Android-Based Educational Games for Online Learning at Kindergarten

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ABSTRACT

Technology becomes a part of today's lifestyles. Improving the quality of memorizing is significantly related to the development of learning resources through techno-logical inno-vation. Educational games are one of the learning resources that can improve the memori-zation skills of PG/Kindergarten students. The purpose of this study was to develop an Android-based educational game as learning media and assess their effectiveness. The development model used was the ADDIE model. This research was conducted at Daar Al Husna PG/Kindergarten in Malang. Validation by material and media experts showed that the Android-based educational developed was very good and worthy of use. The effective-ness of the application of this Android-based educational game was assessed through pre-test and posttest score.

I. Introduction

The presence of technology and industry 4.0, which is identical to the digital and virtual world, has changed the paradigm and mindset of life (Suheri, 2019). The 21st-century demands for learning to be carried out actively, creatively, innovatively, and independently (Safitri, 2019). Technology that was previously created only to help humans has now de-veloped into a means of entertainment, games, com-munication, and others (Mustofa et al., 2019). Mo-bile technology has become learning media in the form of games, one of which is educational games (Efendi, 2018). Mobile-based games are one way to increase children's learning creativity by playing while learning. Applications that stimulate children's motor sensors are needed in the form of mobile-based educational games. For good learning compre-hension, currently, the emphasis is on visual media that looks attractive with additional images and sounds (Rahadi et al., 2016).

Mobile-based game applications contain sound, images, and interactive games that can introduce teaching material to make it more interesting to ac-cept and understand, especially for children who are still at an early age (Efendi, 2018). Animation, with its various roles, has become a crucial technology of science (R. S. Untari et al., 2020). This

method can spur children's brains to be able to think more actively and creatively at a growing age. These educational games should be designed with an attrac-tive and interactive appearance to recognize mem-bers of the body, the environment, animals, families, plants, countries, vehicles, the universe, and Islam. Educational games become a fun learning medium, has a series, and cause addiction (Pramuditya et al., 2018). Games and simulations show the effects of several sectors, namely students' performance, en-gagement, and motivation (Vlachopoulos & Makri, 2017).

Educational games are games that are packaged to stimulate thinking, including increasing concentra-tion and solving problems (Rahman & Tresnawati, 2016). An effective interactive learning technique for early childhood is to use educational games because most children at an early age have a high curiosity towards everything in their environment (Suheri, 2019). Games have positive functions and benefits for children: children get to know computer technol-ogy, learn to follow directions and rules, practice solving problems and logic, train motor nerves and spatial skills, establish communication with parents while playing together, and get entertainment (Suprianingsih et al., 2016). Cognitive, motivational,

affective, and social processes underlie Indonesian computer game learning (Mayer, 2019).

Games are an entertainment media that children choose to get rid of boredom or just to fill their spare time (Pramuditya et al., 2018). Besides, games can also be a learning medium to improve children's brain development in motor, affection, cognitive, spiritual, and balance, thus educating their brain abilities (Ramadhan et al., 2016). Games will be very useful if used positively, like those functioning as an educational media that combines elements of education with entertainment or often called "playing while learning" (Irsa et al., 2016). The making of educational games must focus on developing interactive games because the interactivity is the main media to deliver learning to children at the early age.

II. Method

This study used the R&D method with the AD-DIE model. The researchers worked on two stages, including *first*, the educational game development stage and, *secondly*, the quasi-experimental stage to assess the effectiveness of the educational game. The first stage used the ADDIE model including analysis, design, development, implementation, and evaluation. The flow of educational game development done with the ADDIE model is as follows: a) analysis; this stage is to identify problems, understand product work systems, analyze products, and conduct reviews; b) design; this stage aimed to create an Android-based educational game design that could be used in the form of a vocabulary memorization game in 3 languages; c) development; this stage is to create new products or improve old products as an Android-based educational game development. At this stage, expert validation (material and media experts, followed by revisions) and product testing were also carried out with a one-group pretest-posttest design; d) implementation; this stage applied field trial (Clark, 2000). The first stage was carried out by socializing educational games based on Android through distribution to teachers and students. The second stage, namely quasi-experiment; and e) evaluation: this stage is to determine the level of implementation of the ADDIE model development. The next step is to measure the quality of the media developed product related to the learning process, both before and after implementation.

The research design used in this study was one-group pretest-posttest design Table 1 below describes the research design used by the researcher.

Table 1. One-group pretest-posttest design experiment

$$O_1 \quad X \quad O_2$$

a. Source: (Campbell & Stanley, 2015)

Notes:

O_1 : Pretest (initial observation) before treatment

O_2 : Posttest (final observation) after treatment

X : Android-based educational game treatment

The data in this study were analyzed using descriptive analysis and assumption tests. Descriptive analysis was conducted to broadly determine the mean value of the observed variables, while the assumption tests in this study were carried out using SPSS with a sig α 0.05, consisting of homogeneity and normality tests. This research involved Daar Al Husna PG/ Kindergarten students in the academic year of 2020-2021. There was 1 class designated as an experimental class, with a total of 18 students.

A. Data Collection Tool

The data analysis techniques used in this study were questionnaires and memorization tests for vocabularies in 3 languages. The questionnaire was used for media validation including display, language, and image/graphic presentation. This instrument was used to generate data regarding validator's assessments and suggestions on the Android-based educational game. Validation includes construct validation, exactness, completeness, and suitability of the suitability. To measure the ability to memorize, the Piaget formal objective, and the instrument used to measure thinking ability is a subjective test. Measurement of learning outcomes was done through tests. The observational appraisal rubrics involved planning, product processing, and presentation. The performance of the observation rubrics started from designing to making a presentation.

B. Data Analysis

The data of the study were analyzed descriptively and inferentially. Media and material expert assessments are used to analyze the data from media validation results, inferential analysis was used to test the hypothesis with a significance value of 0.05 (5%). The commemoration of the outcome of the product evaluation followed the assessment criteria on 5 scales, namely: 1) very good; 2) good; 3) fair; 4) poor; and 5) very poor. Hypothesis testing was performed by *t*-test analysis used to specify determine the effectiveness of the media. If the sign value is less than 0.05, then H_0 is rejected. This definition that the Android-based educational game has a significant impact on the ability to memorize vocabularies in 3 languages.

III. Results and Discussion

The process of developing an Android-based educational game followed the analysis, design, devel-

opment, implementation, and evaluation stages as follows:

A. *Analysis Stage*

At this stage of analysis is carried out through several stages, namely needs analysis, determining the field of the material, gathering references, and establish boundaries (Thiagarajan, 1974). Therefore, it was obligatory to develop product of educational games, especially for PG/Kindergarten students to be able to improve their ability to memorize vocabularies in 3 languages. The material, references, and boundaries to be developed were based on the curriculum in schools.

This educational game development material consists of 3 menus, namely learning, songs, and games. In the learning menu, there were 9 themes: myself, the environment, animals, family, plants, my country, vehicles, the universe, and Islam. In the song menu, there are 9 themes, namely the five senses, my house, the animals, the name of the days, the garden, the rainbow, the names of objects, metamorphosis, and Rasulullah. In the game menu, there are 3 themes, namely body puzzles, object puzzles, and house maze.

The multimedia flowchart as an algorithmic process for creating Android-based educational game features is shown by a user flow chart. One of its features is "basic theory, practices, and tasks". Practices and tasks show that the educational game is integrated with the curriculum, so that students' ability to memorize vocabulary in 3 languages increases can be seen in Fig. 1.
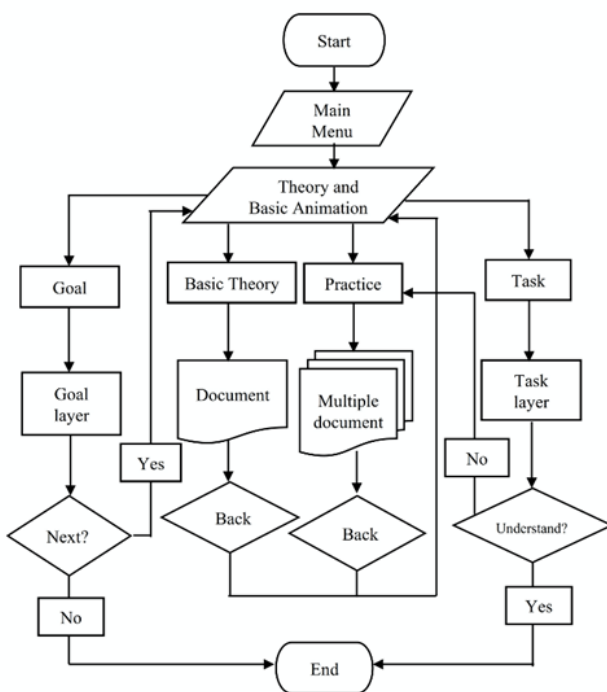

Fig. 1. Multimedia flowchart

B. *Design Stage*

The design stage was carried out to design an Android-based educational game. It started with designing the achievement of students' final abilities, expected abilities, and subject matter by including images, texts, animations, audios, and videos. The stages of designing the Android-based educational game began by designing an application icon and image used CorelDraw. Then the next step is to create an interface used Adobe Flash, such as creating icons and moving animation images or icons. Fig. 2 describes the stages when designing and creating content used coding educational games. This part was the most difficult because you must design insert images, objects, texts, audios, videos, and backgrounds, creating moving animations one by one, and making interactive buttons as needed. The process must be followed step by step, otherwise the animation will not be successfully created. It gets complicated if errors in the programming language and logical thinking.

Fig. 2. The coding process in the visual

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Before building an application, it was necessary to write advanced features in the ActionScript 3.0 language programming. wrote the coding in the visual studio, adobe flash coding was executed. On encoding execution was useful for facilitating the process of updating educational games on Adobe Flash or Macromedia Flash (Fig. 2).

Fig. 3 shows the appearance of the Android-based educational game. A learning medium becomes interactive, interesting, and practical because there is an animation effect that is presented on each material. Images, graphic, audio visual, and interactive videos content that promote the consignment of the substance are also embedded to make it easier to understand. Moreover, it is easy for users to understand the material with a guide/instruction and several navigation buttons.

Fig. 3. Interface of Interactive Multimedia

C. Development Stage

The stages for ADDIE development are shown in the procedure flowchart, as shown in Fig. 4.

The results of the assessment are shown in Table 2. Table 2 shows the results of media validity testing by substance and media experts. The average score of the material expert validation was 4.86, which is categorized as very good. The average score of validation by media experts was 4.9, which also is categorized as very good. Experts agreed that this educational game presents animated material that is very full, suitable, and compatible for learning.

Table 2. The Results of Expert Validation

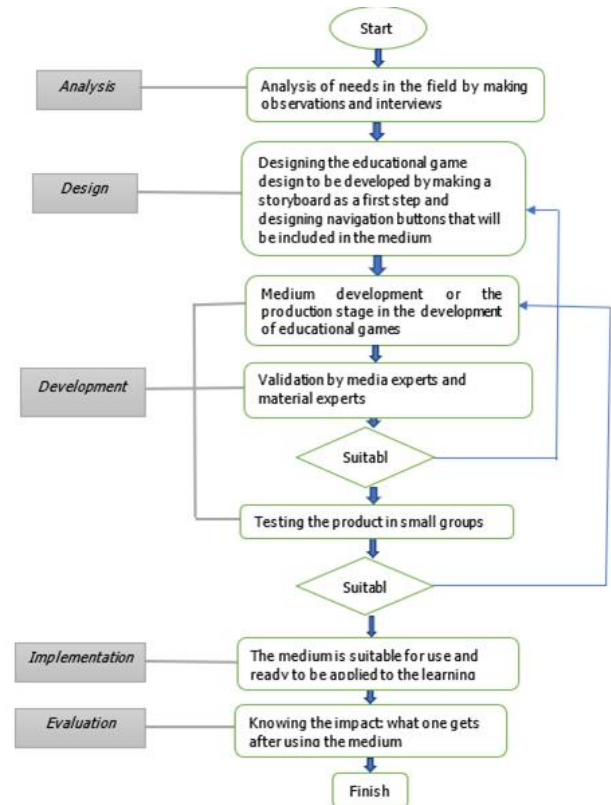| Validator	Indicator	Score
Material Expert	Content Suitability	4.8
	Exactness and comprehensiveness of the subtance	4.9
	Student-centred Compatibility	4.9
Average		4.86
Media Expert	Layout and language	4.9
	Presentment of graphics or pictures, and animation	4.9
	The fundamental of multimedia	4.9
Average		4.9

Fig. 4. The stages for ADDIE

Table 3, the sig. value of 0.000 <0.05 means that there was a significant difference between the students' ability to memorize vocabularies in 3 languages before being treated and after being treated. This showed that the ability to memorize vocabularies in 3 languages after being given treatment was higher than before being treated. The test of the validity and effectiveness of the educational game product showed that it had a significant effect on the students' ability to memorize vocabularies in 3 languages and could be used in teaching and learning activities.

Table 3. Product Validity Testing

Nilai	N	SD	Mean	t-test
Pretest	18	4.65	65.55	0.015 (0.000)
Posttest	18	3.58	87.15	0.010 (0.000)

The development of the educational game in this study was system-based learning, which used software and hardware. The behavior of playing online games is preferred because it offers various benefits for the players both mentally and materially (Lutfiwati, 2018). Through educational game products, students can easily reach out when memorizing, singing, and learning. Therefore, the use of instructional media is highly recommended to enhance the quality of learning (Zaman & Eliyawati, 2010). This is in line with the results of research which stated that

the educational games created to teach the development of thinking and creativity, which include learning to recognize animals, children's songs, cheerful scribbling, coloring, and the alphabet, supported by an interface, are easy to understand and operate by children early age 3-6 years (Putra et al., 2016).

This simulation game with the aim of education can be used as an educational medium that has a "learning by doing" pattern. This game can be used as an alternative medium for Early Childhood Education (PAUD) teacher learning in changing conventional learning methods into game simulation learning methods, to develop children's creativity because educational games have some elements: challenge, accuracy, reasoning, and ethics (Vega, 2016). In the learning process, educational games made cannot replace the position of teachers and books (Pramuditya et al., 2018). Using games as learning media will not be efficient without the support and roles of parents and teachers (Shaula & Hasyim, 2017). The Transformative Potential of Role-Playing Games (TRPG) is very effective for encouraging knowledge, developing role-playing skills, encouraging collaborative creativity, and exploring one's personal development (Daniau, 2016).

Animated multimedia plays a very important role in education. The efficacy of the application of interactive media in PjBL (give the definition in this bracket) has a significant positive effect on learning achievement ((R. Untari et al., 2020). This is indicated by the average percentage for students with a high ability level of 94.3%, students with a moderate level of ability of 92.2%, and students with a low ability level of 92.2% (Pramuditya et al., 2018). The use of Android as a learning medium is very effective and efficient, where learning can be done while playing games, which makes early childhood more interested in learning because Android can be used as a medium for playing while learning (Jayanti et al., 2018). This is in line with the results of research which stated that game-based learning and 21st-century skills have received a lot of attention (Qian & Clark, 2016). Careful planning of university management, designer, and lecturers are needed to create beneficial and useful online learning for the students (Rohman et al., 2020)

IV. Conclusion

Based on the results of research on testing the Android-based educational game developed by researchers, it can be concluded that: This research generated a product in the form of an Android-based educational game. The development stage in this study used the ADDIE development model, namely analysis, design, development, implementation, and evaluation. The Android-based educational game developed is categorized as feasible for use, as indicated by the average score of the material expert validation of 4.86, which is in the very good category, and the average score of the validation of the media experts is 4.9, which is also in the very good category. There is a significant effect between the ability to memorize vocabularies in 3 languages before being treated and after being treated. This is shown by the sig. value amounting to 0.000 less than 0.05, which means there is a significant difference. In terms of the aspect's interpretation, analysis, inference, evaluation, explanation, and self-regulation which increased by 33.4%, 16.7%, 33.3%, 4.5%, 25%, and 44.5%, respectively, this educational game learning medium can be used as a suitable learning media and can be used for a wider group of classes, especially at the PG/Kindergarten level.

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