

# DEVELOPMENT OF E-KOMATIK MEDIA (MATHEMATICAL E-COMIC) WITH A CONTEXTUAL APPROACH TO THE MATERIAL OF RECTANGLES AND TRIANGLES

Ani Afifah <sup>1</sup>, Putri A.D. <sup>2</sup>  
PGRI Wiranegara University  
fifa.ani@gmail.com

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Media can help the learning process, its existence is expected to improve student understanding. This study aims to develop an E-Komatik (Mathematical E-Comic) media with a contextual approach to the material of quadrilaterals and triangles to build the understanding of the seventh grade junior high school students. The development model used by the Thiagarajan model known as the 4-D model (four-D model) was modified into a 3-D model which only reached the third stage, namely define, design stage, and develop stage, because it was adapted to the needs of learning media development. The media development process uses Inkscape for coloring and finishing comics. The subject of the trial used sampling by taking 10 students seen from the level of student ability. The results showed that E-Komatik was valid based on the validation assessment, effective based on the percentage of learning completeness and practicality from the results of implementation observations. In addition, E-Komatik can also help students' understanding based on 3 levels, namely 42% at the intraposition level, 36% at the translational level, and 22% at the extrapolation level.

Keywords: Media, Contextual Approach, Concept Understanding

## 1. INTRODUCTION

Mathematics has an important role in the development of Science and Technology . In accordance with the expression Susilo [1], mathematics is a science that have knowledge. Mathematics can also make students become human beings who have an important role and occupy a core position in the mirror of the world of science so that they can think logically, critically, rationally and confidently. Therefore, it is necessary to have a strong mastery of mathematics from an early age.

Mathematics is taught at all levels of education. According to Cornelius [2] There are five reasons it is necessary to study mathematics because mathematics is: (a) a means of thinking clear and logical, (b) the means to know the patterns of relationship and generalization of experience, (c) a means to solve problems every day , (d) a means to develop creativity, and (e) a means to increase awareness of cultural development. Mathematics subjects in grade VII Junior high school have learning about quadrilaterals and triangles. In learning to wake up quadrilaterals and triangles, visualization is needed. This visualization can be an image or a direct form of a building. The visualization is used as an example of a concrete or semi-concrete form of a shape so that the concept of the shape can be accepted by students easily.

Flat shapes are one of the materials that have been introduced since elementary school such as squares, rectangles and triangles. The material will be re-taught in class VII by adding several flat shapes such as trapezoid, parallelogram, rhombus, and kite. Appropriate curriculum in 2013 [3] that rectangles and triangular part of the materials flat and one subject of mathematics in high school students of class VII second semester. In this subject students often make mistakes, this can happen because students do not understand the concept, lack of student accuracy, and cannot visualize.



Trianto [4] states that k enyataan in the field of students simply memorize the concepts and less able to use mathematical concepts when they have real-life problems associated with the concept owned. Because teachers tend to give formulas and how to use formulas to solve existing problems. So that students do not know the meaning of the symbols they use and learning becomes unpleasant.

Sudjana and Rivai [5] media learning can improve student learning in the learning process, its presence is also expected to improve student understanding. Meanwhile, the teacher is easier to organize and give instructions to students what to do from the media they use, so that their task is not merely to convey material through words (lectures). The use of pictures and photos and graphics is one way of learning with learning media. Learning media can also improve processes and understanding through students' thinking levels. The level of human thinking follows the stages of development starting from simple thinking to complex thinking. The use of instructional media is closely related to the stage of thinking that because through the medium of learning things -things complex can be simplified. Therefore, the use of learning media in the learning process is highly recommended to improve the quality of learning.

Research by Mediawati [6] showed that the use of instructional media at this stage of the learning will greatly assist the effectiveness of the learning process and the delivery of plague early in the learning materials. On the other hand, the media is able to arouse students' motivation and interest. In addition, it can help students improve understanding, present interesting data, and make it easier to get information. From this, it is necessary to select learning media that are in accordance with the material to be taught, one of which is graphic media. Mamolo [7] says that the media graphics as a medium to communicate facts and ideas in a clear and strong through a combination of disclosure of words and images. One type of graphic media is comics. Comics can be used effectively by teachers in an effort to arouse interest, understanding, and reading skills, as well as to expand reading interest. The use of comics in teaching is combined with teaching methods, so that comics can be an effective teaching tool [8]. Therefore, comics can be used as learning media that makes it easier for teachers to learn.

There are two types of comics, namely printed comics and electronic comics (E-Comic) [9]. In general, printed comics or E-Comic are almost the same, the difference is in terms of use and marketing, if ordinary comics or printed comics are printed the same as textbooks used during learning. It's another thing with E-Comic which is used by using the application. it's another thing with E-Comic which is used by using the application. the development of digital technology that has recently emerged, thus creating a new trend in the use of the word electronic, namely by adding an "e" in line at the beginning of each word [10].

Learning activities at Junior high school 1 Winongan, Pasuruan Regency, class VII students follow the method explained by the teacher in front of the class in solving problems, when given questions related to everyday life, students have difficulty in solving these problems. The teacher introduces the concept to students using objects around the classroom as a medium of learning in understanding the concept of quadrilateral and triangle material such as blackboards, windows and other objects in the classroom. This causes less fun, challenging, motivating students during the learning process. Johnson [11] states that contextual learning and teaching engages students in important activities that help them relate academic lessons to the real-life contexts they encounter.

Seeing these problems, efforts are needed to help and facilitate students in learning independently. One way to do this is to develop E-Komatik learning media (Mathematical E-Comic) that can help and support the learning process. Solve the problem in their daily lives, abiding students need to have an concept that can be used to solve a problem that has to do with the concept owned. In understanding concepts, students are not limited to just knowing but students must be able to connect one concept to another. Bloom [12] says that concept understanding is the ability to capture meanings such as being able to express the material presented in a more understandable form, being able to provide interpretation, and being able to apply it. Therefore, it is necessary to understand the concept to solve the problems encountered in everyday life on the material of rectangles and triangles.

## 2. Method

This research is a research and development because this research develops learning tools, namely E-Komatik media to improve students' understanding. Sugiyono [13] says that the method of research and development is a research method that is used to produce a particular product, and test the effectiveness of the product. The development model that will be used in this research is using the Thiagarajan model [14] which is the 4- D model ( four D model ). The four stages are Define stage , design stage , develop stage and disseminate stage . However, this E-Komatik development research modifies the 4-D model into a 3-D model which only reaches the third stage, namely define, design, and develop , because it is adapted to the needs of learning media development.

## 3. Results and Discussion

Based on the stage of development of the model of research development is to modify the model 4-D into 3-D models Then the procedure of research and development of media E- Komatik is as follows:

### (1) Define stage

This stage aims to determine and confirm the instructional needs that are used as a reference for developing E-Komatik media . At the definition stage there are five activities to be carried out, namely:

#### a. front-end analysis

Analyzing learning problems by conducting interviews with teachers regarding the learning media used in quadrilateral and triangle teaching and learning activities. In addition, paying attention to students' understanding of the influence of student activities in learning.

#### b. learning analysis

The analysis was carried out to determine behavior during learning. This analysis is needed so that learning takes place smoothly, effectively, and efficiently. At the time of learning, the teacher explained that when students were given examples of questions, they understood and only a few had difficulty working on the questions.

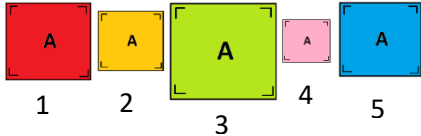
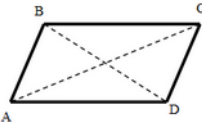
#### c. concept analysis

This concept analysis is adapted to the final preliminary analysis, which is to determine the Basic Competence and its indicators. The concepts taught are expected to be able to understand the concept of quadrilaterals and triangles based on their type, nature, circumference and area, and be able to solve problems in everyday life.

#### d. Task analysis

This task analysis aims to identify the main skills to be studied. This analysis ensures a thorough review of the assignments in the learning material. The tasks given to students are group assignments. The assignments are questions related to everyday life. Based on the results of the analysis obtained an overview of the tasks required in learn.

**Table 1. Description of Group Task**

Material	Task	Steps
Square Ratio	<p>Edo must arrange the following quadrilaterals, so that they are balanced from the largest to the smallest. Which is the correct order?</p> 	<ol style="list-style-type: none"> <li>Students read the problem</li> <li>Students are asked to sort from the largest to the smallest in an orderly manner so that they are balanced</li> <li>Students work on the answer sheet provided by the teacher</li> </ol>
Quadrilateral properties	<p>Edo saw a quadrilateral with the properties of a flat shape according to him as follows:</p> <ol style="list-style-type: none"> <li>Has two pairs of parallel sides</li> <li>Opposite angles are equal</li> <li>Right angles</li> <li>The two diagonals are the same length</li> </ol> <p>Flat shapes that have these properties are...</p>	<ol style="list-style-type: none"> <li>Students read the problem</li> <li>Students are asked to find which rectangle matches the properties that appear in the problem.</li> <li>Students work on the answer sheet provided by the teacher</li> </ol>
Angles in a quadrilateral	 <p>Edo sees a sign like a quadrilateral, Edo wants to know if the sum of the total angles is 360°, if it is known that angle B is 120°, what is the measure of angle A, angle C and angle D?</p>	<ol style="list-style-type: none"> <li>Students read the problem</li> <li>Students are asked to find which angle is appropriate by relating the properties of the quadrilateral</li> <li>Students work on the answer sheet provided by the teacher</li> </ol>

## (2) Design Stage

The purpose of this stage is to design a learning device that is developed, namely learning media in the form of E-Komatik (Mathematical E-Comic). This stage is carried out after the learning objectives are determined. In this stage, the preparation of tests and initial design of learning devices is carried out. The test in question is a learning evaluation test for quadrilateral and triangle material. The test consists of 6 descriptive questions that match the understanding indicators developed and adapted from Taxonomy Anderson and Krathwohl [15].

The developed E-Komatiks are presented in color to attract students' interest to read them. inkscape is used to develop comics [16]. The initial sketch of the comic was done on HVS paper, then from the initial sketch, the initial sketch was sharpened and colored in inkscape, after coloring, then finishing in Inkscape.

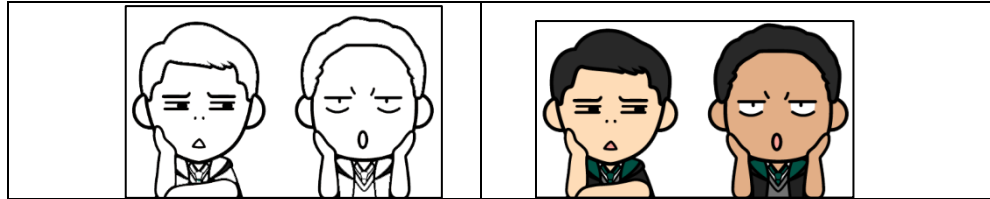


Figure 1. Coloring sketches in Inkscape



Figure 2. E-Komatik after finishing in Inkscape

The initial design of E-Komatik with a contextual approach is the design of products and instruments used during the trial. The developed E-Komatik media adjusts the basic competencies, indicators of competency achievement and learning objectives are determined. E-Komatik tells the story of 7 children who are playing together. In E-Komatik there are two series, namely series 1 which tells the hide and seek game by 5 children, the material studied is about properties, ratios, diagonals, and angles. In series 2, 7 children make kites where 5 children in series 1 are included in the story in series 2, the material studied is about the perimeter and area of rectangles and rhombuses, the Pythagorean principle.



Figure 3. Character introduction sheet on E-Komatik



Figure 4. Practice question sheets on E-Komatik

### (3) Development Stage

The development stage is to produce a revised draft of learning tools based on expert input and data obtained from trials. Activities at this stage are expert assessments and field trials. Expert assessment includes content validation which includes all learning tools and instruments that have been developed. The results of the validation of the experts are used as the basis for revising and improving learning tools and media.

Field trials were carried out to obtain direct input from the field on the learning media that had been made. In the trial activity also to determine the effectiveness and practicality of the developed E-Komatik media. In the trial, all responses, reactions, and events that occurred during the trial were recorded.

The data on the results of the effectiveness test are in the form of learning outcomes for working on questions series 1, series 2 which will be group scores and evaluation tests by students. Data analysis was carried out according to the rubric that had been developed. Students are said to have completed learning if the student's score is above the average, which is 70. After the score is obtained, the percentage of students who have achieved mastery learning will be calculated with the following formula:

$$\text{effectiveness} = \frac{\text{The sum of students who achieve complete learning}}{\text{Sum of test subjects cona}} \times 100\%$$

According to Hobri [17], the learning media is declared effective if 80% of the test subjects meet learning mastery. However, if <80% of the trial subjects meet the learning mastery, the learnig media cannot be declared effective.

The practicality of the media is measured based on the results of the assessment of teacher observations and student observations. The practicality of the model is measured based on the results of the observer's assessment to state whether or not the model can be implemented in the classroom with the components and learning tools provided. Activities carried out to analyze practicality data in the form of observations. Based on the results of data analysis, the following results were obtained:

**Table 2. Recap the results of data analysis on learning media**

Data analysis	Instrument	Results and Criteria	Information
Valid	Media	4.3 with valid criteria	Meet the set criteria
	Material	4.4 with valid criteria	Meet the set criteria
	Question series 1 and Series 2	4.5 with valid criteria	Meet the set criteria
	Evaluation Test Questions	4.1 with valid criteria	Meet the set criteria
	lesson plan	4.1 with valid criteria	Meet the set criteria
	Teacher activity observation sheet	4.1 with valid criteria	Meet the set criteria
Practical	Student Activity Observation Sheet	4.1 with valid criteria	Meet the set criteria
	Teacher activity observation	4.09 with high criteria	Meet the set criteria
	Student activity observation	4.01 with high criteria	Meet the set criteria
Effective	Questions and evaluation tests	90% Completed Study	Meet the set criteria

The ability to understand mathematical concepts wants students to be able to utilize or apply what they have understood into learning activities. If the student already has a good understanding, then the student is ready to give definite answers to statements or problems in learning.

In taxonomy by Bloom [18], the taxonomy is organized into 6 levels covering knowledge, understanding, application, analysis, synthesis and evaluation. Then Bloom's taxonomy was revised by



Anderson and Krathwohl [19] to remember, understand, apply, analyze, evaluate and create. In this study only used 3 levels, namely remembering, understanding and applying only. The following is a table of indicators that have been developed.

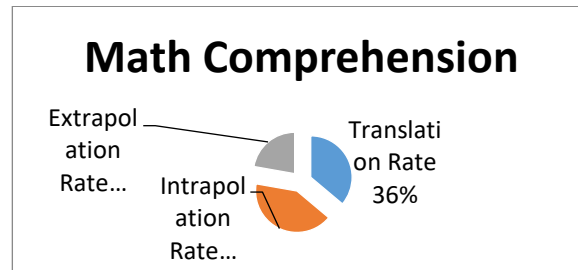
**Table 4. Indicators of Understanding adapted from the revised taxonomy of Anderson, LW and Krathwohl, DR**

Cognitive Aspect	Indicator
Remember	1. Explain the properties of quadrilaterals and triangles 2. Memorize the formula for the perimeter and area of a quadrilateral
Understand	1. Describe the parts of quadrilaterals and triangles from their angles, sides and diagonals 2. Calculating the perimeter and area of a quadrilateral
Apply	1. Apply the Pythagorean principle to the problem 2. Apply the formula for the perimeter and area of a quadrilateral to the problem

Understanding is divided into three, according to Nana Sudjana [20], where understanding can be divided into three categories.

- The first level is an understanding of translation, starting from translation in the true sense, which is related to the student's ability to translate mathematical sentences into a form that is more in line with his situation. For example, if a student is given a cube-shaped object, the student is able to show which are the edges, sides, vertices and diagonals.
- The second level is the understanding of intraposition, which is connecting the previous parts with what is known next, or connecting some parts of the graph to events, distinguishing between the main and the non-essential. For example, when students are given a cube shape and instructed to determine the length of the wire needed to make the frame of the block, if the student can determine which formula can be used to solve the problem.
- The third level of understanding is extrapolated understanding. With extrapolation, it is hoped that someone will be able to see behind what is written, be able to make predictions about consequences or be able to expand perceptions in terms of time, dimensions, cases, or problems. For example, when students are given a drink box along with its size, then they are instructed to determine how much water can fill the drink box. If students are able to determine which formula can be applied to solve the problem and can calculate it to get the answer.

The level of students' understanding of mathematical concepts using the E-Komatic (Mathematical E-Comic) media based on a contextual approach can be seen in the following diagram:



**Figure 5. Math Comprehension Diagram  
Based on Levels according to Sudjana [20]**

From the diagram above, it can be said that of the 10 students who were the test subjects. The most prominent understanding of mathematical concepts is the intrapolation level with a percentage of 42%, the lowest understanding of mathematical concepts is the extrapolation level with a percentage of 22%. If based on the level of student ability, the low ability students stand out at the intrapolation level, the moderate ability students stand out at the translational level and the high ability students stand out at the extrapolation level.

#### 4. Conclusions

The product developed in this research is E-Komatik. in this E-Komatic material, it is adjusted to the basic competencies in the 2013 curriculum, namely (3.14) Analyzing various rectangular shapes (square, rectangle, rhombus, parallelogram, trapezoid, and kite) and triangles based on sides, angles, and the relationship between sides and between angles and (4.14) Solve problems related to quadrilaterals (squares, rectangles, rhombuses, parallelograms, trapezoids, and kites) and triangles. Based on the results of the validity, practicality and effectiveness tests, the E-Komatik media has been declared valid, practical and effective. The value of product validity is seen from the results of the assessment of experts. The practical value of the product is seen from the results of observations during learning. The value of the effectiveness of the product is seen from the student's completeness value derived from group scores and evaluation test scores. Media E-Komatik consists of a material nature, diagonal, sides, and corners of square and triangular and rectangular circumference and rhombus. Media E-Komatik composed of components, namely (1) Cover, (2) Instructions for use, (3) Table of Contents, (4) Introduction of character, (5) The learning objectives of each series, (6) Fill in the comics, and (7) Student answer sheets that are outside the E-Komatik media. Media E-Komatik using a contextual approach which exercises the media E-Komatik associated with everyday life. E-Komatik consists of two series, namely series 1 with material on properties, diagonals, sides and angles in quadrilaterals and triangles, in series 2 with material on perimeter and area of quadrilaterals and triangles. The use of E-Komatik media in learning is intended to build students' understanding of the material presented.

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