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“LABIRIN MATEMATIKA” A DRILLING EDUCATIONAL GAME

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Abstract

Monotonous mathematics problems drilling makes students bored. A new breakthrough in delivering the exercises is propose in this article. Educational game called "Labirin Matematika" (Maze of Mathematic) was developed as a media for practicing some material questions. This study delivers validity, practicability, and effectiveness the educational game developed. The game made using five step of ADDIE research and development models. The game tested to 10 7th class students of SMPN 1 Mojoanyar. Data collected by field note, validation sheet, and questioner's sheet. The Data is analyzed using qualitative descriptive. The game is valid due to expert validation. The average value for media is 73.43, while the material got 75. The game is practically applied due to expert judgement and student responses. It also effective since the number of students passed material test is 70%.

Keywords: Educational Game, Maze of Mathematics, Problem's Drilling Media

1. Introduction

Mathematics is a key to science since it can help student in higher education (Husain, 2016: 343). In learning mathematics student should have good ability in doing arithmetic operation. The operations consist of addition, subtraction, multiplication, and division. These operations have been studied since elementary school level.

Even so, there are still junior high school students find it difficult to operate counting operations. Suprihatiningsih stated that only 15.73% of students can master the reduction of negative integers (Suprihatiningsih, 2012: 142-147). Moreover, Noer explains that average only

10 grade VII-B of 35 student of SMP Negeri 2 Kendari pass daily test (Yanti, 2015: 57). Difficulty in operating mathematical calculation caused by various error factors.

Utami states that, the mistakes experienced by students are: 1) concept errors, 2) principal errors, and 3) procedural errors (Utami, 2016: 246). In addition, Ramlah.et.al mentions three conceptual errors made by students (Ramlah, 2016: 182). First, concept errors that are errors in changing the shape of integers into fractions and errors in describing negative fractions. Second, errors in fact that do not write negative marks on the results of reductions that should be negative value and errors in writing

calculated operations. Third, principal errors that are errors determining fractions worth and allness summing or reducing integers by fractions. While procedural errors committed by students include: 1) miscalculation of counting operations, 2) errors in funding fractions, 3) incomplete procedure errors and 4) errors in doing just about any (Kusaeri, 2014: 76). Therefore, the solution is: 1) to overcome the concept errors teachers can use contextual learning with learning media, 2) to overcome the principal errors teachers can use the Osborn Parne learning model and infrastructure drilling, 3) to overcome the errors of procedures teachers can use warming up on learning absorption (Nurrahma, 2018: 1-2). Student can be improving solving problem ability by doing more. Providing students many problems in acquiring a certain skill called a drilling. Drilling helps students understand the concepts, principles, and facts of mathematics procedures indirectly. In attracting students, developing a game as a drilling form is a good choice.

Games is an arena for the decisions and actions of the players. There are certain targets and missions that the player must achieve. Games are not only played for entertainment and fun, but can also serve as a means of training, education, and simulation (Kurniawan & Lubab, 2014: 23-26). Prensky states that games that are combined with educational content are called educational games (Pribadi, 2018). In this article, an educational game will be collaborating with a maze (interconnected hallway games). The Maze can help children through challenging games, which in principle introduce the sense of adventure to train children's skills in facing a variety of obstacles. The maze will provoke students to find a way out by instructions from a question.

The game is designed for seventh grade junior high school (SMP) students since they have an interest in playing a game especially in a sense of curiosity and curiosity. The curiosity will bring students to play the game until the end. In doing so, the storyline will be very influential in creating high curiosity for students. The game is expected to reduce the difficulty of students in arithmetic operations. As well as bringing a new atmosphere and new motivation for students in learning mathematics.

2. Method

The game develops using ADDIE development model. There are five steps starting by Analysis, Design, Development, Implementation and Evaluation stages.

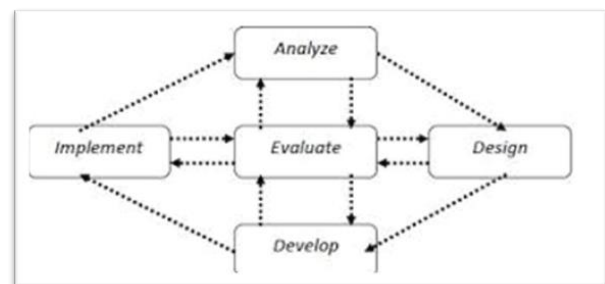


Figure 1 ADDIE Development Model

Data is collected using field note, validation, questioners, and test. The collected data was analyzed using following steps.

a. Validity

Validators fill in validation sheet. The data collected, and then analyzed using following procedures.

- i. Finding the average of criteria:
- ii. Calculating percentages validity:
- iii. Evaluate validity total score:
- iv. Determine the validity using the following table.

Table 1. Validity Categories

No.	Score	Categories
1.	$85 < RT \leq 100$	Super Valid
2.	$70 < RT \leq 85$	Valid
3.	$55 < RT \leq 70$	Quite Valid
4.	$RT \leq 55$	Not Valid

b. Practicability

i. Theoretical Practicability

The theoretical practicability is evaluated form validation sheet. It evaluates by finding the average of practicability, then match with the following table.

Table 2. Practicability Categories

Categories	\bar{N}_p	Annotations
A	$85 < \bar{N}_p \leq 100$	No Revision
B	$70 < \bar{N}_p \leq 85$	Light revision
C	$55 < \bar{N}_p \leq 70$	Hard revision
D	$\bar{N}_p \leq 55$	Not Practice

ii. Practices

Practicability is measured by student responses. The response is collected after students play the game. Collected data is evaluated by finding percentages student choosing “yes” in the responses sheet. The response is positive while SR equal or more than 70%.

c. Effectiveness

The effectiveness is measured using test result. The test is given during the game. Test result is analyzed using following procedures:

- i. Collect students score.
- ii. Student passes the test if get score equal or more than 75.
- iii. Figure up the number of students who pass the test.
- iv. Compute percentages student which passes the test

- v. Determine the effectiveness. The game is effective while students test result shows that 60% or more students pass the test.

3. Result and Discussion

According to ADDIE development model, there are five steps to perform. There are some activities during every step:

a. Analysis

In this step, researcher gather information about the needs in developing the game including curriculum, software, and games.

b. Design

This phase focus on creating a prototype. Several activities perform in this phase including made a storyboard based on analysis phase. Storyboard includes algorithm, type of the maze, game instructions, and math problems.

c. Development

Once the prototype is fix, the next stage is realizing the game. The game was created using Unity 3D. Figure 2 shows the home appearance. There are 5 buttons in this page. “play” for starting the game, “petunjuk” informs player



how to play the game, pengaturan helps player to setting up buttons, “info” provides information about the game, and “keluar” is button to exit the game.

Figure 2. Menu

Figure 3 shows the maze used in the game. In The game, a player finds the way out from the maze by several obstacle. The obstacle was designed in mathematics problem especially in number patterns. There are 20 problems provided. The problems used in the game is already tested to students to yield, easy, sufficient, and hard.

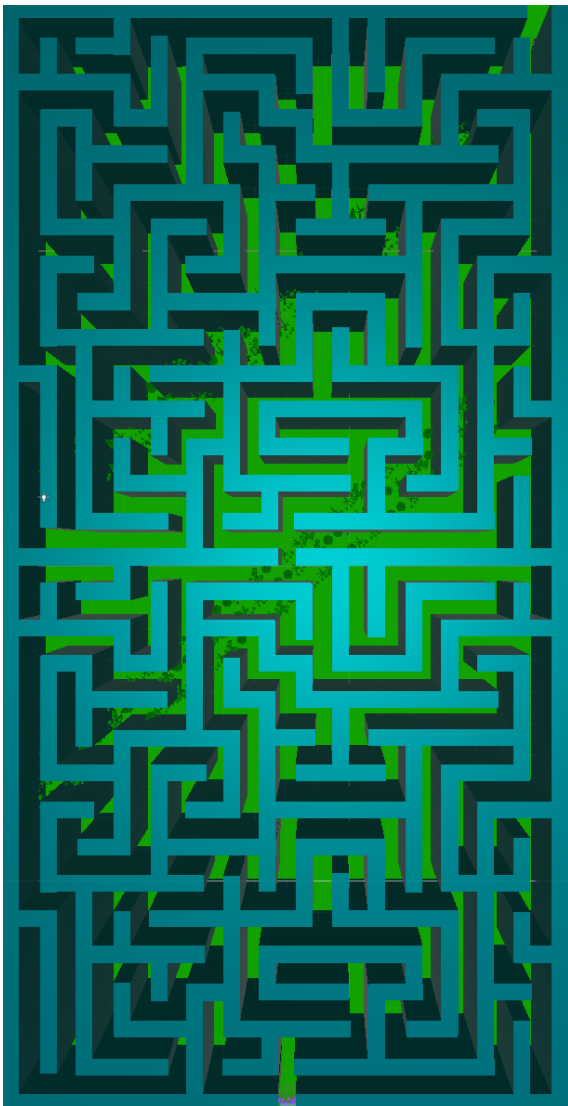


Figure 3. The Maze

Figure 4 shows how the problem appears, it come out randomly. Player will find problem in every intersection point. The problem will direct player to find the right direction in finding the way out. Every player

has 3 lives', in other words player have 3 chances to answers questions.

The games that have been successfully made are then given to the validator to be assessed and given suggestions for improvement.

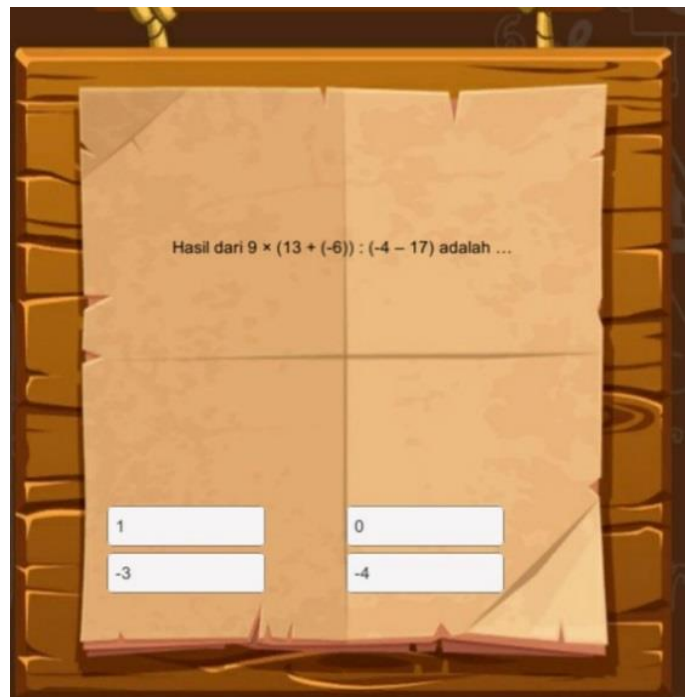


Figure 4. an Example of the Question

d. Implementation

In this phase, "Math Maze" have passed validator's assessment and have been revised based on expert advice. Before tests to student, teacher try it first. The game is tested to class VII-E SMPN 1 Mojoanyar students.

e. Evaluation

In the final stage, data collected from previous stage was analyzed to evaluate quality of the game. The analysis consists of validity, practicability, and effectiveness game.

f. Result

i. Validity

The average of every aspect, several aspects build in a criterion. The criteria consist of content qualities, Design Interface, User Interactions, and Accessibility. Content qualities consist of questions based on learning objective, composition of easy, medium, and difficult questions, every question has an answer key, good language. User interaction consists of buttons consistency, hints, attractiveness, and difficulty. Design Interface measure text and figure, background, colors, fonts type and size, music used. Accessibility ensures every button (directions, mouse, play, options, info, exit, and back) is working well.

Analysis data have been done based on validation sheet. The results are written down in the following table.

Table 3. Expert’s Media Analysis

No.	Criteria	Avg
1.	Content’s Quality	75
2.	Design Interface	75
3.	User Interactions	68,75
4.	Accessibility	75
Total Average		73,43

The table shows that the media’s average validity is 73,43. Highest validator score are on content’s quality, design interface, and accessibility. While other criteria, user interface, gain 68,75. Overall, the experts state that the game is valid.

The expert also evaluates media based on its materials. The assessment consists of contents quality, learning objective suitability, feedback, and motivation. The Following table shows the result.

Table 4. Material’s analysis

No.	Criteria	Avg
1.	Contents Quality	75

2.	Learning Objective Suitability	75
3.	Feedback	75
4.	Motivation	75
Total Average		75

ii. Practicability

Practicability analysis is based on student’s response. The response, which is consist of 25 questioners, is obtained after game trials. The questioner is yes or no question. The following table shows student’s responses.

Table 5. student’s responses

Question Number	Y		N		%SR
	F	%	F	%	
1	10	100	0	0	
2	10	100	0	0	
3	6	60	4	40	
4	8	80	2	20	
5	5	50	5	50	
6	9	90	1	10	
7	10	100	0	0	
8	8	80	2	20	
9	10	100	0	0	
10	7	70	3	30	
11	8	80	2	20	
12	10	100	0	0	
13	10	100	0	0	84,8
14	6	60	4	40	
15	8	80	2	20	
16	8	80	2	20	
17	10	100	0	0	
18	10	100	0	0	
19	10	100	0	0	
20	10	100	0	0	
21	9	90	1	10	
22	8	80	2	20	
23	4	40	6	60	
24	8	80	2	20	
25	10	100	0	0	

Based on the table, the frequency of students who choose the "Yes" or "Agree" is more than "Disagree" or "No" option. It can also be seen from the 25 question items, the average response to the "Agree" option was 84.8%, while the average student response to the "Disagree" option only 15.2%. From these results most students agree and give good respond to the game. In other words, the game is practice.

iii. Effectiveness

The following is the percentage of game completion. The completeness is seen by the results of the test.

Table 6. Students test results.

Categories	N Student	Percentages
Passed	7	70%
Failed	3	30%

The table shows that the percentage of students who passed the "Mathematical Maze" game is 70%, while the students who failed are 30%. This shows that the game is effective.

4. Conclusion

Based on the analysis of the results of the media expert's review, the results of the material expert's review and the student's response. Therefore, the following conclusions are obtained: 2) The "Mathematical Maze" game has been declared "valid" by the validator with the total average value of the validation game "Mathematical Maze" 74.54. With details of the assessment of media experts 74.07 or "valid" and material experts 75 or "valid". 3) The game "Mathematical Maze" which was developed fulfills the practical aspects theoretically with the acquisition of scores in the qualitative category B which means it can be used with a little revision. While practical practice was obtained from the results of the questionnaire responses of class

VII-E students of SMPN 1 Mojoanyar with a percentage of 84.8%. 4) The developed "Math Maze" game fulfills the effective category to be used as a media for question practice. This can be seen from the classical minimum completeness criteria which reaches 70%.

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