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DEVELOPMENT OF JUNIOR HIGH SCHOOL MATHEMATICS TEACHING MATERIALS ASSISTED BY GEOGEBRA SOFTWARE WITH A CONTEXTUAL APPROACH TO IMPROVE MATHEMATICAL CREATIVE THINKING

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Abstract:
The purpose of this study was to develop mathematics teaching materials assisted by geogebra media on the mathematical creative thinking abilities of seventh-grade students of junior high school. Implementation of teaching materials using geogebra-assisted media is a way to help students understand mathematics learning, especially in quadrilateral material. For the quality teaching materials to meet the criteria of being valid, practical, and effective. This research uses a type of research and development (R&D). In this research, a development model is used, namely the ADDIE model. The ADDIE model is a research and development model consisting of 5 (five) stages, namely analysis, design, development, implementation, and evaluation. The results obtained from this study are the validity of teaching materials that are declared very valid with teaching materials that have been developed using geogebra assistance produces valid and practical teaching materials for the learning process with the results of an average validity value of 96.93% and an average practicality value of 94.6%. Suggestions that can be given are to take advantage of the teaching materials that have been developed so that educators or students can take advantage of teaching materials carried out remotely online or offline. Then other researchers can develop this teaching material on other mathematics material so that it can be utilized by other audiences.

Keywords: Teaching Material, Geogebra, Contextual Approach

PENGEMBANGAN BAHAN AJAR MATEMATIKA SMP BERBANTUAN SOFTWARE GEOGEBRA DENGAN PENDEKATAN KONTEKSTUAL UNTUK MENINGKATKAN PEMIKIRAN KREATIF MATEMATIS

Abstrak:
Tujuan dari penelitian ini untuk mengembangkan bahan ajar matematika berbantuan media geogebra terhadap kemampuan berpikir kreatif matematis siswa kelas VII SMP. Implementasi bahan ajar dengan menggunakan media berbantuan geogebra ini merupakan suatu cara untuk membantu siswa dalam memahami pembelajaran matematika terutama dalam materi segiempat. Agar bahan ajar berkualitas maka

harus memenuhi kriteria valid, praktis, dan efektif. Penelitian ini menggunakan jenis penelitian research and development (R&D). Dalam penelitian ini digunakan model pengembangan yaitu model ADDIE. Model ADDIE merupakan model penelitian dan pengembangan yang terdiri dari 5 (lima) tahapan yaitu analysis, design, development, implementation, dan evaluation. Hasil yang diperoleh dari penelitian ini yaitu validitas bahan ajar dinyatakan sangat valid dengan bahan ajar yang telah dikembangkan dengan menggunakan bantuan geogebra menghasikan bahan ajar yang valid dan praktis untuk proses pembelajaran dengan persentase rata-rata nilai kevalidan sebesar 96,93% dan persentase rata-rata nilai kepraktisan sebesar 94,6%. Saran yang dapat diberikan adalah untuk memanfaatkan bahan ajar yang telah dikembangkan ini, para pendidik atau peserta didik dapat memanfaatkan bahan ajar dilakukan secara online atau luring. Kemudian untuk peneliti lain dapat mengembangkan bahan ajar ini pada materi matematika yang lainya agar dapat diamanfaatkan oleh khalayak banyak.

Kata kunci: Bahan Ajar, Geogebra, Pendekatan Kontekstual

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INTRODUCTION

Mathematics is a very important subject that must be taught at all levels of education. Mathematics also serves to train abstract thinking and can find solutions that can help solve the problems at hand. One of the difficulties in answering math problems is that students cannot solve questions in detail and order according to indicators. Field conditions indicate that mathematics learning does not involve maximum student activity (Muflihah, Ratnaningsih, & Apiati, 2019). Creative thinking is the ability of students to understand a problem and finish it with creative methods. Students should be taught to develop their thinking skills to survive in an ever-changing and competitive situation. But the ability to think creatively is very low, this can be seen from the research based on (Khoiri, Rochmad, & Cahyono, 2013). It states that Indonesia is still ranked 38th out of 42 countries, and according to Akbar, Syaodih, and Lisnawati (2015) that among the causes of the low achievement of students in learning mathematics is the learning process that is not optimal and learning is only student-centered, there is no interaction and teachers tend to use conventional

learning. You can stimulate students' creative thinking skills in many ways, one of which can be done by choosing models, methods, and approaches to the learning process. According to Ruseffendi (2006) creative nature will appear in children if they are trained and accustomed from childhood to exploration, inquiry, and problem-solving.

An alternative solution to the problem of students' creative thinking is to use a geogebra-assisted contextual approach. The geogebra-assisted contextual approach can help students understand the meaning of the learning material they are learning by linking the context of daily life so that students have flexible knowledge (Amir, 2015), this is in line with Ulya, Irawati, and Maulana (2016) that contextual is one of the most important learning concepts that helps teachers in linking the material being taught with real situations. In line with Kumarawati and Prihatnani (2018) suggesting a geogebra-assisted contextual approach is a learning approach that encourages students to make connections between their knowledge and its application in their lives as individuals, communities, and members. In contextual learning, students are directly involved in important activities that help students relate academic learning to the real-life contexts they encounter. The discovery of meaning is the main characteristic of context (Johnson, 2002).

In addition to the methods used, of course, ICT-based interactive teaching materials are also needed to support these methods to help learning activities reach their goals. Sari (2021) stated that the use of interactive teaching materials, especially in integrating mathematics software, can make it easier for students to understand concepts. One of the technologies in learning mathematics that can be utilized is geogebra software. Geogebra-assisted quadrilateral teaching material is a rectangular presentation of material with image designs using ethnomatic images. Geogebra is a mathematic learning media that can be used as a physical tool to convey the content of teaching materials through various forms/variations of geogebra media. With the appearance of geogebra, ethnomatics can convey an understanding of concepts and be associated with the culture that exists on the island of Java so that students can understand the concept of quadrilaterals that are interrelated with each other, both looking for the concept of circumference, area, and elements contained in quadrilaterals and triangles. In this teaching material, student worksheets (LKS) are also presented which must be done by students as a form of exercise after learning and there are several rectangles as a form of challenge for students to solve complex mathematical problems. With the

development of valid, practical, and effective geogebra-assisted teaching materials, students are expected to be able to understand mathematics material better. Therefore, this study aims to see the process and results of the development of geogebra-assisted teaching materials based on the results of the analysis of the learning implementation observation sheet, teacher and student response questionnaires to the learning process, and the effectiveness of increasing the mathematical creative thinking skills of junior high school students obtained from the final test results.

METHODS

This research uses a type of research and development known as Research and Development (R&D). In this research, a development model is used, namely the ADDIE model. The ADDIE model is a research and development model consisting of 5 (five) stages, namely Analysis, Design, Development, Implementation, and Evaluation. The five stages must be carried out in a structured and continuous manner. The analysis stage includes media analysis, curriculum analysis, and material analysis. Media analysis is carried out to determine the extent to which the use of media will be developed in learning. In conducting media analysis using literature studies related to aspects that must be contained in the media. Curriculum analysis is carried out by reviewing the curriculum that is being applied so that learning media are developed by the applicable curriculum. The study of the curriculum includes core competencies, basic competencies, and indicators that must be achieved. Material analysis is carried out to determine the material to be studied in learning using the developed media (Kurniawan, Putri, & Hartono, 2018).

At the design stage, it aims to produce an initial product or product design that is adjusted to the analysis that has been carried out. The activities carried out at this stage are the selection of the initial format and framework as well as the selection of instruments. Next, namely, the development stage is a continuation of the design stage, at this stage the development of the instructional media design that has been made is started. This development stage, consists of several steps including: a) developing a design framework of learning media and instruments made in the previous stage, which will then be evaluated by experts, and b) Assessment of learning media carried out by experts who are competent in the field. Experts in the field of media and materials can provide criticism and suggestions for better media preparation,

and c) revise the validated media based on suggestions and criticisms from media and material experts. The implementation phase is a learning media that has been developed and declared worthy of testing by lecturers of media experts and material experts then tested on research subjects on a small scale. At this stage, a limited trial is carried out whether the LKPD is suitable for use or. Finally, in the Evaluation stage, a final revision of the learning media is carried out based on questionnaires and observation sheets obtained in the field. The subjects of this research and development are students in the first semester of the 2022/2023 academic year, which is 30 people.

The steps in analyzing student test data are as follows: 1) Giving scores from the results of students' answers by predetermined benchmark scores. The test scores that have been obtained by each student are from 0-100. The scores that have been obtained by students are made into a form of value using the following rules:

Table 1. Learning Model Validity Criteria

Score	Validated Category	Information
20-24	Very Valid	Valid/ No Revision
16-19	Valid	Partial Revision / Partial
11-15	Quite valid	Majority Revision/ Partial
6-10	Not Valid	Not Valid / Total Revision

(Adapted from Akbar, 2013)

Table 2. Exspert Validity Criteria

Percentage (%)	Validation Level	Information
76-100	Valid	Valid / No Revision
50-75	Quite valid	Partial Revision / Partial
26-49	Not Valid	Majority Revision/ Partial
<26	Not Valid	Not Valid / Total Revision

(Adapted from Bernard, 2014)

RESULTS AND DISCUSSION

From each stage that is carried out, of course, there is an explanation related to the results of the research. The following are the results and discussion of the research that has been done.

Analysis

In the analysis stage, several things need to be analyzed including curriculum analysis, syllabus analysis, material analysis, and student analysis. In curriculum analysis, the thing that needs to be considered is the curriculum that applies to the education unit, namely the 2013 Curriculum (K13). Furthermore, for the analysis of the syllabus, subjects at the junior high school level. Then, the analysis of the material must be the same as the analysis of the curriculum used. The material used to develop teaching materials is rectangular material and analyzes the subject to be developed, namely square. Finally, student analysis, according to Aspriyani and Suzana (2020) student analysis was carried out to find out the characteristics of students in mathematics subjects who still considered mathematics difficult to learn.

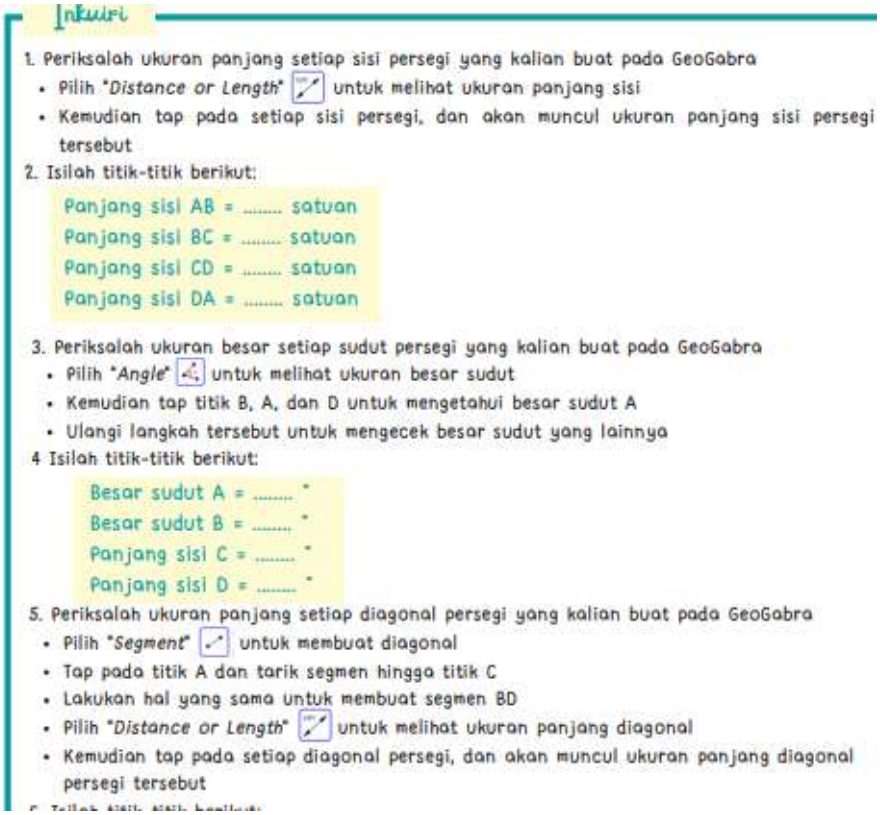
Design

In this stage, an assessment of the teaching materials that will be developed is carried out, starting from the cover material, content, activities, and applications used. The initial stage of the design is carried out by self-assessment of the teaching materials developed. An example of the initial display of teaching materials that have been personally assessed can be seen in figure 1. Figure 1 is an initial display of the cover of the worksheet which is a printed teaching material. The worksheets are steps or instructions for use that are presented in writing to apply the teaching materials contained in the geogebra application.

Figure 1. First Look of LKPD

Development

After producing the LKPD, validation is carried out by the experts/experts in their field, or called validators. This was done to get assessments, comments, suggestions, or inputs that were made to three validators who were two lecturers who were media experts and material experts, as well as a subject teacher at the junior high school at the research site. After the revision, it produces an LKPD which is then re-validated by providing a validation questionnaire sheet to evaluate the results of the revision. The following table analyzes the validation questionnaire sheet for 3 (three) validators.


Inkuiri

1. Periksalah ukuran panjang setiap sisi persegi yang kalian buat pada GeoGabra
   - Pilih "*Distance or Length*" untuk melihat ukuran panjang sisi
   - Kemudian tap pada setiap sisi persegi, dan akan muncul ukuran panjang sisi persegi tersebut
2. Isilah titik-titik berikut:
   Panjang sisi AB = ... satuan
   Panjang sisi BC = ... satuan
   Panjang sisi CD = ... satuan
   Panjang sisi DA = ... satuan
3. Periksalah ukuran besar setiap sudut persegi yang kalian buat pada GeoGabra
   - Pilih "*Angle*" untuk melihat ukuran besar sudut
   - Kemudian tap titik B, A, dan D untuk mengetahui besar sudut A
   - Ulangi langkah tersebut untuk mengecek besar sudut yang lainnya

4 Isilah titik-titik berikut:
   Besar sudut A = ... °
   Besar sudut B = ... °
   Panjang sisi C = ... °
   Panjang sisi D = ... °

5. Periksalah ukuran panjang setiap diagonal persegi yang kalian buat pada GeoGabra
   - Pilih "*Segment*" untuk membuat diagonal
   - Tap pada titik A dan tarik segmen hingga titik C
   - Lakukan hal yang sama untuk membuat segmen BD
   - Pilih "*Distance or Length*" untuk melihat ukuran panjang diagonal
   - Kemudian tap pada setiap diagonal persegi, dan akan muncul ukuran panjang diagonal persegi tersebut

Figure 2. Geogebra Steps Appearance

Table 3. Analysis of validation Questionnaire Result

No	Validator	Average %
1	Validator 1	95,67 %
2	Validator 2	96,55%
3	Validator 3	98,67 %
Total		290,89
Average		96,93

In general, the data obtained from the validation questionnaire sheet had the average value obtained from the validators of 96.22%, thus fulfilling the valid criteria. Based on the validation results that have been obtained, the teaching materials that have been developed are feasible to use.

Implementation

In this implementation stage, there are several stages of LKPD testing for students as respondents including one-to-one, small group, and large group.

One to one

The One-to-One stage was carried out for three grade VII junior high school students from different schools. In line with the one-to-one trial, it also provided a student response questionnaire to provide an assessment and response to the teaching materials used. From one-to-one trials to produce teaching materials that must be revised according to comments or suggestions from respondents. After the revision, the teaching materials are formed.

Small group

After producing the LKPD, a trial was conducted on five seventh-grade junior high school students from different schools. In line with the trial, a student response questionnaire sheet was also given to provide an assessment and response to the LKPD which was used to determine the practicality of the LKPD. The results of the small group trial were in the form of student comments stating that the teaching materials developed were interesting and good to use.

Large Group

A large group trial was carried out on students of SMP/class VII. In this trial, there were seven students from different schools at the research site. After the trial is complete, a student response questionnaire is given to get an assessment of the LKPD that has been tested. After the student response questionnaire sheets were analyzed in the responses and suggestions section, the results were more directed to their opinion saying that the teaching materials were good to use. This was by the results of the analysis of the average value of the entire student response questionnaire that had been analyzed.

The assessment of the practicality of the teaching materials used is a student response questionnaire sheet with a total of 20 statement items. Each of these questionnaires was given to each student, totaling 15 students, with details of 3 students in the one-to-one trial, 5 students in the small group trial,

and 7 students in the large group trial. From the results of data analysis on the student response questionnaire sheet, the percentage of the average value was 94.6%. Based on the description above, it states that the very practical score interpretation criteria are in the 80.00%-100% interval. This is in line with research conducted by Handayani and Sulisworo (2021) which states that the results of the development of geogebra-assisted teaching materials obtain an average practicality value of 83%, so it can be concluded that the teaching materials that have been developed are included in the level of teaching materials that have been developed. very practical. Based on Table 4 which states that the results of the analysis of the validation questionnaire sheet by the validator obtained an average value percentage of 96.93%, this proves that the teaching materials that have been developed are valid and reinforced by previous research conducted by Nur (2017) which resulted in learning media using geogebra is valid with the validity criteria obtained from the media validation questionnaire of 95.51%. In this case, the teaching materials that have been developed can be categorized as valid.

Evaluation

At this stage, evaluation is carried out starting from the design stage to the implementation stage which aims to determine the validity response of the students' practicality validators to the teaching materials that have been developed. Based on the description above, it can be concluded that the teaching materials for rectangular materials based on the Geogebra-assisted Contextual approach to class VII students can be categorized as valid and practical teaching materials. This assessment process is in line with research conducted by (Fitriani, Hidayah, & Nurfauziah, 2021), the difference lies in the use of learning models and the material being taught. This research is in line with research conducted by Setiawati, Risalah, and Oktaviana (2021) with the results of the development of learning media for the square concept based on the Geogebra software widely for SMP in Bandung City which produces valid and practical learning media. And this research was also carried out, namely by giving a mathematical abstraction test. This stage is carried out to see the achievement of the teaching materials that have been developed. This mathematical abstraction test is given to two different classes, the first class uses geogebra-assisted contextual approach teaching materials, and the second class uses ordinary learning.

Table 4. Normality Test Results

Tests of Normality		
Class	**Kolmogorov-Smirnov**	
	Df	**Sig**
Experiment	30	0.004
Control	30	0.004

Table 4 is the result of the normality test with SPSS 23 using the Kolmogorov - Smirnov method. Significance values for the experimental class and control class resulted in a significance of 0.05 so the data was not normally distributed. Then, a one-party non-parametric test, namely Mann Whitney U, with the selection of the Monte Carlo test, will be carried out, as shown in table 5 below.

Table 5. Mann-Whitney Test Results, Mathematical Creative Thinking Ability

Test Statistics[a]	
	PRETEST
Mann-Whitney U	004
Wilcoxon W	004
Z	004
Asymp. Sig. (2-tailed)	0,004
a. Grouping Variable: CLASS	

Table 5 shows a significant result of 0.000 or < 0.05, which means that the achievement of creative thinking skills of class students who used geogebra-assisted contextual approach teaching materials is better than those using ordinary learning. This happens because the teaching materials were designed to trigger the development of these abilities, where students are stimulated to recall previous materials related to what will be studied, then students are led to do the modeling process from concrete things to abstract things. students are taught to be able to form a formalization of the concepts learned logically, until students are triggered to be able to apply the concepts learned to other, broader content, thereby increasing students' creative thinking abilities (Asryana, Sanapiah, & Kinasih, 2017).

CONCLUSIONS

Based on the results of the research that has been carried out, it can be concluded that the teaching materials that have been developed using the help of geogebra produce valid and practical teaching materials for the learning process with the results of the average percentage value of validity of 96.93% and the percentage of average value average practicality of 94.6%. Suggestions that can be given are to take advantage of the teaching materials that have been developed so that educators or students can take advantage of teaching materials carried out remotely online or offline. Then other researchers can develop this teaching material on other mathematics material so that it can be utilized by other audiences.

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