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DEVELOPMENT OF SCRATCH-BASED EDUCATION GAME TO TRAIN CRITICAL THINKING SKILLS ON HUMAN MOVEMENT SYSTEM MATERIAL

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ABSTRACT

Learning in the 21st century requires students to have critical thinking skills. However, based on the result of previous research and observations at MTs Al Uswah Bergas it is known that students' critical thinking skills are still at a low level. Scratch-based Edugame is identified as a potential learning media to train students' critical thinking abilities. This study aims to determine the validity of Scratch-based Edugame, analyze the level of students' critical thinking skills after using Scratch-based Edugame, and also determine student responses after using Scratch-based Edugame. This research follows the Research and Development (R&D) method with ADDIE model. The validation results indicate that the Edugame learning media is valid, with a Vcount of 0.91. After using the Edugame, 36.7% students achieved critical thinking skills in the high category and 63.3% students demonstrated critical thinking skills in the very high category. Furthermore, students responded positively to the Scratch-based Edugame, with an average student response rating of 89.6%. Based on the results, the Scratch-based Edugame learning media is found to be valid and effective to train students' critical thinking skills, meanwhile, the overall student response to this Edugame learning media was very good.

Keywords : education game; scratch; critical thinking skills; human movement system

INTRODUCTION

In the 21st century, learning is designed to keep up with technological developments (Syahputra, 2018). There are four abilities that must be developed in 21st century learning, including communication skills, collaboration skills, critical thinking and problem solving skills, as well as creative and innovative skills. innovation skills) (Hayati, 2020). Critical thinking ability is one of the most important abilities to be mastered by students. Alsaleh (2020) reveals that the ability to think critically is an ability in a person where he can determine something that can produce analysis, evaluation, interpretation, and inference, or an explanation using real evidence, methodologies, concepts, certain criteria. Critical thinking skills are abilities that need to be developed in science subjects. To be able to study complex material in science subjects well, students need the ability to think critically. One of the complex materials in science subjects is the human movement system material. The material for the movement system in humans is quite complex material because this material consists of basic concepts which are interconnected with each other (Analicia and Yogica, 2021). To be able to understand the material students must have the ability to analyze and synthesize concepts properly so that students get a meaningful learning process.

Although this critical thinking ability is very important, based on research

conducted by Nurkholifah and Mayasari (2018) it also shows the results that the achievement of each indicator of critical thinking ability is 50%. This is also in accordance with the results of observations made at MTs Al Uswah Bergas where it is known that the average level of students' critical thinking skills is still relatively low. However, the percentage of students' critical thinking skills cannot be known with certainty because students' critical thinking skills have never been measured and the learning evaluation tools used have not entirely used HOTS questions. Based on these problems, it can be seen that there is a need for learning media that can train the critical thinking skills of junior high school students, especially in the material of the human movement system. One of the learning media that can be used to train students' critical thinking skills in science subjects is Education Game (Edugame).

Learning using Edugame is different from conventional learning which is usually dominated by teachers. Applying learning while playing can make students more active, educative, and have a high spirit of cooperation to solve a problem so that students become enthusiastic in participating in learning activities (Aini, 2018). The use of Edugame to improve critical thinking skills is considered quite effective, this is in accordance with research that has been conducted by Supandi and Senam (2019), where students' critical thinking skills after using Edugame learning media have increased quite significantly. One of the platforms that can be used to make Edugames is Scratch.

Scratch is a programming application in which you can create interactive games, interactive stories, and animations, and you can share the work that has been made with others via the internet in the application itself (Satriana, Yusran, and Basrul, 2019). According to Chandrashekhar *et al.* (2018), Scratch is an application to introduce a programming language, because Scratch uses an easier programming language. Meanwhile, based on research results from Kusumawati (2022) scartch is considered to be an effective learning medium to improve student learning outcomes. Therefore, it is necessary to develop a Scratch-based Edugame that can train junior high school students' critical thinking skills, especially in the subject of human movement systems. This study aims to test the validity of the Scratch-based Edugame learning media that has been developed, to analyze students' critical thinking skills after using Scratch-based Edugame, and to determine student responses after using Scratch-based Edugame.

METHOD

The method used in this study is the Research and Development (RnD) method. The RnD research method is a research method used to produce certain products and to perfect a product in accordance with the references and criteria of the product being made so as to produce a new product through various stages and validation or testing (Khoerniawan *et al.*, 2018). The procedure used in this research and evaluation. The flow of the research design to be carried out is shown in figure 1.

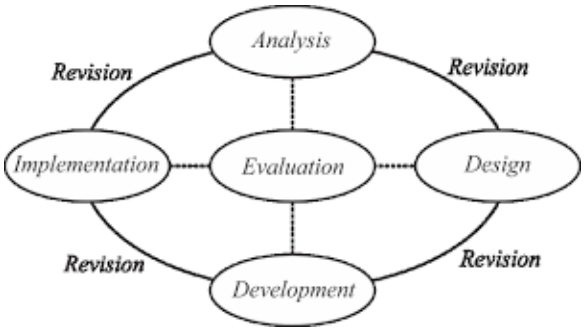

Figure 1. Research Design Flow

After the Edugame development was carried out, the results were obtained in the form of Scratch-based Edugame learning media which were ready to be tested and ready to be used. The results of Edugame development can be seen in Figures 2 and 3.

Figure 2. Result of the Development Scratch-based Edugame

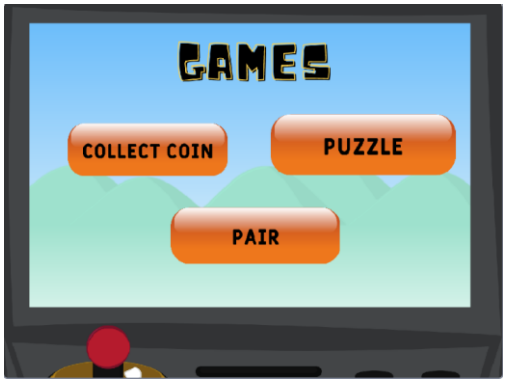

Figure 3. Option Game in Scratch-based Edugame

Subjects in this study were divided into two groups, namely subjects for product trials and subjects for product implementation. The subjects for the trial at the development stage of this Edugame learning media were class IX A students of MTs Al Uswah Bergas, totaling 31 people, while the subjects for the implementation stage of the Edugame learning media were class VIII B students of MTs Al Uswah Bergas, totaling 30 people. As for the Edugame learning media validator, it consists of 5 experts.

To find out students' critical thinking skills after using Edugame, the subject for product implementation is given 15 multiple choice questions about the human movement system which in these questions contain aspects of critical thinking. Meanwhile, to find out student responses to edugame learning media, the subjects for product trials were given a questionnaire containing 10 statement.

RESULT AND DISCUSSION

The Validity of Scratch-Based Edugame Learning Media on Human Movement System Material

Data on the validity of Edugame learning media was obtained through the results of validation by media and material experts at the development stage. Edugame was validated by 5 media and material experts, consisting of 2 Integrated Science lecturers at FMIPA UNNES and 3 science subject teachers. The result of the validation of media and material experts were then analyzed using the Aiken's V formula. If the calculation results obtained $V_{count} \geq V_{table}$, then the Edugame learning media can be declared valid. Whereas if the results of $V_{count} \leq V_{table}$ then the Edugame learning media is declared invalid because this Edugame learning media is validated by 5 experts with 4 score levels, so that the value of V_{table} can be known based on the test the value of Aiken's V is 0.87. So to be declared valid, the results of validity calculations must be greater than or equal to 0.87.

Meanwhile, the results of the validation analysis of Edugame learning media by media and material experts can be seen in table 1. Based on table 1 it can be

seen that the V_{table} obtained on all indicators is 0.87 so that Edugame learning media can be declared valid on all indicators. Meanwhile, the average V_{count} obtained is 0.91, so it can be seen that the average $V_{count} \geq V_{table}$, therefore the Edugame learning media can be said to be valid to be used as a middle school science learning media. The validation results of Edugame learning media show that the media is valid to use because the learning media developed has met the specified criteria. As for the validation of Edugame learning media, there are suggestions from media and material experts, so that after validating the Edugame learning media a revision is made based on suggestions from media and material experts.

Table 1. Results of Edugame Learning Media Validation

No.	Aspect	Indicator	V Count
1.	Material aspect	Accuracy with basic competence	0.93
		Accuracy with learning indicators	0.93
		The material in the media is in accordance with facts, principles and concepts	0.87
		Compatibility with aspects of critical thinking skills	0.87
		There is a complete bibliography on the media	0.87
2.	Media Aspect	Can be used repeatedly	1
		Completeness of learning media with a guidebook	0.93
		Media contains aspects that must be owned by an educational game	0.93
		Compatibility with needs	0.87
		Legibility of writing with the appropriate font type and size	0.93
		Interesting and practical media	0.87
		The media is easy to use and simple to operate	0.87
		Use the right language	1
	Average		**0.91**

Level of Students' Critical Thinking Ability After Using Edugame Learning Media

Measuring the level of students' critical thinking skills is carried out at the implementation stage. The level of students' critical thinking skills was measured using the problem instrument. The questions consist of 15 multiple choice questions, which have been validated and tested before. Recapitulation of student scores can be seen in Figure 4.

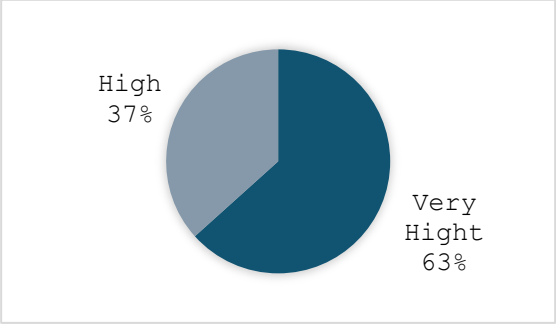

Figure 4. Recapitulation of Student Scores

Based on the results of the recapitulation of student scores in Figure 2, it can be seen that there are 2 categories of critical thinking skills obtained by students, namely students with high critical thinking skills and students with very high critical thinking skills. The percentage of students who have high critical thinking skills is 36.7%. Meanwhile, students who have very high critical thinking skills reach 63.3%. From the results of the students' work on the questions that have been obtained, an analysis of the percentage of achievement of students' critical thinking skills for each indicator is also carried out. Meanwhile, the results of the analysis of the percentage of critical thinking skills for each indicator can be seen in table 2 below.

Table 2.Critical Thinking Skills Analysis

No.	Aspect	Indicator	Average
1.	Give a simple explanation	- Ask and answer clarifying questions and challenge questions - Focusing questions	84%
2.	Build basic skills	- Consider the sources used - Observe and observe reports	93.33%
3.	Conclude	Induce and consider from the results of induction	80.7%
4.	Provide further explanation	Identify assumptions	83.33%
5.	Mengatur strategi dan taktik	Set strategy and tactics	86.7%
	Average		**86%**

Based on the analysis of critical thinking skills in table 4.2, all aspects get very good criteria. In the first aspect, namely providing a simple explanation, the selected indicators are asking and answering clarifying questions and challenge questions and focusing questions, on this aspect the results are 84%. The second aspect is building basic skills, the selected indicators are considering the sources used and observing and observing reports, in this aspect the results are 93.33%. The third aspect is concluding and the selected indicators are inducing and considering the results of the induction, in this aspect the results are 80.7%. Then, the fourth aspect is to provide further explanation and the indicators chosen are to identify assumptions, the results obtained in this aspect are 83.33%. The fifth aspect is setting strategies and tactics, the selected indicators are determining an action, the results obtained are 86.7%. From the percentage of achievement of each indicator of critical thinking ability, it can be seen that the average percentage of achievement of critical thinking ability obtained is 86.5%. This achievement was obtained because the students had used the Edugame learning media in which the Edugame learning media contained aspects of critical thinking skills.

Student Responses to Edugame Learning Media

Student responses are used as a

reference for evaluating Edugame learning media. Student responses are known based on the results of filling out student response questionnaires. Student response questionnaires were filled out by students after testing the Edugame learning media at the development stage. This trial was carried out after the Edugame learning media was declared valid by media and material experts. The trial was conducted on 31 class IXA MTs Al Uswah Bergas students. Meanwhile, the aspects assessed by students in the student response questionnaire include two aspects, namely media and material aspects.

Based on the results of this student response questionnaire analysis, it can be seen that there were 6 students giving good responses and 25 students giving very good responses. Besides that, it is also known that the average student response obtained reached 89.6% and entered into very good criteria, so that Edugame learning media can be used without revision. The recapitulation of student response questionnaire results can be seen in Fig. 5.

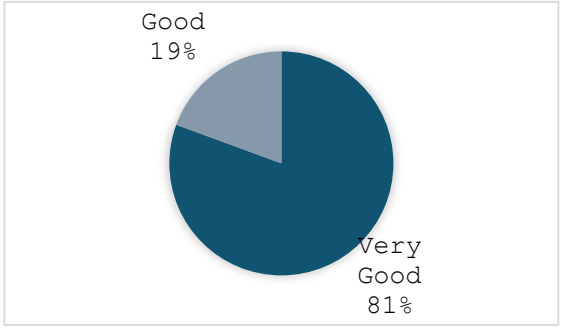

Figure 5. Recapitulation of Student Response Questionnaire Results

Based on the student response questionnaire that has been obtained, an analysis of the achievement of each student response indicator is also carried out. Meanwhile, the results of the analysis of the achievement of each student response questionnaire indicator can be seen in table 3.

Table 3. Analysis of the Achievement of Each Indicator in the Student Response Questionnaire

No.	Indicator	Results (%)
1.	Edugame learning media can help me to practice answering questions on the human movement system material	86.29
2.	Edugame learning media made me understand the human movement system material	86.29
3.	The design of Edugame learning media is interesting	87.9
4.	The images and image sizes contained in the Edugame learning media are compatible	90.32
5.	The color combination in Edugame media is harmonious	92.74
6.	The material contained in the Edugame learning media is easy to understand	88.71
7.	Edugame learning media can be used as an interactive learning media	87.1

8.	Edugame learning media attracts my interest in learning	90.32
9.	Edugame learning media is easy to use	95.16
10.	The language used in Edugame media is easy to understand	91.13
	Average	**89.60**

Meanwhile, from the data in table 3 it can be seen that the average percentage of educational media achievement obtained is 89.60% and is included in the very good category, so that it can be used without revision for each indicator. The achievement of each of these indicators is because the Edugame learning media is in accordance with the learning media criteria.

CONCLUSION

Based on the results of the research that has been done, it can be seen that Scratch-based Edugame learning media based on the evaluation of the Edugame validator is declared valid for use with an average □□□□□ obtained more than □□□□□. Meanwhile, students' critical thinking skills after using Scratch-based Edugame are in the high and very high categories, this is indicated by the results of the analysis of the work on the material on the human movement system. Apart from that, the student response to Edugame was very good, this is shown by the results of the student response questionnaire.

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