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DEVELOPMENT OF ANDROID-BASED PUZZLE GAME MEDIA FOR CLASS III ELEMENTARY SCHOOL

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Abstract

This research and development aims to produce a product and determine the feasibility of an Android-based puzzle game media for fractional material for grade III elementary school. This research was conducted in the researcher's home environment, namely, RW 001, Jakamulya Village, South Bekasi District, Bekasi City. The research method used is the research and development (R&D) method with the ADDIE development model (Analysis, Design, Development, Implementation and Evaluation). Data collection techniques using observation, interviews, and questionnaire. The data were analyzed using the Miles and Huberman analysis model. Respondents in this development are one material expert lecturer, one media expert lecturer, one language expert lecturer and third grade students in RW 001, Jakamulya Village, South Bekasi District, Bekasi City. The test results for developing Android-based puzzle game media to three experts (expert review) obtained an average value of 88% or the media was in the very good category. In addition, the results of the One to One trial stage are 95% and the Small Group is 98%. Referring to the results of data analysis of the Miles and Huberman model, the puzzle game media based on Android is a valid product and is suitable for use in learning mathematics in grade III Elementary School.

Keywords : Media Games, Puzzles, Android, ADDIE, Math, Fractions.

Abstrak

Penelitian dan pengembangan ini bertujuan untuk menghasilkan produk dan mengetahui kelayakan media permainan puzzle berbasis Android untuk materi pecahan kelas III SD. Penelitian ini dilakukan di lingkungan rumah peneliti yaitu, RW 001, Kelurahan Jakamulya, Kecamatan Bekasi Selatan, Kota Bekasi. Metode penelitian yang digunakan adalah metode penelitian dan pengembangan (R&D) dengan model pengembangan ADDIE (Analysis, Design, Development, Implementation dan Evaluation). Teknik pengumpulan data menggunakan observasi, wawancara dan kuesioner. Data dianalisis menggunakan model analisis Miles dan Huberman. Responden dalam pengembangan ini yaitu satu dosen ahli materi, satu dosen ahli media, satu dosen ahli bahasa dan Siswa kelas III di lingkungan RW 001, Kelurahan Jakamulya, Kecamatan Bekasi Selatan, Kota Bekasi. Hasil uji coba pengembangan media permainan puzzle berbasis Android kepada tiga ahli (expert review) diperoleh nilai rata-rata 88% atau media masuk ke dalam kategori sangat baik. Selain itu hasil dari tahap uji coba One to One sebesar 95% dan Small Group sebesar 98%. Merujuk pada hasil analisis data model Miles dan Huberman, media permainan puzzle berbasis Android merupakan produk yang valid dan layak digunakan pada pembelajaran matematika di kelas III Sekolah Dasar.

Katakunci: Media Permainan, Puzzle, Android, ADDIE, Matematika, Pecahan

Introduction

During a pandemic like now, students are required to study at home by maximizing the use of technology. According to data from the Ministry of Education and Culture, 94% of students are in the yellow, orange and red zones, which causes schools not to hold face-to-face learning at school, but instead students do online learning from home (Kemdikbud, 2020).

Online learning is learning that is carried out using the internet network. Online learning aims to meet educational standards through the use of Information Technology. Students can interact with teachers using several applications such as Google classroom, video conference, telephone, Zoom or via Whatsapp Group (Astini, 2020).

In a research journal it was written that 100% of the 64 elementary school teachers who filled out the questionnaire used WhatsApp as the first choice, 15% used Google Classroom, 12% used Google Form, 7% used learning videos on YouTube, and 3% used Zoom Meeting. (Anugrah, 2020). This data shows that there is minimal use of interesting platforms as learning supports used by teachers during this pandemic.

The online learning process requires educators to create a more enjoyable learning atmosphere even though they do not meet face to face with students. This can be realized through the use of interesting learning media. Learning media is anything that can be used to convey information in the teaching and learning process so that it can stimulate students' attention and interest in learning (Arsyad, 2016). Learning media that is suitable for students in times like these are Android-based smartphones that can be used anywhere and anytime, such as learning videos, quizzes or educational games.

However, in reality there are still many educators who have not been able to create a pleasant online learning atmosphere and have not used interesting learning media, so there are still many students, especially at the elementary school level, who feel bored with online learning. Not a few students ignore the assignments given by educators and prefer to play with their friends or play with gadgets to relieve boredom. These gadgets or smartphones are used to access things outside of learning, such as watching videos on YouTube or TikTok and playing offline games or online games with their peers.

Based on the results of observations and interviews in the researcher's home environment, namely Jakamulya sub-district, South Bekasi sub-district. Elementary school age children in grades 3 and 4 almost every day play online games together from morning to afternoon and even at night. In fact, in the morning the children should take part in online learning and do the assignments given by the teacher first. Parents only complain about their children's habits without taking firm action. This makes children increasingly irresponsible for their obligations in carrying out assignments during online learning.

The researcher also conducted an interview with one of the class III teachers at SDN Jakamulya V who taught several children in the researcher's home environment. The teacher said that many students rarely did and submitted assignments during online learning. Even though the students' parents have been reminded, there are still quite a few of them who do not complete and submit their assignments. The teacher also mentioned that during daily assessments and mid-semester assessments, many students had not reached the school's KKM or Minimum Completion Criteria, especially in the Mathematics learning content. The average score obtained by students is 63, while the school's KKM is 68.

The questions that many students answered incorrectly were questions about fractions. In this material, there are quite a lot of students who cannot differentiate between the numerator and the denominator, students also still have difficulty when ordering fractional numbers from smallest to largest. This is what makes the daily assessments and mid-semester assessments for class 3 students not yet reach the KKM.

In line with the statement expressed by the 3rd grade teacher at SDN Jakamulya V, in interviews with grade 3 children in the researcher's home environment who also attend school at

SDN Jakamulya V, 3 out of 5 children stated that it was the fraction material that they understood less than the material on working and collect assignments. The teacher also mentioned that during daily assessments and mid-semester assessments, many students had not reached the school's KKM or Minimum Completion Criteria, especially in the Mathematics learning content. The average score obtained by students is 63, while the school's KKM is 68.

The questions that many students answered incorrectly were questions about fractional matter. In this material, there are quite a lot of students who cannot distinguish between numerators and denominators, students are also still having difficulties when they have to sort fractional numbers from the smallest and from the largest. This is what makes the daily assessment and midterm assessment of grade 3 students have not reached the KKM.

In line with the statement expressed by the 3rd grade teacher of SDN Jakamulya V, in an interview with 3rd grade children in the researcher's home environment who also attends SDN Jakamulya V, 3 out of 5 children mentioned that it is the fractional material that they do not understand compared to Android-based educational game materials so that students can play while learning. Although in reality there are still many students who have not used Android as a learning medium.

This has also been stated in several previous research articles and journals. As in the Merpati journal which writes that elementary school students who already have their own Android often abuse the Android by using it to play games. Students often forget time to study because they are too fun playing games so that their learning achievement decreases (Sanjaya, 2014). Based on this data, it is proven that students have not used Android as a means to learn while playing, students only use Android to play.

In one of the studies, it was written that elementary school students had difficulty determining fractions in mathematical models and it was also difficult to distinguish between the numerator and the denominator of the fraction (Deringol, 2019). This shows that there is still a lack of meaningful Mathematics learning in elementary schools, so students are still unable to implement the learning material.

From the above problems, a solution is needed so that students can carry out online learning in a fun way without feeling bored. The ideal learning process can be supported by the use of learning media such as the use of educational games. Learning media for elementary school students can be said to be good if the media is in accordance with the material, interesting, and in accordance with the existing reality (concrete). Learning media must also include pictures or illustrations related to the material so that not only the writing and numbers contained in the media. This can make the learning media a tool to increase students' interest and focus on learning materials.

One of the solutions to the existing problems is to make a learning media development from the problems that have been presented, then the researcher will conduct research with the title "Development of Android-Based Puzzle Game Media for Grade III Elementary School Fraction Material". In general , Android-based or mobile-based puzzle games are only designed to arrange picture pieces into a whole picture, but in this development research the researcher combines the concept of the puzzle game by adding several problems of Mathematics fractional material which will later produce a score that is in accordance with the questions answered correctly by the students. That way students can understand the basic concept of fractional material through the development of this puzzle game media .

In this Android puzzle game application, researchers also prepare material pages and how to play. The material page contains brief material on the introduction of pure fractions in grade III elementary school and the page on how to play contains procedures or game tutorials so that students can learn in advance the fractional material that will be discussed and the steps that must be taken in this game. The puzzle game was chosen because this game can increase the concentration of grade 1 students by 35% at SD Negeri pokoh 1 Ngemplak, Sleman Yogyakarta

(Ramadhan et al., 2016). In addition, puzzle games can also improve the learning outcomes of grade V students which include cognitive, affective, and psychomotor outcomes in social studies learning content at SDN Klantingsari 1, Tarik, Sidoarjo. The results were obtained based on research conducted in 3 cycles (Maslukhah & Abdullah, 2013)

In this study, researchers will also make game media flexibly because it only requires Android that can be used anywhere and anytime. This game media can also be used offline so that it can save costs because you only need to install the game once on an Android device and then it can be used without the need for an internet network. The display of the game media will also be made as attractive as possible by using illustrations that are in accordance with the ongoing learning. With the development of puzzle game media in Mathematics learning, fractional material for third grade elementary school students is expected to be used as a support for online learning that is currently ongoing, as well as face-to-face learning after this pandemic ends.

Methods

The research method used in this development is the research and development method using the ADDIE development model. The ADDIE model itself stands for the 5 stages of development, namely Analyze, Design, Development, Implement, Evaluate (Branch, 2009).

This research and development involves several respondents, namely tester respondents and user respondents. The Android-based puzzle game media developed will be tested by 3 experts, including material experts, linguists, and media experts. Meanwhile, the user respondents or those who were targeted for the trial in the development *of Android-based puzzle* game media were grade III students in the researcher's home environment, namely, RW 001, Jakamulya Village, South Bekasi District, Bekasi City.

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Table 1. Interval Scale Likert

Criteria	Score
Strongly Agree (SS)	5
Agree(s)	4
Simply Agree (CS)	3
Disagree (TS)	2
Very Disagree (STS)	1

(Source: adapted from Sudijono, 2012)

To calculate the average score of material testing, learning design testing, and media testing and media use by comparing the number of scores given by the examiner or validator (F) with the maximum number of scores (N) with the following formula: (Sudijono, 2012)

$$\text{Percentage} = \times 100\% \frac{Total\ skor\ yang\ diperoleh}{Jumlah\ keseluruhan\ skor\ maksimal}$$

In this type of quantitative research, it is necessary to include relevant hypothesis testing techniques.

Results and Discussion

This research and development resulted in an Android-based puzzle game media product for grade III elementary school pecan material named "Pacamat (Mathematical Fraction Puzzle)". This game also contains short material about the introduction of fractions and the game process combined with several math problems of fractional matter.

The development of Android-based puzzle game media has been carried out by referring to the stages of the ADDIE development model. The first stage is Analyze by collecting data through observation and interviews with grade III elementary school students in the researcher's home environment, namely RW 001, Jakamulya Village, South Bekasi District and grade III teachers of SDN Jakamuly V regarding learning in Mathematics learning content. The following are the stages of the analysis carried out, including:

First, conducting a needs analysis so that information was obtained that the limitations of the learning media used during online learning were one of the factors for the lack of interest of students in doing the online assignments given every day, so that the average score of Mathematics for grade III students was less than KKM. This shows the need for learning media that are interesting, flexible and easy to use by grade III elementary school students such as game media.

Second, conducting student analysis on grade III elementary school students in the researcher's home environment. Generally, they are 9 years old and based on the results of the study of cognitive development theory, the student is at the concrete operational stage. At this stage, students are not able to think abstractly so that in learning it should be connected to the reality that exists in daily life. (Ahmad et al., 2016) However, students can already use social language to communicate with the surrounding environment, students also have reading and writing skills. This is evidenced based on the student's statement during the interview that the student is used to reading Thematic books and doing schoolwork given by the teacher.

Third, conducting material analysis based on the results of interviews with grade III students in the researcher's home environment, information was obtained that some students had difficulty determining numerators and denominators in simple fractions. Other data was also obtained from the results of interviews with third grade teachers of SDN Jakamulya V which stated that the results of the Daily Assessment (PH) and Mid-Semester Assessment (PTS) of odd semester students in grade III on fractional material were still below the KKM. So, the fractional material used by the researcher in the development of Android-based puzzle game media. The second stage is Design, after getting information from the previous stage, namely the analysis stage, then the researcher determines indicators based on the basic competencies of grade III fractional materials for elementary school as follows.

Table 2. Basic Competencies and Mathematical Indicators of Fractional Materials for Grade III Elementary School

Basic Competencies (KD)	Indicator
3.4 Generalize the idea of fractions as part of a whole using concrete objects.	3.4.1 Determine the numerator and denominator on a fraction. 3.4.2 Write the magnitude of a number on an object that describes a fraction. 3.4.3 Manifesting a fraction on concrete objects.

Furthermore, the researcher made material that would be in the media of Android-based puzzle games. The content of the material is prepared and adjusted to the learning indicators. The

researcher saves the material to be used in Microsoft Word. The content of this material will later be placed on the material page in the Android-based puzzle game media.

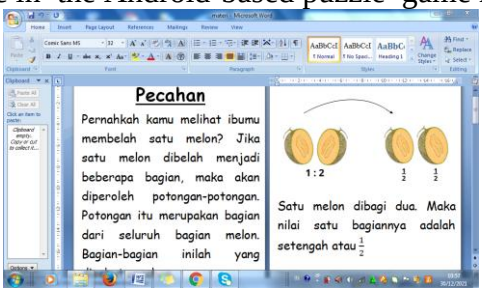

Figure 1. Material Creation Process

After that, the researcher made a flow diagram or sequence of the puzzle game media process to facilitate the process of developing Android-based puzzle game media. The flow diagram of the design design for the development of Android-based puzzle game media is as follows.

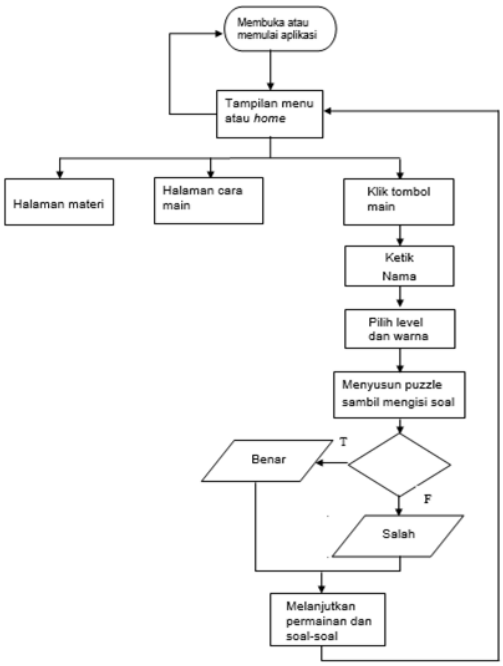

Figure 2. Puzzle Game Media Flow Chart

Furthermore, the researcher determined various software that can be used to create Android-based puzzle game media such as Canva, Articulate Storyline, Microsoft Word, and Google Drive.

The third stage, namely Development, begins with the pre-production stage, namely by creating images for the background and story board of Android-based game media using the Canva application made using a smartphone. After that, the production stage, at this stage the researcher and developer realized the design that had previously been designed into a development product in the form of Android-based puzzle game media by making an Android-based puzzle game using Articulate Stroyline. Production starts from creating a menu page for the puzzle game media that was developed. There are three buttons consisting of "Play", "Material", and "How to Play" buttons.

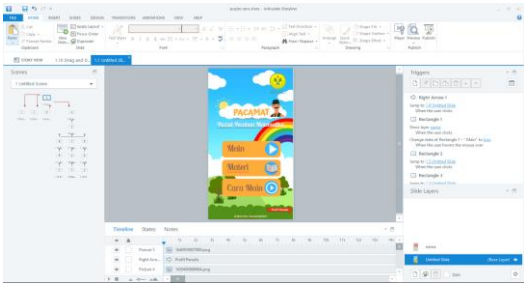

Figure 3. Creating a Home Page or Menu

Next, the researcher made a page of material. The material that will be presented contains fractional materials that have previously been made during pre-production.

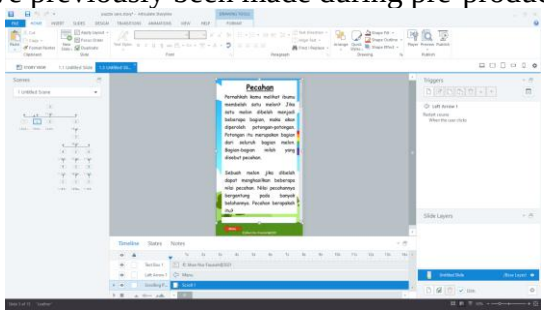

Figure 4. Creation of Material Pages

After the Menu Page and the Material page are completed, the researcher then creates the Main page. When entering the Play page, users will enter the level selection page to determine the difficulty level of what kind of game will be played. Next, users will enter a page to choose colors consisting of red, yellow, and green. After that, the user will enter the Main page. The Main Page consists of a blank puzzle board, puzzle pieces, and fractional material practice questions that must be adjusted to the placement of puzzle pieces on the puzzle board.

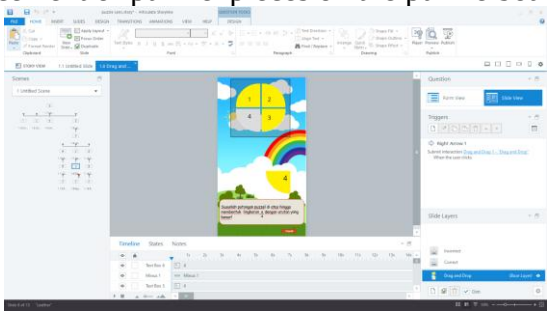

Figure 5. Creating a Play Page

Once the Menu, Materials, and Main pages are created. Next, the researcher created a how-to page that contains images of the sequence to play Pacamat.

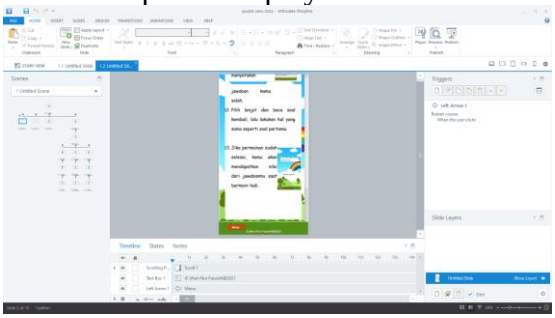

Figure 6. Creating a How to Play Page

After all the pages have been created, the researcher then publishes the game in html form and then converts it into an Android application.

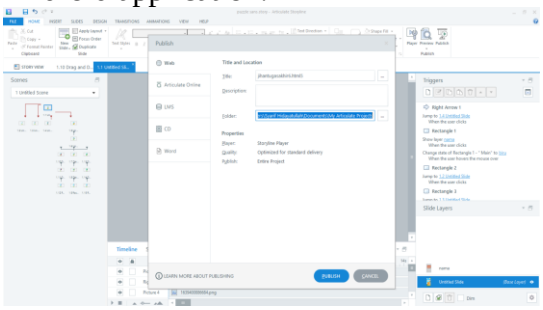

Figure 7. Publication

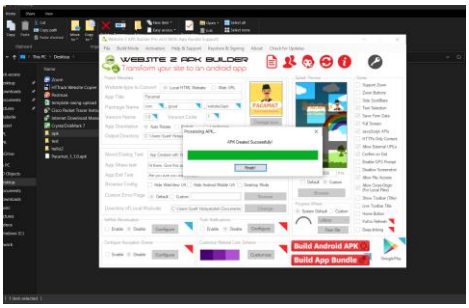

Figure 8. Convert html to Android apk

Furthermore, in the Post-Production stage, the researcher validated the digital book by an expert reviewer consisting of material experts, linguists, and media experts. The results of the assessment are used as a reference for the revision of Android-based puzzle game media to be improved so that the Android-based puzzle game media developed becomes feasible to be implemented.

The fourth stage is Implementation, after the Android-based puzzle game media has received an assessment from experts and has been revised, then the game media is implemented to the target of the game media, namely grade III elementary school students in the researcher's home environment, namely RW 001, Jakamulya Village, South Bekasi. Implementation activities were carried out at the researcher's house, where students gathered at the researcher's house to conduct a one-to-one evaluation involving 3 students and a small group evaluation involving 8 students.

The fifth stage is Evaluation, at this stage there is data on the results of validation from experts or expert reviews such as material experts, media experts, and linguists. In addition, it contains data on the results of student response questionnaires. The following is a table of the validity of the expert test and a table of student response questionnaire data.

Table 3. Expert Test Validation Results

Trial Phase		Result	Criterion
Expert Test	Media Members	82%	Excellent
	Material Expert	94%	Excellent
	Linguist	88%	Excellent
	Total	**88%**	**Excellent**

Based on the table above, it can be seen that Android-based puzzle game media obtained an average result from material experts, media experts, and linguists of 88% and was included in the very good criteria.

Table 4. Results of Student Response Questionnaire Data

It	Respond	Result	Criterion
1	*one to one*	95%	Excellent
2	*small group*	98%	Excellent

Based on the table of student response questionnaire data above, it can be seen that Android-based puzzle game media has obtained very good criteria and can provide convenience to students in understanding fractional material.

Conclusion

This research and development resulted in an Android-based puzzle game media product for grade III elementary school pecan material named "Pacamat (Mathematical Fraction Puzzle)". This research and development involves examiner respondents, namely material experts, linguists, and media experts. This study also involved user respondents, namely grade III elementary school students in the RW 001 research house, Jakamulya Village, South Bekasi District. In developing Android-based pule game media, the researcher refers to the ADDIE development model which consists of 5 stages of development, namely analysis or analysis, design or design, development or development, implementation or Implementation, and evaluation or evaluation. The products developed are assessed by experts. This product received an average of 88% overall assessment at the expert review stage conducted by 3 experts, which means very feasible. This product also received an assessment from user respondents with an average overall score at the one to one evaluation stage of 95% and the small group evaluation stage of 98%, where both values have a very feasible meaning.

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