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Development of Android-based "Pete" Educational Game to Improve Elementary School Student Learning Outcomes in Social Science Learning

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Abstract

Social science has an essential role in training students' abilities to interact and participate in society. However, social science learning has complex material, so many students have difficulty in learning social science material. This research aims to answer these problems, namely by developing an Android-based educational game to improve social studies learning outcomes. This research is a development research using the ADDIE model, i.e. Analysis, Design, Development, Implementation, and Evaluation. Collecting data using observation, interviews, questionnaires, and tests. Qualitative data were analyzed using descriptive analysis techniques, while quantitative data were analyzed using percentage analysis techniques. Based on the validation and trial results, it is stated that this android-based educational game is valid and feasible to use. Android-based educational games are proven to be able to improve student learning outcomes, especially in social science learning. However, some improvements are still being made in accordance with the suggestions and input from the validators and students.

Keywords: *educational games, android based, social science learning outcomes.*

Abstrak

Ilmu Pengetahuan Sosial (IPS) memiliki peran penting untuk melatih kemampuan peserta didik dalam berinteraksi dan berpartisipasi di masyarakat. Akan tetapi pembelajaran IPS memiliki materi yang kompleks sehingga banyak peserta didik yang mengalami kesulitan dalam mempelajari materi IPS. Penelitian ini bertujuan untuk menjawab permasalahan tersebut, yakni dengan mengembangkan game edukasi berbasis android untuk meningkatkan hasil belajar mata pelajaran IPS. Penelitian ini merupakan penelitian pengembangan dengan model ADDIE, yaitu *Analysis, Design, Development, Implementation, dan Evaluation*. Pengumpulan data menggunakan observasi, wawancara, angket, dan tes. Data kualitatif dianalisis dengan menggunakan teknik analisis deskriptif, sedangkan data kuantitatif dianalisis dengan teknis analisis persentase. Berdasarkan hasil validasi dan uji coba produk yang telah dilakukan, dinyatakan bahwa game edukasi berbasis android ini valid dan layak digunakan. Game edukasi berbasis android terbukti dapat meningkatkan hasil belajar siswa, khususnya pada pelajaran IPS. Namun demikian, beberapa perbaikan masih dilakukan sesuai dengan saran dan masukan dari para validator dan siswa.

Kata kunci: *game edukasi, berbasis android, hasil belajar IPS.*

INTRODUCTION

Education in Indonesia has a level system and various fields of study. One of the fields of study is social study (Khotimah et al., 2022), which is given to students from the elementary school level as it has an essential role in training students' abilities to interact and participate in society. However, social science learning has complex materials, so many students complain that social study is a difficult lesson because it is considered monotonous, tedious, and difficult to understand and needs memorizing (Nugraha et al., 2020).

Social studies integrates various branches of social studies and humanities, such as sociology, history, geography, economics, politics, law, and culture (Lilik & Andayani, 2016). Social studies is the embodiment of an interdisciplinary approach to social theories. It is an integration of various branches of social studies. However, social studies need to be patterned for instructional purposes with simple, enjoyable, easy learning materials (Siska, 2016). The purpose of social science learning is to prepare students as citizens who master knowledge, skills, attitudes, and values that can be used as the ability to solve problems, make decisions and participate in various social activities to be good citizens (Rosardi, 2021). Based on the 2013 curriculum for the elementary school level, it is stated that social science aims to (Jumriani et al., 2021):

- a) Teach basic concepts of sociology, geography, economics, history, and citizenship, pedagogical and psychological;
- b) Develop critical and creative thinking skills, inquiry, problem-solving and social skills;
- c) Build commitment and awareness of social and human values;
- d) Improve the ability to work together and compete in a pluralistic society, both nationally and globally.

Technological development brings a significant impact on various aspects of life (Saidah & Damariswara, 2021). So, in teaching social studies material in the classroom, the teacher must have innovative strategies and media so students can understand the material well and not make them feel bored (Syaharuddin & Mutiani, 2020). In social studies

learning, the media must be interactive, innovative, effective, and able to build a conducive, fun learning atmosphere and encourage the success of teaching and learning activities (Rusli et al., n.d.). So, digital-based learning can provide an interesting and enjoyable learning atmosphere, so students can be active and obtain meaningful messages (Jannah et al., 2020).

Due to the Covid-19 pandemic, the application of technology and information features as learning media cannot be avoided (Hafni, 2021). Digital-based learning can provide an interesting and enjoyable learning atmosphere, so students can be active and obtain meaningful messages (Jannah et al., 2020). Besides giving learners a new learning environment, technology can also increase student activity and is not limited by space and time (Danuri, 2019). The application of technology and information in the learning process focuses on the application of multimedia. Interactive multimedia currently used in many learning media make students independent to learn (Saidah & Damariswara, 2021). One is using educational games in learning (Binanto, n.d.). However, using educational games are still rarely used in the learning process. Whereas, the use of educational games is one of the developments in learning media.

Learning media is defined as people, objects, or events that make students' conditions more likely to get attitudes and skills (Darodjat et al., 2021). Meanwhile, according to Hamalik, using learning media in the teaching and learning process can increase students' motivation and stimulus to learning activities and influence students psychologically (Yufrinaslis et al., 2021). There are several principles for developing learning media, including simplicity, unity, and emphasis. Balance, in developing media, a balance is needed in the positioning of each component in the developed media (Salma, 2015).

One example of developing learning media is an educational game, which is any contest between players who interact by following specific rules to achieve specific goals (Ridoi, 2018). With the existence of educational games media, it is hoped that it can increase learning motivation affecting the level of concentration, speed of absorbing subject matter, and maturity of understanding of several subject matter so that it impacts optimal learning outcomes (Wibawanto, 2020). Making instructional games as a learning model has several stages, which include goals, rules, competitions, challenges, fantasy security, and entertainment. Several stages of learning with the help of computer game models are as follows: presentation of information, playing instructional games, judging of responses, providing feedback about responses, remediation, checking the score, and exiting (Ziraluo, 2020)

Games in mobile devices nowadays are becoming a rapidly growing industry. Therefore, the game is also used as a means to develop people's interest in education (Kidi et al., 2017). This study uses an Android-based educational game. Android is software (software) used on mobile devices (running devices), which includes an operating system, middleware, and core applications (Karman et al., 2019). Android is a Linux-based operating system (Yahya et al., 2019). The Android user interface is based on direct manipulation, using touch input similar to real-world actions, such as swiping, tapping, pinching, and reverse pinching to manipulate objects on the screen. It is specifically used for mobile devices such as smartphones or tablets (Wijayanto, 2018).

Due to the use of Java language programming, the Android operating system is readily accepted by the market and proliferating. Moreover, its advantages as software that uses a

computer code base that can be distributed openly (open source) also become another reason (Damanik et al., 2020). This allows users to develop and even create new applications. This advantage causes many software developers to flock to develop Android-based applications. So now, when compared to other Operation Systems for mobile phones and tablet PCs, the Android operating system is far superior (Maryanto et al., 2014).

The gaps and the importance of learning media for education get the researchers to do some observation to understand deeper about the problem and create some solutions for the problems. Based on the results of the observations, it was found that the learning process activities carried out in the classroom used some existing facilities such as LCD, TV, and sound as well as a computer lab. Some students have an Android phone at home. In the current era, teachers are required to be more open to technology in developing learning materials.

This research is based on previous research on developing Android-based educational game learning media in economics subjects for ten graders at Senior High School (Nurisa & Ghofur, 2019). This study uses the ADDIE method in developing an Android-based educational game. The research showed that the media is effective to use in economic subjects ten graders of Senior High School students; it is proved by the perfect field trials (85.86%) and the increase of students' learning outcomes after using android-based game learning media. The acquisition of learning outcomes also proves it before being treated was 69.55%, increased by 14.15% to 83.7%.

Other research is developing learning media for Android-based educational game media in physics subjects (Rozi & Kristari, 2020). This study uses a prototype model with technical data analysis using the Guttman and Likert scales in the research process. The learning media for android-based educational games in this research is for physics subjects. The research results stated that this learning media is effective in physics subjects for eleven graders at Senior High School. The average score on field trials with an overall validity level, namely 90%, categorized the media as a very good learning media.

In addition, there is research on developing the Android-based educational game "SI GALANG" in social studies subjects on traditional clothing for grade four at elementary school (Asri & Yermiandhoko, 2018). This study used the Borg and Gal model and using quantitative analysis techniques. The media in this research is used for the Social Studies subject. The results of the study stated that this learning media is effective to apply in social studies subjects of traditional clothing for class IV SD. It is marked by the average score of field trials with a product validity level of 91% and the acquisition of overall learning outcomes of 82.5%. The results show a very good categorization. These facts prove that the development of learning media has a perfect impact on improving student outcomes, increasing students' motivation and interest in learning, and reducing boredom in the learning process. In addition, developing android-based media is also practical because it can be used anywhere and anytime (Hamid et al., 2020).

Different from previous research, this research intends to develop an Android-based educational game learning media to help answer the abovementioned problems. In addition, this research was conducted to provide innovations by utilizing android in the learning process so that the development of this educational game is expected to have a good impact on the distance learning process. Minimize students' boredom in learning social studies and

teach the use of android wisely by using it to play while learning to use educational games based on android. Therefore, it is hoped that this product can increase the effectiveness of learning during the pandemic.

METHODS

This research is research and development research. This study was designed using the ADDIE learning development model with five stages of development: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is an approach that emphasizes the analysis of how each of its components interacts with each other when described as follows (Rayanto & Sugianti, 2020):

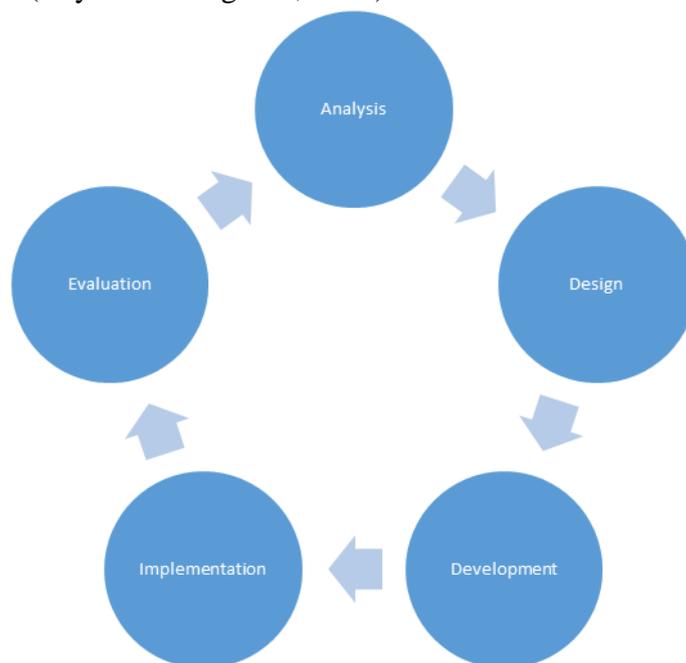


Figure 1. ADDIE Research Stage

This study's research and development procedure uses the ADDIE model. *First*, Analysis. At this stage, the researcher conducts unstructured interviews with teachers regarding the problems encountered related to learning media to obtain solutions. At the Analyze stage, researchers found several problems contained in the learning process in social studies subjects, including the following:

1. Student learning outcomes are still lacking in practice, and most of them only master theory. It can be seen from the results of last year's study. 48% of students are still remedial.
2. The lack of understanding of concepts in social studies subject material for economic activities.
3. Media that is less varied and less enjoyable in social studies subjects for economic activities.
4. The absence of teaching materials and other supporting media in social studies subjects for economic activities

So that the problem found by researchers is that students need new learning media that are more attractive, make it easier for them to understand the material, and are not limited by space and time.

Second, the design. At this stage, the researchers designed design learning media to facilitate researchers in designing media that have analyzed previous problems. At the design stage, the researchers formulate general learning objectives specifically for materials to develop products and test instruments. Then, the researchers create a learning strategy concept using the Android-based "PETE" educational game for social studies lessons on economics. Initial sketch of the storyboard or application settings. This storyboard includes a splash screen, main menu, about the menu, evaluation list, material menu, and user identity. In developing this educational game-based learning media, the presentation style and content must be designed as attractive as possible. It can be understood to arouse students' interest in learning.

Third, development. In this stage, the researcher begins to develop the product by preparing a storyboard and game design. Fourth, Implementation is a process to determine the effectiveness of the media that has been developed. The implementation process is carried out with an initial trial. Then an assessment is carried out to determine the effectiveness, quality, and attractiveness of the "PETE" android-based educational game media product.

Fifth, evaluation. Evaluation process to determine the achievement of the objectives of the developed product and whether the product is feasible to operate in the field. The trial phase was carried out by learning material and media design experts. The trial design carried out in this development research is the validation of social studies material, learning media design experts, and students as users of the developed product. The purpose of product validation is to obtain evaluations and suggestions from the validator to determine the product's validity.

The product test subjects of the android-based educational game media were fourth-grade elementary school students. The test was carried out with the control class group and the experimental group (Figure 2). This experiment was conducted by comparing student learning outcomes through the pre-test and post-test of the control group and the experimental group. This development research use pre-test and post-test experimental designs (Sugiono, 2013).

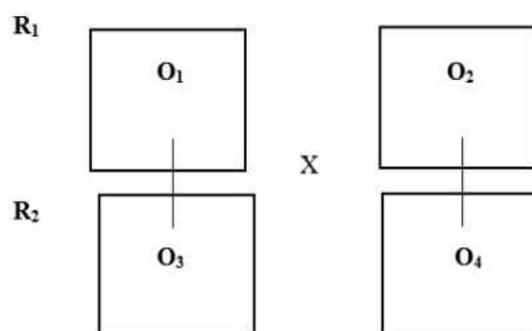


Figure 2. Pre-test and post-test experimental design

Information:

R₁ = Experimental group

R₂ = Control group

X = Treatment in the form of using the android-based educational game media "PETE"

O₁ = Pre-test activity of the experimental group

O₂ = Post-test activity of the experimental group

O₃ = Pre-test activity of the control group

O₄ = Post-test activity of the control group

The validity of the product developed in this study was measured using an assessment instrument in the form of a questionnaire containing questions and answers using a Likert scale rating guideline that ranged from 1 to 5. The formula used to measure product validity was as follows (Gitnika, 2016):

$$P = \frac{F}{N} \times 100$$

Information:

P = Final score

F = Score

N = Maximum score

Table 1. Product Validity Criteria

Level of Achievement (%)	Qualification	Notes
86 – 100	Very decent	No Revision Needed
60 – 80	Worth it	No Revision Needed
40 – 60	Enough	worth Revision
20 – 40	Less	worth Revision
0 – 20	Very Unworthy	Revision

The effectiveness of the android-based educational game media product "PETE" can be seen through increasing student understanding as measured by the post-test results on the economic activity material under the essential competencies carried out by the control group and the experimental group. Testing was carried out using the Independent Sample T-test using the SPSS 25.0 for Windows program. Student learning outcomes in the experimental and control groups can be known by comparing the tcount and t table with a significance level of 0.05 or 5% and DB n-2. 0.05 atau 5% and db n-2.

RESULTS AND DISCUSSION

Research and Development Results

The purpose of developing learning media is focused on improve student learning outcomes. For this purpose, researchers collect and select relevant literature as well as the actual information in books, the internet, and other sources. The material is structured in a way that provides many opportunities to think and use language that is easy for students to understand.

The product produced in this development is an android-based educational game on social studies subjects. The development of digital technology at this time has provided many advantages for anyone in accessing various information and connecting without crossing borders, without being limited by space and time (Suhartati, 2021).

The development of this learning media refers to the ADDIE development design process, namely Analyze, Design, Development or Production, Implementation or Delivery, and Evaluation. In this study, researchers developed an android-based educational game on social studies on economic themes which are expected to be used as a supporting learning resource that can increase students' understanding of economic social studies material.

Product Specification

The development of the Android-based "PETE" educational game in social studies subjects for the fourth-grade elementary school economic activities, including pre-production, production, and post-production.

1. Pre-Production

In the pre-production stage, there are several determinations, namely analyzing content competencies and indicators, collecting references, selecting images and animations, and making storyboards.

2. Production

Creating an educational game, "PETE", based on android for social studies subjects, material for economic activities based on android in learning strategy courses for elementary/middle school using the android studio 3.4 application.

3. Post Production

At this stage, final editing and product packaging are carried out to be prepared for the implementation stage.

The Android-based "PETE" educational game product on social studies subject material for economic activities consists of 6 parts: descriptions of learning media, assistance, materials, evaluation, and developer profiles. The following is a brief profile of the products developed:

- Product name: PETE (Economy Theme Educational Game)
- Type of File: Apk (Application Package File)
- Size on disk: 46.7 MB

Table 2. Android Learning Media-Based Teaching Materials and their descriptions

No.	Android Learning Media-Based Teaching Materials Section	Information
1.		Splash Screen is the initial display when the application is run.
2.		The menu section contains the needs of learning media users.

Identity Menu

3.



This menu contains the identity of the user name.

Evaluation Menu

4.



On this page, there are four options for evaluating learning that media users can do.

Material Menu

5.



Contains a choice of 1 to 4 learning materials to deepen students' understanding.

Menu How to Play

6.



This menu is a step-by-step guide to using educational game media.

Menu About

7.



The about page briefly describes the PETE (Economic Theme Educational Game) application.

Settings Menu

8.



This menu is part of the setting to blame music or not.

Product Validation Test

The validation test of the Android-based "PETE" educational game development media was carried out in 3 stages; namely, the results of the material assessment of the android-based educational game in social studies subjects with economic themes by expert lecturers in the field of education as material experts. The second stage was obtained from a design assessment of an Android-based educational game in social studies subjects with economic themes by lecturers who are experts in learning design. The third stage is obtained from the assessment of educational games android based on the social studies subject economics theme by expert teachers of thematic learning as product users.

Validation to material experts uses a questionnaire containing a questionnaire regarding the feasibility of the material. The results of material validation get a validation level of 91%, so the qualifications are very valid so that learning media-based teaching materials do not need to be revised. However, improvements need to be made regarding giving examples of surrounding objects and avoiding wasting words. Therefore, this suggestion is taken into consideration by researchers to improve the resulting product development.

The validation results from media experts obtained that the percentage level of validation was 92% after being converted to a 5-scale conversion table. The percentage level of achievement was at a very reasonable qualification level, so android-based learning media did not need to be revised. Based on qualitative data obtained from suggestions or comments from media experts, it is necessary to make improvements regarding the font size that must be adjusted, and the coloring needs to be clarified.

The validation results from learning experts obtained a validation level percentage of 94% after being converted to a five-scale conversion table. The percentage of achievement level was at a perfect qualification level, so android-based learning media did not need to be revised.

Product Trial Results

Table 3. T-test of Experiment Class and Control Class

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Hasil Post tes	Equal variances assumed	10.227	.002	-2.293	85	.024	-3.8317	1.6714	-7.1551	-.5087
	Equal variances not assumed			-2.305	70.123	.026	-3.8317	1.6621	-7.1467	-.5171

Based on the results of the T-test, the value of Sig. Levene's Test for Equality of Variances is $10.227 > 0.05$, so it can be interpreted that the data variance between the experimental class group and the control class group is homogeneous or the same. This is following the theory of the Levene test that if the value is >0.05 means that the two classes are not significantly different then the variance of the classes compared is homogeneous (Nuryadi et al., 2017). So that the interpretation of the Independent Samples Test output table above is guided by the values contained in the "Equal variances assumed" table. Based on the "Independent Samples Test" output table in the "Equal variances assumed" section, the value is Sig. (2-tailed) of $0.026 < 0.05$. Based on the independent sample t-test, it can be concluded that H_0 is rejected and H_a is accepted. Thus, it can be concluded that there is a significant (significant) difference between the average student learning outcomes in the control class group and the experiment class group.

After the researchers taught the control class and the experimental class, learning using android-based educational games on social studies subjects with economic themes that were developed had a positive influence on the value of student learning outcomes. The achievement of the effectiveness of Android-based educational games is indicated by an increase in student learning outcomes in the experimental class which is better than the learning outcomes in the control class.

The development of android-based educational games is carried out because at this time most students can operate android, so in the world of education also have the opportunity to develop Android-based learning media, to keep up with the times, and train students to learn with technology, especially android. Android media can be used by students to gain knowledge, and the development of android-based media can present learning materials and ideas that can be more interesting and fun (Ahmar & Rahman, 2017).

So, learning in the classroom becomes effective and able to improve student learning outcomes.

Android-based learning media can improve student learning outcomes (Darsih & Lubis, 2021). This android-based learning media does not require internet access for its use. Because the media created through Android is in the form of an application that can be opened and stored on a smartphone with an Android system. Digital-based learning can provide an interesting and enjoyable learning atmosphere, so students can be active and obtain meaningful messages (Jannah et al., 2020). Besides giving learners a new learning environment, technology can also increase student activity and is not limited by space and time (Danuri, 2019).

CONCLUSION

The product produced in this development is an Android-based educational game on social studies subjects with economic themes. The development of this learning media refers to the ADDIE development design process, namely Analyze, Design, Development or Production, Implementation or Delivery, and Evaluation. Achievement of the effectiveness of android-based educational games was indicated by an increase in student learning outcomes in the experimental class better than the learning outcomes in the control class. This Android-based educational game was developed only as a supporting medium for instilling concepts in students. So, when learning takes place the experimental activities should still be carried out

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