Educational Game Development for Improving Student Learning Outcomes in Vocational High School

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ABSTRACT

This study aims to produce a learning media product Educational Game Media to improve student learning outcomes in Basic Network subjects in Vocational High School (SMK. This study uses Research and Development (R&D) research methods and then developed and tested its effectiveness using the Whole Life Cycle (SHM) multimedia development method which consists of the analysis stage, design stage, development stage, implementation stage, and assessment stage. Before moving on to the implementation stage, the Educational Game Media was tested using the ISO 9126 software testing model with testing from aspects of Functionality, maintainability, portability, and usability testing. Overall, the characteristics of ISO 9126 tested indicate that the media is suitable for use. At the assessment stage, data collection was carried out to improve the learning outcomes of 24 students by holding a pretest before the application of the media in learning and a posttest after the learning process. After analyzing the data, it was found that there was an increase in student learning outcomes from 4.17% completeness at the pretest to 70.83% completeness at the posttest. With an increase in learning outcomes, it shows that educational game media can help improve student learning outcomes.

Keywords: Educational games, ISO 9126, and learning outcomes.

1. INTRODUCTION

The revolution in science and technology, changes in society, understanding of how children learn, advances in communication media, and information technology have their own meaning in educational activities. This challenge is one of the basics of the importance of a technological approach in the management of education and learning to assist the educational process in achieving educational goals.

Games can be more interesting if they are formulated in a medium. Newbe argues that games provide two interesting environments where students must follow the previously described rules and strive to achieve challenging goals [1]. The development of games in the world has grown rapidly, this is indicated by the increasing number of game fans [2][3].

According to Cagiltay, there are several benefits of games including: can make people control emotions, train people to be sporty or not cheat, can increase brain intelligence, increase creativity, can improve reflexes, make people think fast, brain nerve reflexes work quickly, as well as other reflexes such as hand reflexes to press buttons, educational games can help eliminate boredom in learning, encourage someone to set strategies when becoming a leader, increase self-confidence, games also train the use of logic when playing a game [4][5].

It is very possible for teachers to be more creative in packaging learning materials such as Basic Networks through the use of the concept of the snake and ladder game [6][7]. The existence of snake and ladder learning media will make students more active, creative, and happy in participating in Basic Network learning [8][9][10].

Thus, using learning media, it is hoped that students will find it easier to understand the material presented by the teacher. SMK Negeri 1 Sumarorong is one of the vocational high schools in Mamasa Regency, West Sulawesi Province that has implemented the 2013 curriculum. This school has nine skill programs, one of which is the Computer and Network Engineering Expertise Program.

The learning media available in the classroom, especially the Computer and Network Engineering Expertise Program, on average already use a projector, but at the time of learning, there are still teachers who explain the material with books as the medium without using the available facilities. There are also teachers who have used PowerPoint slides and books in-class teaching.

Basic Networking subjects are basic compulsory subjects for the Computer and Network Engineering expertise program in Vocational High Schools (SMK). Basic Network Learning is divided into two, namely theory and practicum. Judging from student learning outcomes in Basic Networking subjects in the aspect of knowledge, only about 40% of students get scores above the Minimum Completeness Criteria (KKM) while 60% of students get scores less than KKM. So, it can be said that students' understanding of the material is still lacking. In addition, based on the results of interviews with teachers, it was revealed that the obstacles felt during the learning process were that the learning media used were still simple and monotonous so that learning was only limited to teacher explanations in front of the class using conventional methods which caused the learning process to be less interesting. The learning media used is deemed insufficient to convey the Basic Network material clearly to students because the characteristics of the material are abstract and difficult to understand if the visualization is not included in the media. For this reason, we need a learning media that can help visualize and deliver material more concretely and can achieve the desired competencies, namely improving learning outcomes.

Based on the description above, the game of snakes and ladders as one of the learning media is very important. This is because student learning outcomes are influenced by the learning media used by the teacher, so through the snake ladder media students will be more interested in learning because the snake ladder media concept uses the concept of learning while playing, so it is very possible that their learning outcomes will increase.

2. METHOD

The type of this research is Research and Development (R&D) research with the research method namely the development of the Whole Life Cycle (SHM) multimedia model. This is because the purpose of this research is to produce a product in the form of game media in Basic Network learning, knowing student responses to educational game media, and knowing student learning outcomes after using game media.

Multimedia development consists of five stages, namely the analysis, design, development, implementation, and assessment stages in [11]. The picture above is the research steps of educational game media from the Complete. The developed media will be tested for ISO 9126 using 4 characteristics, namely aspects of functionality, maintainability, portability, and usability [12].

Material assessment refers to the assessment based on the Learning Object Review Instrument (LORI). Material assessment includes several aspects, namely aspects of the quality of the content/material, aspects of the

alignment of learning objectives, feedback and adaptation and motivation[13].

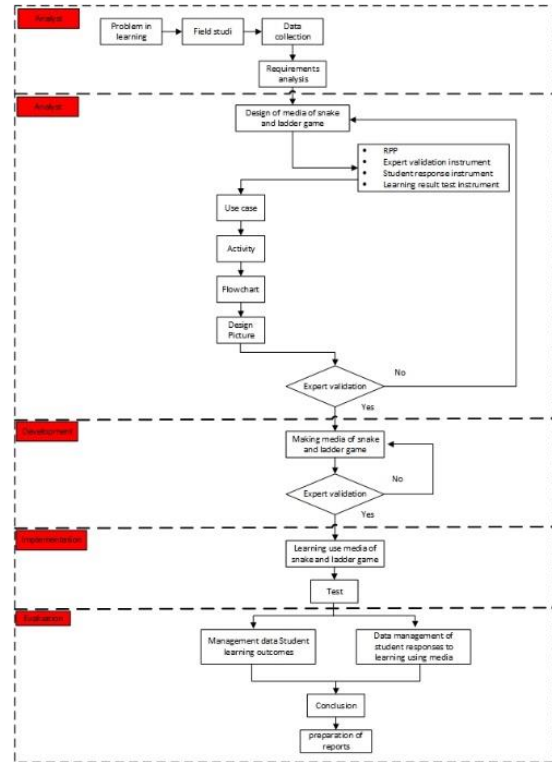The multimedia development model is described as follows:

Figure 1. Research steps for educational games media

The process and logic of a system are depicted graphically from the steps and sequences of procedures of a program commonly known as a flowchart.
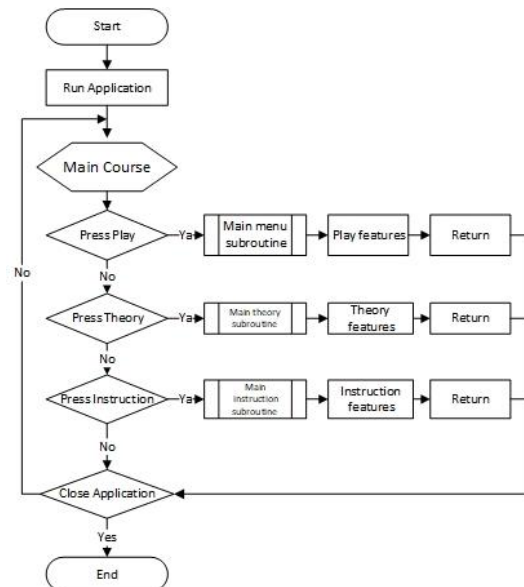

Figure 2. Flowchart educational game

3. RESULT AND DISCUSSION

3.1. Result

3.1.1. Implementation

The product implementation process is carried out by applying the media in the Basic Network learning process for SMK students. Here is the initial view of the application:

Figure 3. Main Page Interface

3.1.2. Test result

The media that was produced after going through the development stage was then tested using the ISO 9126 standard test. Tests were carried out on aspects of Functionality, maintainability, portability, and usability.

3.1.2.1. Functionality

Testing the functionality aspect was carried out using a test case questionnaire by two media experts. For every function that runs well, the examiner will put a checklist in the Yes column, but if the function does not run well, a checklist will be given in the No column in the test case. The following is the result of the calculation of the functionality test.

Table 1. Functionality Test Results

Yes	= (56/56) x 100% = 100%
No	= (0/56) x 100% = 0%

Based on the calculation results obtained a percentage of 100% of the functionality test. This value is then converted to qualitative data and based on the media product rating scale, from the percentage score obtained, the software quality in terms of Functionality has a "Very Eligible" scale and is in accordance with the functionality aspect.

3.1.2.2 Maintainability Test

The maintainability aspect testing is done by testing the software on the analyzability, changeability, and stability aspects.

Table 2. Maintainability Test Results

No	Statement	Sub-Character	Test result
1	There is a warning on the Application for identifying faults, and easy to manage, repair, and develop an application	Analyzability, Changeability	The results obtained from the test show that when there is an error, the application will issue an error warning message, for example when a program code error occurs. after the code is fixed then the application can run properly.
2	Ability Application for minimize unexpected effect from modification	*Stability*	The results obtained from the test show that the application can still run properly and there is no crash after modifications are made.

3.1.2.3. Portability Test

The portability factor test is carried out by running the application on different hardware specifications and operating systems. The result of the test.

Table 3. Result Hardware and Operating Systems Testing

No	Hardware Specification	Operating System	Application Running Process
1	- Intel® Celeron ® CPU N3060 @1.60GHz - Memori RAM 2.00 GB - Harddisk 500GB	Windows 10 Pro	Runs well without any error messages
2	- Lenovo Intel® Celeron® CPU N3160 @ 1.60GHz	Windows 7	Runs well without any error messages
3	- AsusTek Intel® Core™ i3-6006U CPU @2.00GHz - Meomori RAM 4.00 GB	Windows 10	Runs well without any error messages
4	- Laptop Acer Intel® Core (TM) i3 CPU M 370 @2.40GHz	Windows 8	Runs well without any error messages

No	Hardware Specification	Operating System	Application Running Process
	- Harddisk Laprop 500 GB - Memory RAM 4GB - Intel(R) HD Graphic		
5	- Laptop Toshiba Intel® Celeron® CPU N2830 @ 2.16GHz - Harddisk Laptop 500GB - Memory RAM 2.00GB	Windows 8.1	Runs well without any error messages
6	- Laptop Axio Intel® Celeron® CPU N335 @1.10GHz - Hard disk Laptop 500GB - Memory RAM 2.00GB	Windows 10	Runs well without any error messages

The results of the application test from the portability aspect are calculated in percentages. Percentage calculation on portability testing.

Table 4. Result Calculation on Portability Testing

No	Test	Score	Run	Fail
1	Run the application on the computer	6	6	0
	Total	**6**	**6**	**0**

Source: Data analysis Portability Test

From the results above, the percentage of assessment is:

$$Percentage = \frac{result\ score}{total\ score}\ x\ 100\%$$

$$Percentage = \frac{6}{6}\ x\ 100\% = 100\%$$

Based on the results of the above calculations, obtained a percentage of 100% of the portability test. Based on the media product rating scale from the percentage score obtained, the quality of the application in terms of portability has a "Very Good" scale and has met the portability aspect.

3.1.2.4. Usability Test

Usability testing, using a questionnaire developed by James R Lewis contains 19 questions about computer software. This questionnaire was distributed to teachers and students as respondents with a total of 24 respondents. For the analysis of usability testing using descriptive analysis with the formula:

$$Eligibility\ percentage = \frac{observed\ score}{expected\ score}\ x\ 100\%$$

Table 5. Usability Percentage of Respondents' Responses to Media

Category	Number of respondents	Percentage
Very good	20	83,33%
Good	4	16,67%
Enough	0	0%
Not enough	0	0%
Very less	0	0%
Total	**24**	**100%**

In the table above, it can be concluded that of the 24 respondents, there were 20 people, or 83.33% of respondents who responded to the system in the very good category. And there are 4 people or 16.67% of respondents who responded to the system in the good category.

3.2. Discussion

The type of research used is Research and development with a comprehensive Life Cycle (SHM) multimedia development method. The first step in developing this media is analysis. The analysis stage is focused on the following things: (1) Collecting data related to problems that arise in the implementation of Dasa Network learning, especially those relating to the use of learning media and student learning outcomes. Based on the results of interviews with teachers, it was revealed that the obstacles felt during the learning process were that the learning media used were still simple and monotonous so that learning was only limited to the teacher's explanation in front of the class using conventional methods which caused the learning process to be less interesting so that student learning outcomes decreased. This is supported by student learning outcomes in Basic Network subjects in the aspect of knowledge, only about 40% of students get scores above the Minimum Completeness Criteria (KKM) while 60% of students get scores less than KKM. The results of data analysis found an increase in student learning outcomes from 4.17% completeness in the pretest to 70.83% completeness in the post-test; (2) Determine users who can take advantage of the developed learning media. The specified users are students of class X TKJ.

4. CONCLUSIONS

Results Based on research and discussion about snakes and ladders game media, from this research it can be said that:

1. The results of this study are snakes and ladders game media to improve the learning outcomes of class X TKJ students on Basic Networking.

2. Based on the results of expert validation conducted by media experts and material experts, it is stated that this

media is very suitable to be used as a basic network learning medium.

3. From the results of the descriptive analysis of the questionnaire, the views of the students of SMK on the use of flash-based snake and ladder game learning media are in the very good category.

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