94.5
3	language	93.75
4	Execution	93.89
Total		84.25

The last stage is the implementation stage of the finished learning media to the user. After going through the evaluation stage by conducting trials and validation, the researcher can conclude that ARCALIS media has reached the final product and is effective to be used as a real interactive learning media and can increase students' interest in learning.

In accordance with the results of field trials which show that the acceptance and validity of ARCALIS as a mobile-based learning media has been in accordance with the needs and solves the problems that exist in learning. The success of ARCALIS is influenced by the design of the user journey (UI/UX) which is in accordance with the age and habits of the users [17][18]. User experience design that is easy to use can also stimulate students' desire to learn independently [19]. Evaluation that is meaningful and has the criteria of High Order Thinking Skills (HOTS) is also useful in improving students' problem solving and thinking skills in learning [20].

V. CONCLUSIONS

ARCALIS is a mobile learning media based on Augmented reality (AR). This learning media is devoted to students of class XI SMA English subjects with Suggestion material. ARCALIS can be used on mobile/smartphone android platforms with a minimum of version 7. Research and development of ARCALIS use the R&D method with the Plomp model. The stages in the PLM development model consist of the initial investigation stage, the design stage, the realization stage, the evaluation and revision stage, and the implementation stage.

ARCALIS learning media has been tested by SUS and critical thinking and has been validated by media experts and

material experts. The results of the SUS trial obtained a score of 68.86% with a valid category with slight revisions, then the results of the critical thinking test obtained a percentage score of 84.25% with a valid category without revision, which means that ARCALIS media is able to make students think critically (HOTS). In contrast, the results of media validation obtained a percentage score of 93.54% with a valid category without revision and a material validation score of 93.61% with a valid category without revision.

From the data from the trial and validation results, it can be concluded that the ARCALIS learning media developed by the researcher is ready to be distributed to users (class XI SMA students) and is suitable for use as a suitable learning media for students based on initial investigations. In addition, ARCALIS media with suggestion material becomes an interactive learning media to increase students' interest in learning and train students to think critically at a high level by solving problems in animations displayed in AR mode.

From this development research, the researcher hopes that teachers can use ARCALIS media as an attractor of interest and motivation to learn students so that learning outcomes increase in English subjects, especially suggestion material.

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