

Learning media for calculating perimeter of plane figures in edugame for elementary school

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Article Info

Article history:

Received March 27, 2020

Accepted May 3rd, 2020

Published May 11, 2020

Keywords:

Edugame
Elementary School
Learning
Perimeter
Plane Figures

ABSTRACT (10 PT)

Learning is an interaction process among students, teachers, and the sources in learning environment. Learning media is an integral part from the whole system and learning process, which means that the learning media is a crucial element and it determines the learning activity. As one of a learning medias, multimedia animation gives a fun impression and helps learning process in remembering. The process to calculate perimeter of plane figures for 3rd grade students in elementary school will be easier using a multimedia application that is interesting and interactive. This research aims to create a learning application to calculate the perimeter of plane figures in edugame. This edugame contains a tutorial to solve the perimeter of plane figures and some exercises with various plane figures. Through this edugame, the students can find out where the error lies when calculating the perimeter of plane figures. This application has tested using a questionnaire with 17 correspondents who are expert users. They are elementary school teachers with the average score result 2.8, which have an interval score criteria "Good". Meanwhile, the second try out did through a youtube platform which was gained 64 views and 16 comments. The users commonly left comments such as "This application is very useful".

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1. INTRODUCTION

According to UU Sisdiknas Tahun 2003 Bab 1 Pasal 1, [1] Learning is an interaction process between students, teachers, and learning sources in a study environment. Learning activities are defined as individual interactions with their environment. The environment in this case is other objects that allow individuals to gain experiences or knowledge, either new experiences or knowledge or something that has been obtained or discovered previously but it gains attention again to a person, thus it possibly could be an interaction [2].

A learning media is an integral part from the whole system and learning process, it means that the learning media is a crucial element and it defines the learning activity. Multimedia animations give fun impressions and help learning process in remembering [3]. Game that intended to educate can be used as one of the education medias that has a learning pattern called *learning by doing* [4].

Learning method that utilizes Information Technology in order to make the learning atmosphere is more interactive and fun to students and it can be an alternative to do the learning activities [5][6][7] in a written journal [8].

In a written journal [6], learning using animation E-Learning can be a learning tool to teach using electronic applications, media, Internet, Intranet or other computer network medias. In addition, computers and Internet networks which play a role in e-learning is the brainware that is creating content (text, images, video, animation) and user/users of e-learning (teachers and students). It should be noted in making animated e-learning, that the content should be included in accordance with the curriculum that is used by the school to be used for teaching and learning in schools. In a written journal [8], Interactive learning media is the media which is more effective so that the user can feel that practical learning is more fun and can stimulate users desire of learning. The pattern is the process of recognizing an object based on data that already exists to distinguish various patterns with different size and geometry of each pattern is obtained.

Calculations on plane figures are part of elementary school students' mathematical theory for 3rd grade. One of the things that students in 3rd grade of elementary school learns is to find out the perimeter of plane figures. Plane figures have some various forms, therefore the students often have trouble in completion process and accuracy to calculate the perimeter of plane figures.

Based on the description above, this study will be made to calculate the perimeter of several plane figures for 3rd grade of elementary school students. This application has created in a form of edugame, therefore the students can study while playing in interactive way. This edugame contains a tutorial to solve the perimeter of plane figures and some exercises with various plane figures. Through this edugame students can find out where the error lies that is formed in confirmations, only if the students are not careful in calculating the perimeter of plane figures. Through this edugame, it is hoped that the students are not bored and they will be motivated to solve the problem of calculating plane figures' perimeter.

2. RESEARCH METHOD

2.1. Steps to Build a System

Steps to build *Edugame*: Calculating the Perimeter of Plane Figures, as figured in Fig 1.

- a. In Fig 1, it starts with understanding the learning problem that has been faced by Elementary School students, especially on 3rd grade, to calculate the perimeter of plane figures. The problem that has been faced by Elementary School students is how the image visualization is to calculate the perimeter of plane figures that previously in the book then to be adapted in another media that is computer, as an *edugame*. With *edugame*, it is expected that students will not be bored, but they will be motivated to get to know how to calculate the perimeter of plane figures, through various forms with provided scores.
- b. The next development step is designing non-functional needs that needed by the system; for hardware and software. The software supporter is a *sound*, it is needed so the *edugame* feels more motivated to users or students. The sound configuration according to Sungkono (1999) in article [9], music is a sound harmonization that has a meaning and high artistic value. *Sound effect* that usually abbreviated as (FX) is an imitation or real sound that shows imagination energy and experience about the situation that is currently shown [10].
- c. If the designing of functional needs and non-functional have done, then the next step is implementation, in the form of coding and testing the system.
- d. After the testing has done, there is a re-evaluation. If the evaluation result is fulfilled as the design, then the system development is finished. But, if the result is opposite and the test still has a lot of mistakes, then there should be a repairment.

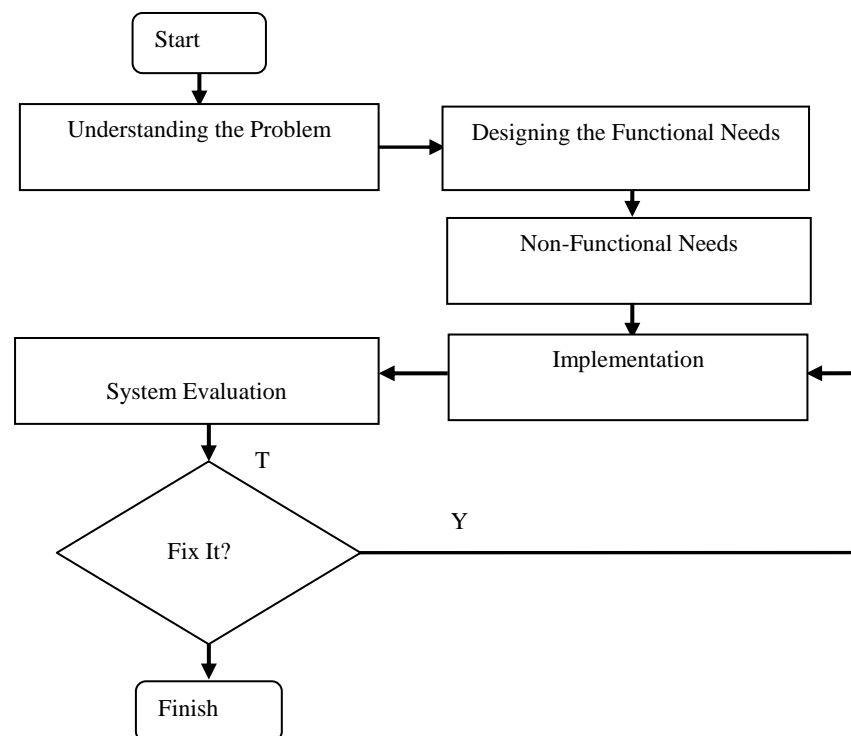


Fig 1. Steps to Build *Edugame* System by Calculating the Perimeter of Plane Figures

2.2. The Working Principle of System

Perimeter of plane figures is the sum of the lengths of its bounding sides. Fig 2 explains the concept of plane figure's formula [11]:

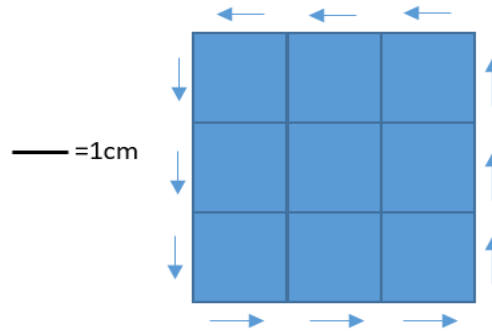


Fig.2 Concept to Calculate the Perimeter of Plane Figures

The formula of square's perimeter $K = side + side + side + side \dots$ [11].
 $1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 = 12 \text{cm}$.

The plane figure's perimeter result on Fig. 2 is 12 cm.

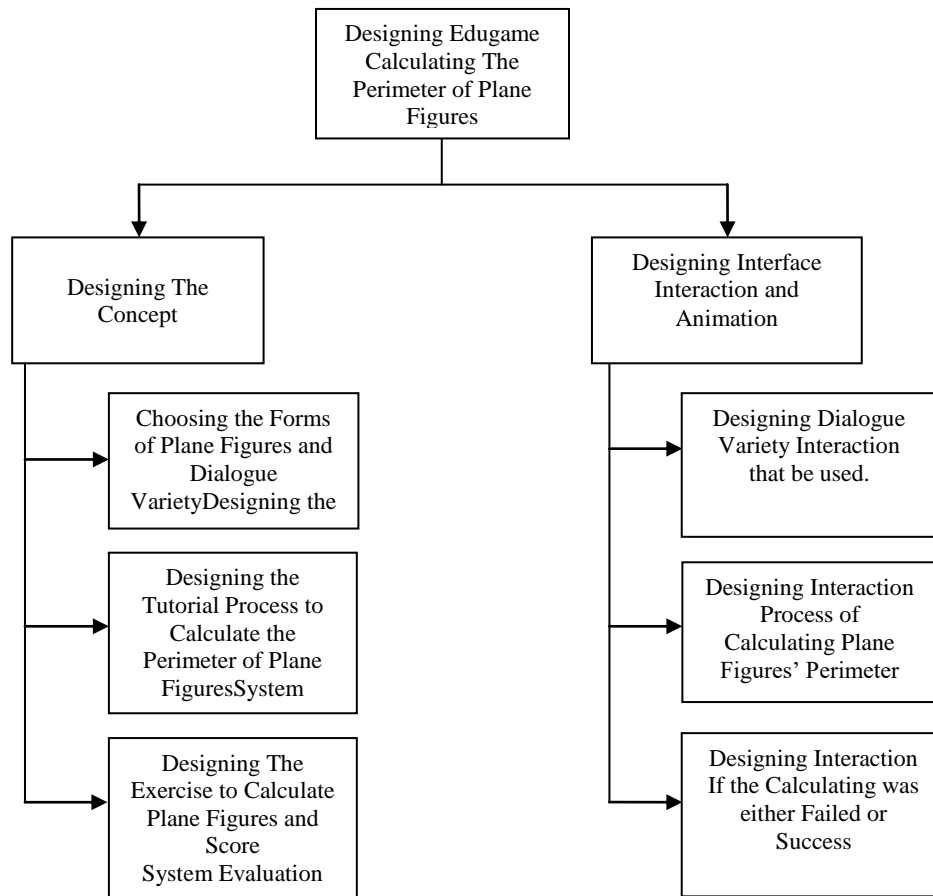


Fig 3. System Design Steps to Calculate the Perimeter of Plane Figures

Fig 3 explains the designing steps on calculating the perimeter of plane figures. Starts from 2 (two) main designs; Concept Design and Interface Interaction and Animation Design.

In the Concept Design, there are some designs:

- a. Choose the Forms of Plane Figures and Dialogue Variety/ *Interaction Style*, those are dialogues between computer and user[12]. Some of the dialogue varieties that used are *WIMP* (Windows,

Icons, Menus, Pointers), *Interface*, *sound* (as backsound and character's voice), and *point and click*.

- b. Designing a Tutorial of Plane Figures Perimeter's Calculating Process. Tutorial in visualization presented suitably as the tutorial from Elementary School's book, that is "Tema 7 for 4th grades" book [11].
- c. Designing the exercise to give a training to students in order to finish calculating the perimeter of plane figures. The exercise designed as *edugame*. If students could finish the exercise correctly, then the students will get scores as how it determined.

Meanwhile, in the Interface Interaction and Animation Design, there are some designs:

- a. Designing interaction of dialogue variety that is used. The dialogue variety that has been selected then designed to interact between systems and users.
- b. Designing interaction process to calculate the perimeter of plane figures. It is because the application is an *edugame*, so if there was a fault during the calculating process, there will be a reaction from system with some confirmations and information so the users or students can find out where the error is.

3. RESULTS AND ANALYSIS

The result from calculating perimeter of plane figures system can be seen on Fig. 4 (a) and (b), Fig. 5, and Fig. 6 (a) and (b).

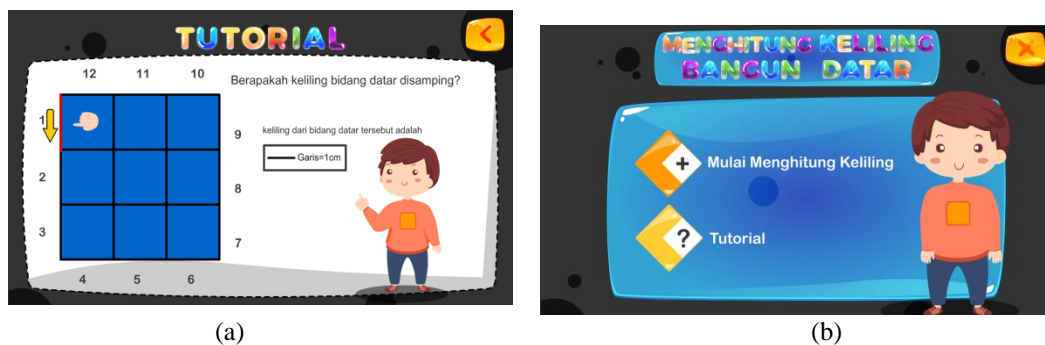


Fig 4. The opening view from system (a) and (b) Tutorial on how to calculate the Perimeter of Plane Figures.

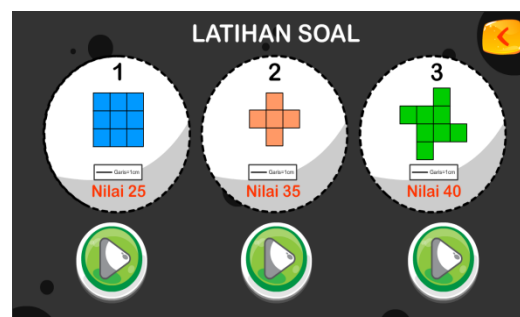


Fig 5. Exercise on various forms of plane figures with scores.

On Fig 4 there is 2 (two) menu options; *Mulai Menghitung Keliling* and the tutorial. If the users or students still do not understand on how to calculate perimeter of plane figures, they can choose the tutorial menu. But, if the users or students already understand on how to calculating perimeter of plane figures, then the users of students can choose the menu *Mulai Menghitung Keliling*. On Fig 5 is exercise on various forms of plane figures with scores. Scores based on unique plane figures, if it is very unique then the score is high.



Fig 6. Completing Process to Calculate the Perimeter of Plane Figures (a) and (b)

Fig 6 (a) and (b) explain the completing process to calculate the perimeter of plane figures. On that process, users or students pointed to the lines that formed as perimeter of plane figures. If the users or students mistakenly choose the wrong lines, then the system will give a *ringtone* signal wrong and the wrong lines' color that previously pointed will change to red, with a confirmation message as showed on Fig 7.



Fig 7. The view if there is an error and the confirmation message

During the process of calculating perimeter of plane figures, if there is an error as showed on Fig 7, the the users or students will be asked to repeat the calculation by pressing the Repeat symbol button. But, if the users or students do not want to calculate again, then they can press the left arrow button back to the main menu.

4.1. Functional Test

Table 1 is the result of functional Test to Main Menu and Exercise Form. The result of Functional Test is to Main Menu and Exercises on Table 1, all of the buttons on user interface menu's view are functioning as expected, so the Functional Test is in Tutorial Form on Table 2.

Table 1. Functionality Test on Main Menu and Exercise Form

Functional Test on Main Menu				
Number	Function	Expected Results	Test	Information
1	Button Starts to Calculate Perimeter	Lead to Exercise Form	Lead to Exercise Form	Valid
2	Button Tutorial	Lead to Tutorial Form	Lead to Tutorial Form	Valid
3	Button Close	Exit from Application and Show Confirmation Form	Exit from Application and Show Confirmation Form	Valid

Functional Test on Exercise Form				
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Number	Function	Expected Results	Test	Information
1	1 st Arrow Button	Leads to 1 st Exercise Form	Leads to 1 st Exercise Form	Valid
	2 nd Arrow Button	Leads to 1 st Exercise Form	Leads to 1 st Exercise Form	Valid
	3 rd Arrow Button	Leads to 1 st Exercise Form	Leads to 1 st Exercise Form	Valid
2	Exercise 1,2 and 3	Users' action with perimeter lines on exercise interact with each other. If there is an error during the calculating, then it shows an error confirmation and the wrong perimeter lines will change into red along with the wrong tone.	Users' action with perimeter lines on exercise interact with each other. If there is an error during the calculating, then it shows an error confirmation and the wrong perimeter lines will change into red along with the wrong tone.	Valid
		b. Undo Button to re-calculate.	b. Undo Button to re-calculate.	Valid
		c. Arrow Button Left to go back to Main Menu.	c. Arrow Button Left to go back to Main Menu.	Valid
		d. Tick Button to confirm the obtained scores.	d. Tick Button to confirm the obtained scores.	Valid

Table 2. Functional Test on Tutorial Form

Functional Test on Tutorial Form				
Number	Function	Expected Result	Test	Information
1	Arrow	The arrow sign automatically runs to give a clue on the traversed perimeter to be calculated.	The arrow sign automatically runs to give a clue on the traversed perimeter to be calculated.	Valid
2	Process Area	Automatically filled with the score of line process of plane figures.	Automatically filled with the line process of plane figures.	Valid
3	Output Area	Automatically filled with the sum result of perimeter lines	Automatically filled with the sum result of perimeter lines	Valid

that traversed along with the score confirmation that obtained.

that traversed along with the score confirmation that obtained.

4.2. Users Test

During users test, there are 2 (two) tests for this application, through online media. There are a test that published on youtube channel and Online Questionnaire Test. Table 3 is the average results of the questionnaire responds from 10 (ten) questions. Average respondents about the application included in “Good Category”, with the average score result 2.8.

Table 3. Average Results from Questionnaire Responds Through Online Media

Respondents	Average Results from Questions									
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
1	2	2	2	3	3	3	2	3	3	3
2	3	3	3	3	3	3	3	3	3	3
3	3	2	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	3	3	3	3
5	3	2	3	3	3	3	3	3	3	3
6	3	3	3	3	2	3	3	3	3	3
7	2	3	3	2	3	2	3	3	3	2
8	3	3	3	3	3	3	3	3	3	3
9	3	3	2	2	2	2	2	3	3	3
10	3	3	3	3	3	3	3	3	3	3
11	3	2	3	3	3	3	3	3	3	3
12	3	3	3	3	3	3	3	3	3	3
13	3	3	3	3	3	3	3	3	3	3
14	3	3	3	3	3	3	3	2	3	3
15	2	1	3	2	3	2	3	2	2	2
16	1	2	3	2	2	2	1	3	2	1
17	3	2	3	3	3	3	3	3	3	3
Average Scores	2,7	2,5	2,7	2,8	2,8	2,8	2,8	2,9	2,9	2,8

On Figure 8 (a) and (b) are a graphic result from questionnaire responses based on the questions. According to the graphic result, questions about users and system are clear and can be easily understood, categorized as “Good”. So there are the questions about easy-learning and user-friendly that categorized as “Good”.

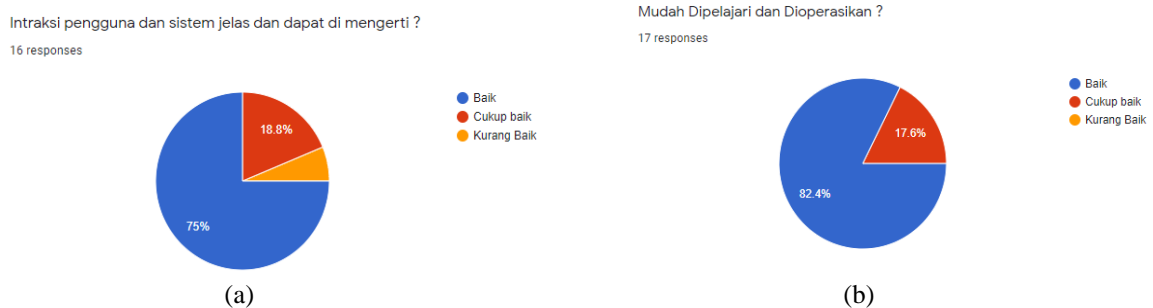
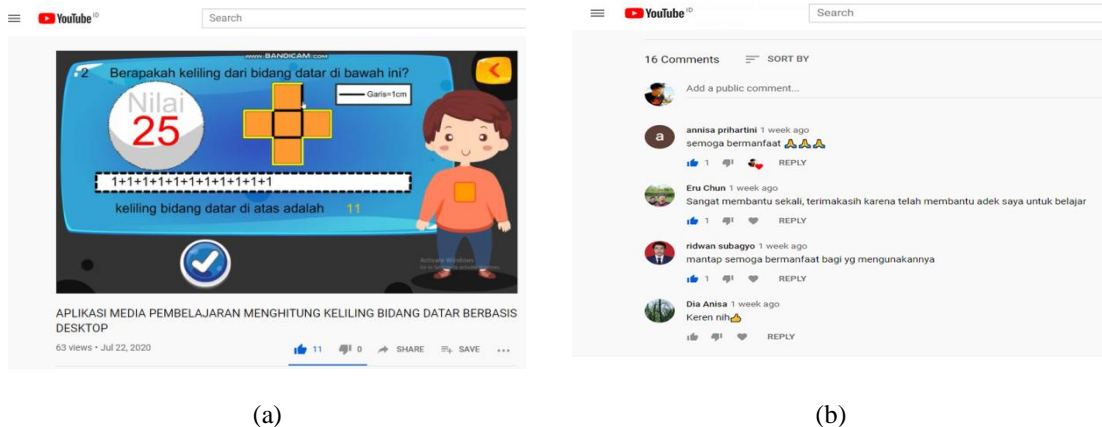


Fig 8. Graphic (a) and (b) are responds from the testing questionnaire through *online youtube publish*, as shown on Fig (a) and (b).



(a)

(b)

Fig 9. Testing through *online youtube publish*

On Figure 9 (a) and (b), there are application ratings by 63 (sixty three) viewers through youtube publish, gained average comments such as “This application is very useful”.

4. CONCLUSION

Edugame calculates the perimeter of plane figures and the students are helped to understand the calculating process visually. The given score also motivates students to get the highest score. Edugame is user-friendly which is easy to operate with the tutorial that is provided on the Main Menu.

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