

## Development of Computer-Based Learning Media Using Mind Map for Learning Mathematics in Topics of Rectangle and Triangle at Secondary School

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DOI: [doi.org/10.24071/seadr.2019.11](https://doi.org/10.24071/seadr.2019.11)

**Abstract:** Computer-based learning media in this rectangle and triangle subject matter uses mind map. Mind map is a technique for delivering information that emphasizes the relationship between one subject and another so that it can help convey rectangle and triangle material. Mind map presentation on rectangle and triangle material is more optimal if presented with a computer because it can provide animation that can generate motivation, help the effectiveness of the learning process, attract and direct the attention of students to concentrate on the content, facilitate the achievement of learning goals and most importantly help students to understand material that is rectangle and triangle. The research model used is a model of research and development adapted according to Borg and Gall. The aim of the study was to develop computer-based mathematics learning media using mind maps on rectangle and triangular subject matter for class VII SMP / MTs students who had met the requirements for validity and practicality. Large group trials were conducted in class VII2 MTsN 3 Pekanbaru with a total of 36 students. Based on data analysis and discussion it can be concluded that this computer-based mathematics learning media is very valid in terms of curriculum, learning, display and programs with validation results of 3.45. This learning media also meets practical requirements with an average student response of 3.47.

**Keywords:** Computer Based Learning Media, mind map, rectangle, triangle.

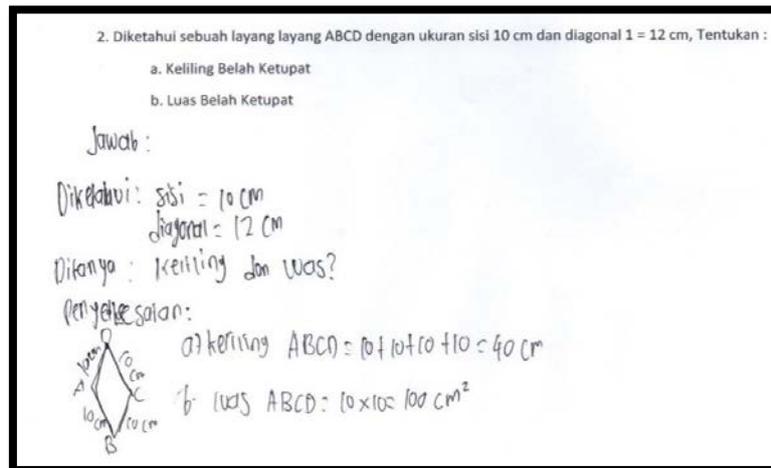
### Introduction

One form of application of technology to education is the use of computer-based learning media in learning in the classroom. The use of computers in learning can help explain concepts in a simple manner with a variety of interesting animations so that they can help students to learn independently (Siswanah, 2013). The presentation of mathematical material with an attractive appearance is expected to be able to attract students' interest in learning mathematics.

The advantages of computer-based learning media should make computer-based learning media widely used in schools, but the facts on the ground are not so. The observations conducted by researchers in three junior high schools in Pekanbaru provided information that although the facilities and infrastructure for utilizing computer-based learning media had been supportive, teachers were not yet optimally utilizing computer-based learning media. Not yet optimal, the teacher utilizes computer-based learning media because the teacher does not have time to create and design media for each material. The less optimal use of computer-based learning media indirectly results in students having difficulty in planting lesson material concepts well, because students only record material presented on the board that makes students bored and not motivated in learning which ultimately makes students less understanding the concept of learning given by the teacher.

Based on the results of interviews with students, researchers found information that in studying the rectangle flat material and triangle students had difficulty in choosing and using the broad and perimeter formula. The results of interviews with these students are in line with the information from class VII mathematics teachers who interviewed the researcher. The teacher explains, students are often wrong in choosing and using the formula on the question that asks for the width of the rectangular and triangular flat building as shown below.





**Figure 1.** One form of problem solving by students

The criteria for rectangle and triangle material are divided into various types of building, namely rectangle, square, length, trapezoid, rhombus, kite and triangle and the basic competencies requested are able to associate the circumference formula and the area between one wake and another can be helped the delivery process using mind map. Mind map is a technique for delivering information that emphasizes the relationship between one subject and another subject, with the main topic being the core associated with subtopics and branches as details (Buzan, 2007)

Some relevant studies for writing this article, namely 1) Adhistry that students' responses to the use of computer media using mind map tend to be positive (Radina, Hamid, & Yusrizal, 2016). 2) Melati that the use of mind map based learning media can increase student learning motivation (Siwi, 2010). 3) David Yoga Hardiyanto that applying mind map to learning can improve student learning achievement (Hardiyanto, 2013). 4) learning media in the form of mind maps have potency effects on student learning outcomes (Aulia, Basir, & Rusmin, 2014). 5) Students' responses in the application of the mind map learning model are very good (Tiharita & Anix, 2017).

In the rectangle and triangle material, there are various geometric shapes, namely, rectangle, square, length, trapezoid, diagonal, kite and triangle. The presentation of concepts about rectangle and triangular material can be made interesting by computer-based learning media because geometric shapes can be made moving animated images that make it easier for students to understand the nature, perimeter and area of each square and triangle. The mind map concept that emphasizes the relationship between a main idea and another main idea is also in accordance with the building material of flat rectangles and triangles. Based on this background the researchers developed computer-based learning media using mind maps on the subject matter of building a flat rectangle and triangle.

Research on the development of computer-based learning media refers to the steps of research development according to Borg & Gall (Sugiyono, 2011). The development steps are as follows.

### Research Method

The Directorate General of Primary and Secondary Education of the Ministry of National Education (2005) follows several alternatives for the Teacher Professional Development Program, as follows:

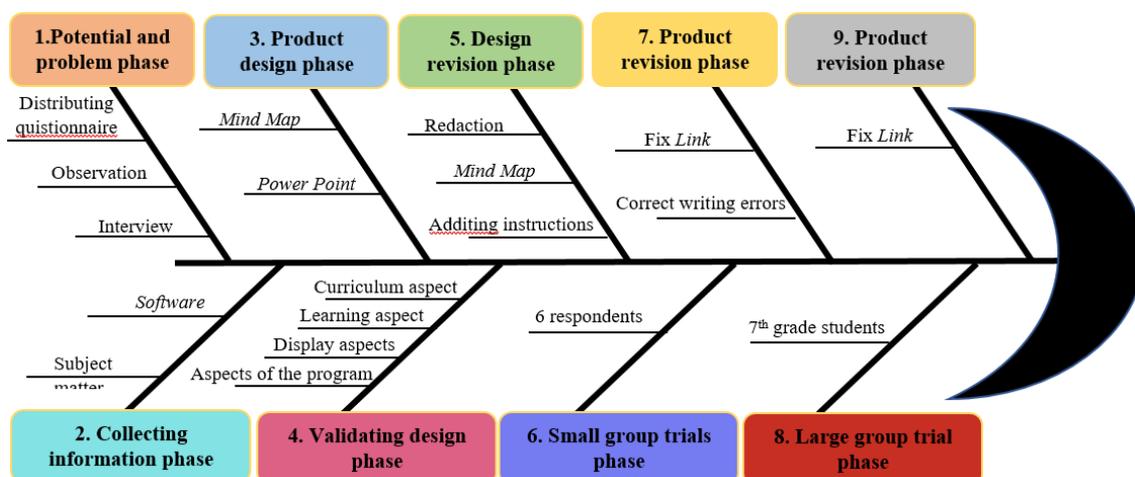


Figure 2. Stage diagram of the research

At the potential search stage and problem, questionnaires were distributed to 12 SMP / MTs in Pekanbaru to see the availability of facilities and infrastructure needed in the use of computer-based learning media, making observations on rectangle and triangle material, and interviewing teachers and students to find out the needs of teachers and students. The information obtained is then used to analyze the needs of teachers, students, materials and infrastructure.

At the information collection stage, the activities carried out are gathering information that can be used as a reference in making learning media such as rectangle and triangle material, namely: 1) Permendikbud in 2016; 2) 2013 Grade VII Curriculum mathematics textbook by the Ministry of Education and Culture; 3) Mathematics class VII KTSP textbooks by the Ministry of Education and Culture and guidebooks for making mind maps, namely; 1) Smart mind map book for children by Buzan ; 2) 1st Mind map book for students, teachers and parents by Windura The design stage is the stage of designing the product, but at this stage the design of computer-based learning media is carried out. The media format used is mind map and power point. This learning media product uses XmindPro software to create mind maps and Microsoft power points to make presentations. The activities carried out in three main stages, namely; 1) Preparation of material for each meeting; 2) Mind map design; 3) Design of rectangle and triangle material power points.

In the design validation stage, the researcher validated the product design by involving three validators who were lecturers of mathematics education. This stage is done using a validation sheet. Broadly speaking, the validation sheet is divided into four aspects, namely; 1) Curriculum aspects; 2) Learning aspects; 3) Display aspects; 4) Program aspects. The validation sheet uses a Likert scale with the answer choice criteria very suitable, appropriate, not suitable and not in accordance with the consecutive values 4,3,2,1. In addition to loading the Likert scale according to the statement, on the validation sheet there is also a suggestion column for improvement by the validator.

At the design revision stage, the researcher made improvements related to the validator's suggestions on the design of the learning media that had been designed previously. The researcher made improvements by correcting the editorial questions that mixed variables that have different units, adding a special power point to the properties of each - flat building, improving the center view of the mind map, and adding direction to the user's actions at the end of each slide.

At the small group trial stage, researchers conducted product trials with six respondents who were VII grade students of junior high school who had not studied rectangle and triangle material. This stage is done by asking students to use learning media and fill out student response questionnaires. On the student response questionnaire sheet there are 16 statements divided into five aspects of assessment, namely; 1) clarity of instructions / instructions; 2) Aspects of accuracy of information; 3) Aspects of presenting images / graphics; 4) Aspects of presentation format; 5) Benefits of learning media for students. In addition to the statement, on the student response questionnaire sheet there is also a

suggestion column containing input improvements by students on the learning media. In the product revision phase, researchers made improvements to the learning media based on the results of small group trials, namely fixing links that were not functioning properly and correcting writing errors.

The large group trial phase was carried out by involving 36 respondents who were VII2 grade students of MTsN 3 Pekanbaru. The teacher uses learning media in learning in class. Students are asked to use the learning media that the researcher developed. At the end of the trial, students were asked to fill out the student response questionnaire in accordance with their respective opinions. In large group trials, links were found that did not function correctly. In the final revision, improvements were made to all links that did not function properly.

## Discussion

At the potential and problem stage, information is obtained that in learning rectangle and triangular flat material, learning media are needed that can display animations to demonstrate the process of forming formulas around and the width of rectangles and triangles and linking formulas around and between one flat and flat other. One solution to answer this need is to use computer-based learning media that can display the animation of the formation of a rectangle and triangular flat formulas and use the mind map to help illustrate the relationship between the formula of one flat and other flat shapes. This solution is very possible to use, because most teachers and students already have personal computers and also have the ability to operate computers properly. Based on the results of the questionnaire that had been distributed by 10 researchers from 12 junior high schools / MTs in Pekanbaru, they have had computer laboratories and projectors, so they found the potential to use learning media in the classroom.

At the stage of gathering information, information about basic competencies is obtained in accordance with the 2013 curriculum (Peraturan Menteri Pendidikan dan Kebudayaan, 2016), namely KD 3.11 Linking circumference and area formulas for various types of squares (square, rectangular, diagonal, square, trapezoidal and kite) and triangles and KD 4.11 Resolves contextual problems related to area and circumference of rectangles (square, rectangle, divisions of squares, margins, trapezoidal, and kites) and triangles. Other information obtained is the rules for making mind maps (Windura, 2013), namely; 1) The mind map center must be in the form of an image reflecting the main topic, colorful with a proportional size and located in the middle; 2) Mind map branches must radiate in all directions, stick directly to the center of the mind map, have different colors; 3) Using keywords and explanations with letter sizes that are getting smaller when getting away from the center of the mind map and not using connecting letters. 4) Using as many images as possible that can strengthen keywords.

At the product design stage, material preparation is carried out for each consecutive meeting as follows; 1) Rectangle; 2) square; 3) Distance; 4) Trapezoid; 5) Rhombus; 6) Kites; 7) triangle. The mind map design can be seen in the following picture:

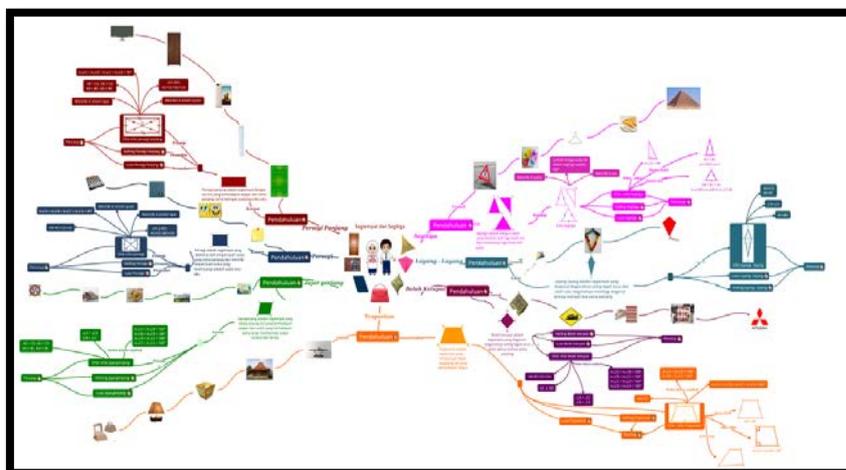


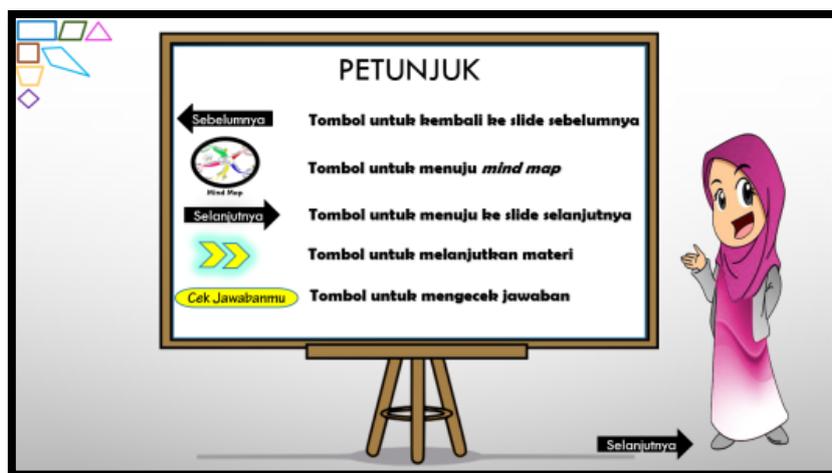
Figure 3. Mind map design

Next is the power point slide show on the learning media



**Figure 4.** Welcome Slide Show

The welcome slide contains the title of learning media, the introduction from the researcher and an interactive "start" button to start using the learning media.



**Figure 5.** Slide instructions

Instructions slides contain information about the functions of each button used on the learning media



**Figure 6.** Display of User Role Slides

On the slide selection of the user's role there is a left and right arrow board that contains a link to deliver the user according to his role: teacher or student.



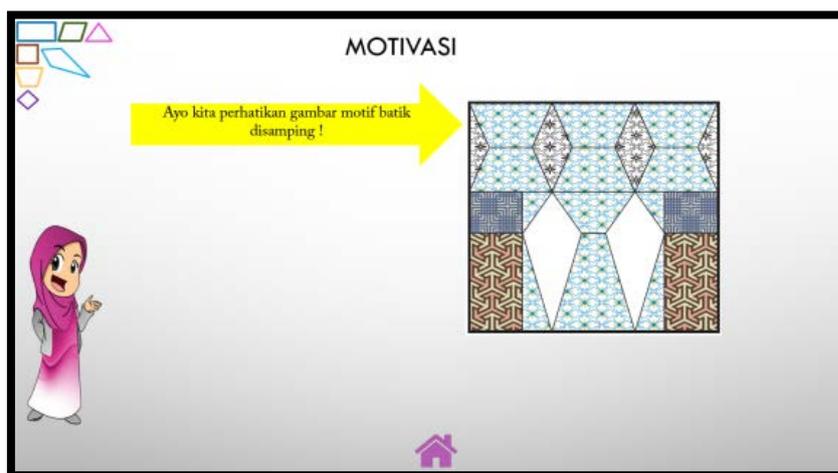
**Figure 7.** Display Slide Menu of Student Learning Media

In the slide menu of student learning media, students are asked to choose one of the available menus, which are motivational, apperception, and material menu.



**Figure 8.** Display Slide Menu Teacher Learning Media

In the slide menu of teacher learning media, the teacher is asked to choose one of the available menus, which is a motivation menu, apperception, material and basic competencies.



**Figure 9.** Display of Motivation Slides

The motivational menu on the “introductory” power point contains encouragement for students to learn to construct rectangles and triangles in general.



**Figure 10.** Display of Apperception Slide

Apperception slide serves to remind students of the material lines and angles that will relate to the material rectangles and triangles to be studied.

At the validation stage, in terms of aspects of the learning media curriculum that the researcher developed obtained a value of 3.33 which means that it falls into the very valid category because it contains basic competencies in accordance with Permendikbud number 24 of 2016, contains indicators of competency achievement in accordance with basic competencies and already contains learning objectives that are in accordance with indicators of achievement of competence.

The results of the validation for the learning aspect obtained a value of 3.47, which means that it falls into a very valid category. All validators strongly agree that the media includes clearly stated usage instructions and all validators also strongly agree that the use of media controls is with the user. The third Validator gives a suggestion to correct the evaluation problem number one on the fifth slide that mixes between variables that have units of centimeters and the size of angles.

The results of the learning media validation on the display aspect scored 3.48 which means that it was included in a very valid category. The three validators found some typing errors. The first validator provides input to replace the center mind map image, because the image that the researcher uses is less like the flat shape that the researcher intended. The third validator gives a suggestion to give a sound effect when students answer questions given by the media and replace images that do not fit the context of the question. The second validator provides advice, which is better at the end of each power point file, there are instructions that direct students to return to the mind map.

Learning media validation results in the aspects of the program get a value of 3.55, which means it is in a very valid category because the media can be operated on all types of computers and the installation process of XMind Pro software is easy, but the three validators still find link errors.

Following are the results of product design validation:

Before revision

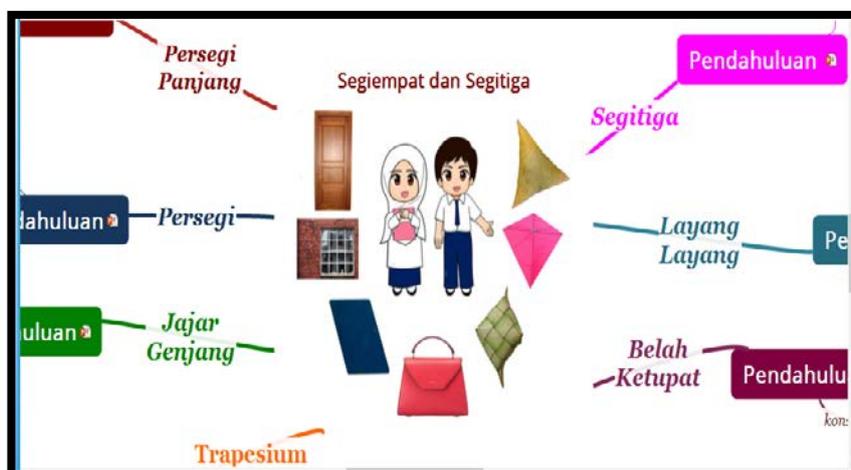
1. Andi mempunyai sebuah meja yang permukaannya berbentuk persegi panjang. Setiap sudut permukaan meja diberi nama titik P,Q,R dan S. Diketahui panjang  $PQ=180$  cm dan  $PS=150$  cm. Jika  $RS=(a+45)$  cm,  $QR=a+b$ , maka tentukanlah nilai  $a$ , dan  $b$ !

After revision

1. Andi mempunyai sebuah meja yang permukaannya berbentuk persegi panjang. Setiap sudut permukaan meja diberi nama titik P,Q,R dan S. Diketahui panjang  $PQ=180$  cm dan  $PS=150$  cm. Jika  $RS=(a+45)$  cm,  $QR=a+b+c$  dan besar  $\angle P=60^\circ$  maka tentukanlah nilai  $a$ ,  $b$  dan  $c$ !

Revision of the mind map center view

Before revision



After revision

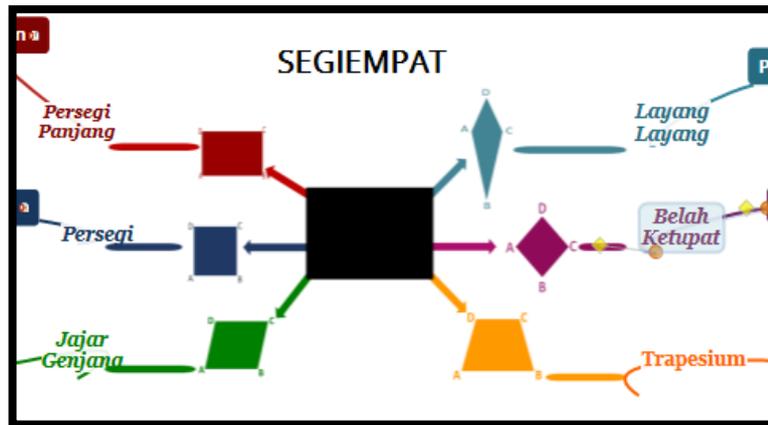


Figure 12. Revised the center of the mind map

Revision of additional user action directions at the end of each slide

Before revision



After revision



Figure 13. Revision results add user direction at the end of each slide

The practicality value of learning media in a small group trial is 3,698 which is considered very practical. But there are still link errors on computer-based learning media developed. In the product revision stage, researchers made improvements to the learning media based on the results of small-scale trials by making improvements to some inactive links and some typos.

The results of practicality in the large trial group test, which is 3.47 which is categorized as very practical. During a large group trial, a medium computer lab could not be used, so students brought their personal laptops. The limited number of students carrying personal laptops makes learning must be done in groups. This group learning makes students not free to use the learning media provided, so students do not feel learning independently. On the questionnaire sheet, students said that by using computer-based learning media, he was motivated to learn about rectangle and triangular flat material. Students' understanding regarding material and concepts is also good, marked by the fluency of students working on variations of the questions given by the teacher. However, there are still link errors on computer-based learning media developed. Finally, revisions to errors in the learning media are made.

## Conclusion

Based on the results of the study it can be concluded that this study has produced a computer-based learning media using mind map on the subject matter of a flat-form earthquake and class VII triangle of SMP / equivalent which is valid and practical. Students assess that learning media can make learning more fun and interesting because learning material is delivered in the form of illustrations accompanied by pictures and animation. With the animations in the learning media make students easily understand the learning material because students are easier to understand the material by looking at the illustrations contained in the learning media accompanied by an explanation of the verbal explanation that is often done by the teacher. The results of this study are in accordance with the results of Desi Liana and Leonard's research (2016) which states that computer-based learning media can help teachers explain rectangle and triangle concepts and calculations and can increase student motivation in the learning process of mathematics.

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