The Development of Educational Game Based Learning Media Increases Computer System Learning Motivation in Vocational High Schools

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ABSTRACT

The development of technology at this time is getting faster with the increasing number of applications about learning that use smartphones, tablets and laptops. The media used so far mostly only uses text, making students feel uninterested in learning the learning material. So that it has an impact on the lack of student learning motivation because the teaching materials used so far have not supported students' understanding. Therefore, it is necessary to design a learning media that can increase student learning motivation through attractive and more interactive devices, one of which is an educational game-based learning media. This study aims to develop learning media in the form of educational games and test the feasibility of the developed media and increase students' learning motivation in using educational game-based media in Computer Systems subjects. The development model used is ADDIE (Analyze, Design, Development, Implementation, Evaluation). The results of the study indicate that educational game-based media is feasible to use in learning. before and after using educational game-based media there were positive changes to students' learning motivation. Students' learning motivation in using educational game media has increased. This shows that the use of educational game-based media in learning activities is declared feasible and can increase students' learning motivation.

Keywords: *Educational Game, Computer System, Learning Motivation.*

1. INTRODUCTION

At this time, digital games are becoming part of the activities of a person's life. The support of mobile and computer technology has brought digital games as one of the learning tools. In relation to learning, digital games not only present immersive and fun activities, but rather activities related to learning content to achieve certain goals [1]. A gaming application can be utilized through technological media such as smartphones, computers or laptops, and tablets. Learning media that utilize smartphones have been found, but most of them are only one-way. Users can only access a summary of the material learned and follow the flow that has been programmed by the creator. In order to create fun learning, it is necessary to use the right learning media and refer to the facilities in schools and at home. Learning media that can be developed is by utilizing smartphones, one of which is educational game-based learning media.

Games that have educational content are better known as educational games. Educational games are a learning tool for teachers that are quite effective in delivering material so that a higher desire for learning for students grows. The use of educational games in the learning process aims to be able to overcome learning problems in increasing learning motivation, helping the development of intelligence and improving students' abilities in the learning process [2]. Educational games are games that have been specially prepared to direct students (users) something to the selected learning, improve the concept of description and lessons for them in honing their skills and encourage them to play them [3]. A well-designed game can provide an authentic exercise in thinking and working in certain roles and contexts [4].

Educational game media combines learning and playing, this educational game can also be used to attract interest and increase student motivation to gain knowledge. This educational game on research and development was created with the help of the Construct

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2 application. The final result of the product developed is in the form of an application that can be accessed on android-based smartphone devices. In the use of educational games in interactive animation media can increase student learning motivation, because in educational games students are actively involved in the learning process packaged in the game, so that students' curiosity about the material to be studied will increase, such a fan can have a positive influence on student learning motivation [5]. Motivation and learning are two things that influence each other. Motivation is the motivation contained in a person to try to make a change in good behavior in meeting their needs. Both of these things are efforts that encourage someone to do something. In motivation it contains a desire that activates, moves, channels, and directs the attitudes and behaviors of the learning individual [6].

Based on the results of interviews with teachers of Computer Systems subjects at SMK Negeri 10 Malang class XI TKJ, the school uses the 2013 Revised 2018 Curriculum. Currently at SMK Negeri 10 Malang, learning is carried out using a Blended Learning model. Blended Learning is a learning model that combines face-to-face learning with e-learning. Blended Learning is a new concept in learning where the delivery of material can be done in the classroom and online [7]. In the Blended Learning model carried out by SMK Negeri 10 Malang, it applies an odd-even system to implement the learning model. Students who have an odd absence number will do face-to-face learning at school, while students who have an even absence number will do online learning or distance learning. Students who carry out the online learning process will get material on that day by being given learning media in the form of modules or learning videos that will be uploaded through Google Classroom.

In carrying out the learning process carried out at SMK Negeri 10 Malang, there are two activities, namely theoretical and practicum learning activities. In theoretical learning activities, teachers more often explain and only provide or deliver material using learning media in the form of modules, learning videos and power point slides. After the material is completed, the teacher will usually give practice questions. So that students here are only required to listen, read and record explanations from the teacher, and students do not develop their abilities. Of the many students in the classroom, only a small part is active in the learning process in the classroom.

Based on preliminary observations by interviewing teachers of computer systems subjects , the material is quite a lot and using logic makes it difficult for students to be able to understand the material. Coupled with the monotonous learning process, it makes students quickly feel bored and saturated in following the learning.

Based on this situation, independent learning media is needed that can make learning more interesting and able to make students more motivated in learning. One of the alternative media that needs to be developed is educational games. Researchers developed educational game-based learning media in Computer Systems subjects focusing on KD 3.2-4.2 with material on Analyzing and Assembling logic relation functions (basic logic, combinations and sequential), KD 3.3-4.3 with material on Applying and Practicing Arithmetic logic operations.

2. RESEARCH METHODS

This research and development use the ADDIE method. The use of ADDIE was chosen in this study because the ADDIE development model is simple and easy to learn because it is one of the systematic learning design models and has five stages that are easy to understand, so that it can make it easier to develop educational games. In

in addition, the development of ADDIE is considered sequential but also interactive where the results of the evaluation at each stage can take the development to the next stage. The ADDIE model has five research steps, namely: (1) Analyze; (2) Design; (3) Development; (4) Implementation; (5) Evaluation.

a. Analysis

Problem analysis, needs analysis, material analysis, student characteristics analysis and resource identification are carried out through data collection and research derived from observation, interviews and questionnaires which are then found problems that are the reason for the development of learning media based educational game

b. Design

Aims to provide solutions in the form of learning media designs that will be developed. The design stage includes: material preparation, game design documents, and storyboard design.

c. Development

The creation of media in the form of educational games begins with preparing material in accordance with the topic of learning Computer Systems. Followed by making learning media in the form of android-based educational games. The process of developing educational game media uses a game engine in the form of Construct 2. The learning media that has been arranged in such a way in Construct 2, then exported to an Android-based using web2apk. After the media development is completed, then in this stage material and media validation is carried out.

d. Implementation

It is carried out by conducting small group trials and large group trials. In doing uji try small groups were carried out by taking a sample of 10 students [8]. As for the large group trial, it was carried out by taking a sample of 30 students [8]. Small group trials in class XI TKJ 4, while for large group trials in class XI TKJ 3 at SMK Negeri 10 Malang. In this writing and development, several instruments will be made in the form of questionnaires that are prepared based on applicable regulations. There are three types of instruments as data sources, namely material validators, media validators, users, and learning motivation. The questionnaire of material experts, media experts, and users was developed based on the instrument grid by LORI [9] and learning motivation was developed based on the instrument grid [10]. The data analysis technique used is descriptive percentage to determine the feasibility of educational game-based learning media using equations (1) with validation criteria according to [11], feasibility criteria according to [11] and measuring student learning motivation using equations (2) according to equations (2) according to No. 16 with the criteria of learning motivation according to [12]. The valid criteria for educational game as can be seen in Table 1, the eligibility criteria can be seen in Table 2, and the criteria for student learning motivation can be seen in Table 3.

Formula used to measure the feasibility of *game education*:

$$Va = \frac{TSe}{TSh} x100\% \quad (1)$$

Information:

Va : Validity
TSe : Total overall validity score
TSh : Maximum total score (total number of ideal scores)
100% : Constants

Table 1. Validation Criteria

Percentage (%)	Validity Criteria
85.01 – 100.00	Valid, or can be used without revision
70.01 – 85.00	Quite valid, or can be used but minor revisions
50.01 – 70.00	Less valid, it is recommended not to be used because there are large revisions
01.00 – 50.00	Invalid, should not be used

Table 2. Eligibility Criteria

Percentage (%)	Eligibility Criteria
81.01 – 100.00	Decent, can be used without revision
61.01 – 81.00	Quit feasible, or usable but minor revisions
41.01 – 61.00	Less feasible, needs a large revision, it is recommended not to use
21.01 – 41.00	Not worth it, can not be used
00.00 – 21.00	Very unworthy, unusable

Formulas used to measure student learning motivation:

$$\text{Final Value} = \frac{acquisition\ score}{score} \times 100\% \quad (2)$$

Table 3. Learning Motivation Criteria

No	Value	Motivational Qualifications
1	85 - 100	Very High
2	70 - 84	High
3	55 - 69	Enough
4	40 - 54	Low
5	25 - 39	Very Low

e. Evaluation

At this stage, an evaluation is carried out aimed at improving the product being developed. The evaluation stage is carried out at the end of each previous step.

3. RESULTS AND DISCUSSION

3.1. Product Development Results

The product result of the development is in the form of an educational *game-based* application product for the *Android* operating system in the Computer System subject. The educational *game-based* learning media product developed is named the "SITEKOM" application. SITEKOM has a capacity of 15MB. SITEKOM can be accessed *offline* and *online.* When using the application, at level 1 and level 2 it can be accessed *offline*, while inputting names, classes, and absence numbers at the end of each level 1 and level 2 is accessed *online*. The inputting of names, classes and absence numbers at each end at level 1 and level 2 is accessed *online* so that the total scores obtained at level 1 and level 2 are stored in *the spreadsheet*. This application also has basic competencies used at level 1 and level 2, learning objectives, there are reviews on each mission at level 1 and level 2, and there are also instructions for use. The material in this SITEKOM application includes 2 KDs, namely KD 3.2 Analyzing basic logic, and 3.3 Applying arithmetic logic operations. Examples of displays from educational *game-based* media are as follows:

Figure 1. Opening View

In the opening display or Splash Screen is a condition used to describe images or images that appear when an application or program is in the process of loading.

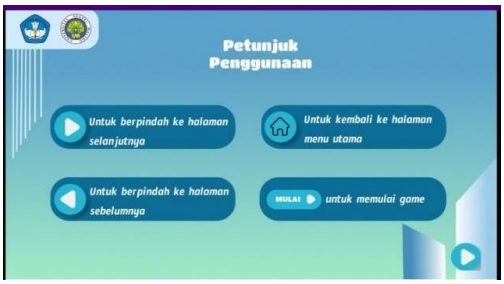

Figure 2. Display Instructions for Use

The instructions for use menu contain an explanation of the function of the button used in the application. The instructions for use of level 1 contains instructions or how to play the game at level 1. The instructions for use of level 2 contains instructions or how to play the game at level 2.

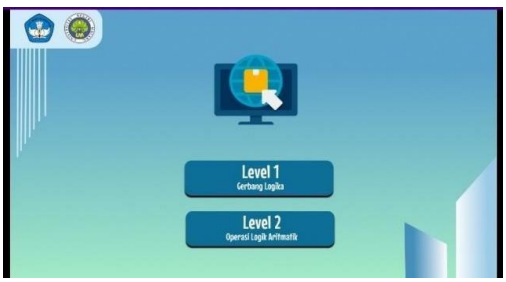

Figure 3. Main Menu View

This main menu display contains several menus that can be selected by students. In this main menu, there is a level 1 menu, a level 2 menu.

Figure 4. Basic Competency Display

The basic competency display contains the use of basic competencies used in educational *game-based* media applications. At level 1 it contains basic competencies 3.2-4.2, and at level 2 it contains basic competencies 3.3-4.3.

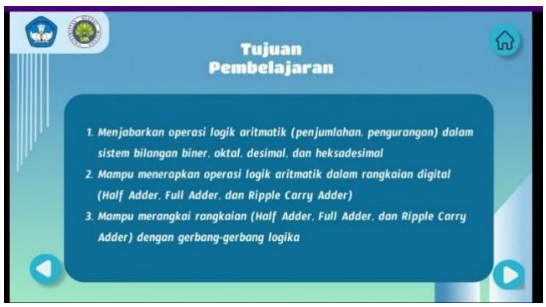

Figure 5. Learning Objectives View

The learning objectives menu contains an explanation of the learning objectives that will be achieved by students.

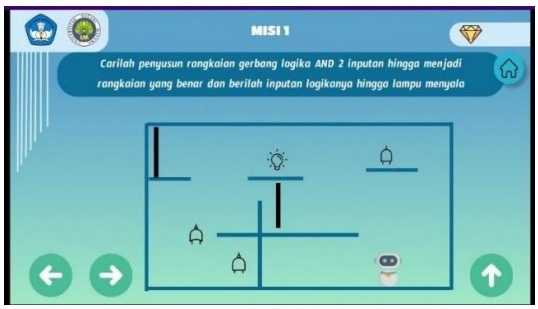

Figure 6. Level 1 Display

In this level 1 menu display, there are 10 missions that must be completed by students. At level 1, students will string together a series of logic gates according to the questions already provided. Before stringing, students must pass through the labyrinth that has been provided. In the maze, there are also materials for stringing together a series of logic gates. After the student has picked up the materials and successfully passed through the labyrinth provided, on the left it will automatically form a series of logic gate materials that can be obtained when passing through the maze. Then students are also asked to input logic. On the button or option box used to input a logic containing the numbers 0 and 1, later the choice can be replaced by pressing the button or option box that has been presented.

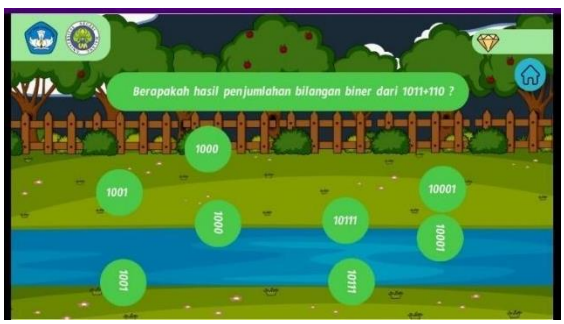

Figure 7. Level 2 View of Mission 1-5

On this Level 2 page, there are 10 game missions that students must complete. In missions 1 to 5 students are asked to choose the correct answer according to the questions that have been provided. Students will be presented with several answer choices by clicking 2 times on the answer choices.

Figure 8. Level 2 View of Missions 6-10

On missions 6 to 10 students are told to choose one of the answers that are considered correct and in accordance with the question, in a way that students must enter the answer choices that are considered correct into the box that is below the answer choices.

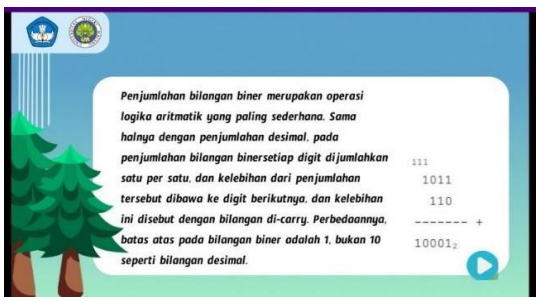

Figure 9. Review View

In this review display contains an explanation of material that has been done or that has successfully passed the game in the previous mission.

3.2. Presentation of Data

The presentation of the data was obtained from the results of validation by material experts, media experts and user trials by class XI students of TKJ SMK Negeri 10 Malang. The validation results are obtained through the distribution of questionnaires to determine the feasibility of educational *game-based* learning media products that have been developed.

Validation of the material is carried out by the teacher on the subject of Computer Systems. Material validation is carried out to find out the validity of the material presented on the product that has been made. Material validation is carried out through questionnaires with several aspects of assessment, namely aspects of content quality, aspects of learning objectives, aspects of feedback and adaptation, aspects of motivation, aspects of ease of access, and aspects of ease of reuse. Here is Table 4, the result of material validation.

Table 4. Material Expert Validation Data

No	Aspects	Tse	Tsh	V%
1	Content Quality	18	20	90.00%
2	Learning Quality Alignment	19	20	95.00%
3	Feedback and Adaptation	6	8	75.00%
4	Motivation	20	20	100.00%
5	Accessibility	7	8	87.50%
6	Reusability	8	8	100.00%
Average		91.25%		

The data from the validation of material experts can be seen that the percentage that gets a less than optimal value is the *Feedback and Adaptation* aspect, which is 75.00%. In this aspect, getting a percentage value is less than optimal because the media developed is still lacking in providing feedback and adaptation of learning objects to the characteristics of learning participants is one way to streamline learning [13]. From this, revisions were made, namely suitability in the use of colors, letters, and images. The percentage value of each aspect if averaged then the overall result is 91.25%. Based on [11], with the validation criteria, the percentage analysis obtained from material experts falls into the category of valid and suitable for use in learning activities. Apart from the percentage results, suggestions and comments are also given to improve the product.

Based on the results of validation carried out by material experts, there are several comments and suggestions given to improve the material on the product being developed. The following are the results of comments and suggestions from material experts presented in Table 5.

Table 5. Product Revisions from Material Expert Validation Results

No	Revision
1	In the *review* section, the material at level 1 has presented the material with the addition of images of a series of logic gates
2	In the material review section at level 2 in the material section the subtraction of hexadecimal numbers has presented the material with the addition of an elaboration of the included hexadecimal number system

Media validation is carried out by someone who has expertise in the field of digital teaching material media. Media validation is carried out to find out the validity of the media presented on the product that has been made. Media validation is carried out through questionnaires with several aspects of assessment, namely aspects of presentation design, and aspects of

interaction of use. Here is a table of media validation results. Data on validation results by media experts are presented in Table 6.

Table 6. Media Expert Validation

No	Aspects	Tse	Tsh	V%
1	Presentation Design	32	36	88.89%
2	Instruction Usability	22	24	91.67%
Average		90.28%		

The aspect of media validation assessment with a high percentage was obtained in the aspect of usage interaction with a value of 91.67%. Usage interactions focus on the ease of use of the application. One of the important points for designing a good media is that learning media must be easy to use for ordinary use, not to mention media that should be easy but make it more difficult for users in appearance and other effectiveness of use [14]. Meanwhile, the aspect of media validation assessment with a percentage that is not optimal is in the presentation design aspect with a validity value of 88.89%.

After expert validation of the material and media, next is the user trial. User trials are carried out in two stages, namely small group trials and large group trials. The small group trial was carried out on 10 students from class XI of TKJ 4, and the large group trial was carried out on 30 students from class XI of TKJ 3 who had taken KD 3. 2 &4. 2 to KD 3. 3 &4. 3 on the subject of Computer Systems. The results of the small group trial results data can be seen in Table 7.

Table 7. Media Trial Results

Aspects	Percentage of Validity	
	Small Group	Large Group
Content Quality	80%	85%
Learning Quality Alignment	85.83%	87.22%
Feedback and Adaptation	85%	87.50%
Motivation	83.75%	83.33%
Presentation Design	83.75%	90%
Instruction Usability	82.50%	81.67%
Accessibility	82.50%	90.83%
Reusability	83.75%	87.92%
Average	83.39%	86.68%

A small group trial was conducted at XI TKJ SMKN 10 Malang on 10 trial respondents. The purpose of a product trial is to find out the responses of students to the product before it is tested on a large group subject. The product trial was carried out on August 04, 2022 offline. Tsaw in the small group that obtained the highest results in the aspect of learning objectives with a score of 85.83%. Aspects of learning objectives get the highest scores because the learning media used are able to attract students to learn and help students to understand the material, besides that it can also help students in learning independently. So that the use of this game-based media can attract students' interest in learning.

Meanwhile, the percentage is not optimal in terms of content quality with a value of 80%. The lack of validity value obtained in the aspect of content quality is because the learning style in each student has a different type of understanding. Each student has the ability to learn both with a visual, auditorial and kinestic style, but there is still one learning style that makes it characteristic in each student in his learning [12]. Overal the average percentage results of small group trials were 83.39%. Referencing the percentage eligibility criteria according to [11] indicates that the product is suitable for use in learning activities.

Large group trials were conducted on 30 subjects from class XI TKJ students. This test is carried out to measure the feasibility of products that have already been made. The trial of product inspection in large groups was carried out on August 11, 2022 offline.

The highest percentage in large groups is in the aspect of ease of access, which is 90.83%. The ease of access aspect obtains the highest validity value because the media is easily accessible through android-based smartphones. So that the use of this media can make it easier for students to learn.

Meanwhile, the percentage has not been optimally obtained in the aspect of usage interaction with a value of 81.67%. The thing that affects the lack of validityvalue obtained in the aspect of usage interaction is due to the difficulty in using menus in this educational game-based media. Overal the average percentage result of large group trials was 86.68%. Referring to that the percentage eligibility criteria according to [11] indicates that educational game-based learning media is suitable for use in learning activities.

3.3. Student Learning Motivation Outcomes

The measurement of student learning motivation in this research and development was carried out on 30 students from class XI TKJ 4 who had taken KD 3. 2 &4. 2 to KD 3. 3 &4. 3 on the subject of Computer Systems. In measuring student learning motivation, this is done using a questionnaire with several aspects. Data on the results of measuring student learning interest can be seen in Table 8.

Table 8. Student Learning Motivation Outcomes Data

Learning Motivation Indicators	Learning Motivation Test Results	
	Before	After
Perseverance in learning	60.83%	88.33%
Tenacious in the face of adversity	64.72%	87.50
Interest and discernment of attention in learning	69.72%	88.89%
Excelling in learning	71.11%	87.50%
Independent in learning	61.94%	87.22%
Strong willingness to learn	61.94%	81.94%
Average	65.05%	86.90%

Based on table 8, it is known that the results before and after there is an increase. In the learning motivation trials, there were significant differences in the beginning and end of product use. In the test, there was an increase of 21.85%. So that the use of educational *game-based* media can increase motivation.

4. CONCLUSIONS

Based on the results of the analysis and discussion, conclusions can be drawn from research on the development of educational game-based learning media to increase student learning motivation in computer system subjects at SMK Malang as follows:

1. Research and development has produced products in the form of educational game-based media with application extensions that can be used on Android. This application is called SITEKOM for learning on computer systems subjects. Sitekom applications developed materials are logic gate materials and arithmetic logical operations. The design of this learning media includes material preparation, game design documents, and storyboard design. The learning media developed has a main menu, namely level 1 and level 2 menus. The level 1 menu contains about the games that must be completed by students, where at level 1 there are 10 game missions with material about logic gates. developed there is a main menu, namely the level 1 and level 2 menus. The level 2 menu contains about the games that must be completed by students, where at level 2 there are 10 game missions with material about arithmetic logical operations. SITEKOM learning media can be run on devices that have 15MB space, at least 2GB of RAM, at least run on android version 6 systems.
2. The products that have been developed have gone through a validation process and media feasibility level test. Based on the material validation value obtained results of 91.25%, media validation obtained results of 90.28%, user validation for small groups obtained results of 83.39%, and large group trial results obtained results of 86.68%. The results of the data analysis above can be concluded that educational game-based learning media is suitable for use.
3. SITEKOM media can increase motivation. Based on data analysis, it shows that before using educational game-based media, 65.05% results were obtained, and after using media, 86.90% results were obtained. There was an increase in student learning motivation by 21.85%.

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