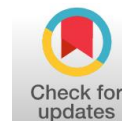


## Development of Learning Media Assisted by Android Studio to Explore Mathematical Ability of Junior High School Students



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### Abstrak

Penelitian ini bertujuan untuk mengetahui prosedur pengembangan dan kelayakan media pembelajaran matematika berbantuan android studio untuk mengeksplor kemampuan matematis siswa kelas VII SMP. Jenis penelitian ini adalah *research and development* (R&D). Model yang digunakan adalah model 4-D. Tahapan model 4-D terdiri dari pedefinisian (*define*), perancangan (*design*), pengembangan (*development*), dan penyebaran (*disseminate*). Instrumen yang digunakan berupa lembar validasi dan angket. Teknik analisis data yang digunakan berupa analisis deskriptif kualitatif. Hasil validasi yang diperoleh dari ahli materi memperoleh rerata sebesar 3,57 dengan kriteria sangat valid, ahli media mendapat rerata sebesar 3,66 dengan kriteria sangat valid, dan uji coba kelompok besar memperoleh persentase sebesar 72,49% dengan kriteria praktis. Berdasarkan tahapan pengembangan produk dan kriteria yang telah ditetapkan maka media pembelajaran matematika berbantuan android studio dinyatakan valid dan praktis serta dapat dijadikan sebagai referensi untuk mengeksplor kemampuan matematis siswa karena pada produk yang dikembangkan fokus dan punya karakteristik yang kuat.

Keyword: Media Pembelajaran Matematika, Android Studio, Kemampuan Matematis

### Abstract

*This study aims to determine the development procedure and feasibility of learning media for mathematics assisted by the android studio to explore the mathematical abilities of seventh-grade junior high school students. This type of research is research and development (R&D). The model used is a 4-D model. The stages of the 4-D model consist of defining, designing, developing, and disseminating. The instruments used are validation sheets and questionnaires. The data analysis technique used is in the form of qualitative descriptive analysis. The validation results obtained from material experts obtained an average of 3.57 with very valid criteria, media experts got an average of 3.66 with very valid criteria, and large group trials obtained a percentage of 72.49% with practical criteria. Based on the product development stages and the criteria that have been set, the mathematics learning media assisted by the android studio is declared valid and practical and can be used as a reference to explore students' mathematical abilities because the products developed are focused and have strong characteristics.*

Keyword: Learning Media, Android Studio, Mathematical Ability

## INTRODUCTION

Technology can use by humans as a tool to solve various existing problems. Technology is now increasingly developing to facilitate human activities and interests in all areas of life. Human life cannot be separated from technology and the presence of technology in life greatly affect



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human activities (Ngafifi, 2014: 46). Therefore, with the development of technology, it becomes a challenge for humans to keep up with every existing development.

In the education field, for example, in this century the development of information technology is very rapid. The spread of technological advances in this era has been felt in various aspects of life, including in the field of education (Sole & Anggraeni, 2018: 10). The use of technology can be utilized as a tool to increase learning opportunities and the learning process (Casanova, Huet, Garcia, & Pessoa, 2020). Thus, teachers are required to be skilled in using and utilizing technology in their learning activities. In addition, teachers must also be able to innovate in learning (Astuti & Purwoko, 2017). The mandatory competence that nowadays' teachers must possess is the ability to use information and technology (Richardo, 2016: 779). Therefore, with the ability to master technology and information, teachers can use it to increase the effectiveness of learning supported by technology that suits the needs of students. A successful teacher is a teacher who has knowledge and skills in implementing the new technologies to increase teaching effectiveness and create positive attitudes (Novaliendry, et al, 2020: 717). Furthermore, utilizing technology in learning can affect the effectiveness of student learning (Geng, Law, & Niu, 2019).

The form of application of technology that can be done by teachers is using media for learning activities. This is in correlation with the results of research that has been conducted that mathematics learning media in the form of electronic comics can be used to support mathematics learning activities to provide more opportunities for students to learn (Astuti, Yuzianah, and Purwoko, 2018). In addition, the form of technology in the learning process that can be used of them is android-based learning media. Android-based learning media besides being efficient and easy to operate, Android has many supporting features as learning media so that students can learn wherever they are. The advantage of using Android-based learning media is the students able to use it wherever they are (Kuswanto & Radiansah, 2018: 19). These findings create the ability in using android-based learning media to be applied to triangle and quadrilateral material.

Triangles and rectangular are taught in grade VII junior high school. Triangles and rectangular in mathematics are the foundation for studying other shapes such as cubes, blocks, pyramids, and so on. Therefore, students need to be able to master and understand the material well, including the area and perimeter of triangles and rectangular so that students can easily apply the material in mathematics and daily life. The plane figure of triangles and rectangular are some of the materials that are often encountered in daily life (Sumiati & Agustini, 2020: 323). Therefore, the material of triangles and rectangular is very important for students to learn. In addition to mastering the triangle and rectangular material, another thing that students need to master is that students must have mathematical abilities. Five standards of mathematical ability must be possessed by students, problem-solving skills, communication skills, connection skills, reasoning abilities, and representation skills (NCTM, 2000). The students may achieve the aims to learn mathematics if the five standards are applied.

The mathematical ability of students on the triangle and rectangular material in one junior high school is still not optimal. Some students got low scores below the Minimum Completeness Criteria (KKM) based on the provisions at the school of 75. Some students did not achieve the KKM at the daily test 1. The data is as below.

**Table 1. The total student of class VII did not reach the KKM**

Class	The total students did nor reach the KKM
VII A	18
VII B	17
VII C	20
VII D	17
Jumlah	72

Data on the percentage of students who did not reach the KKM in each class is as below.

**Table 2. Percentage of students did not reach the KKM**

Kelas	Persentase
VII A	56 %
VII B	55%
VII C	63%
VII D	53%

According to Krutetskii, mathematical ability includes all or part of aspects consisting of spatial conceptions, arithmetic and operations, the use of suitable logical methods, and the ability to think logically (Kattou et al, 2013: 171). Students' mathematical abilities can be categorized into three, high, medium, and low abilities. Students' mathematical abilities are not the same, some students have high, medium, or low abilities (Widarti, 2013: 4). Therefore, the students need to master their mathematic abilities so that mathematical problems can be solved correctly by students.

The variation in learning is an effort aims to increase the success of students in receiving the material. The variation in learning can improve quality and have a positive impact on increasing student learning achievement (Ichsan, 2020: 29). In the learning process, the delivery of material in many ways is needed, explaining the material through discourse is not enough, but needs to involve other material such as android-based learning. This media is used to convey interesting material so that students' enthusiasm for learning can increase.

Android-based learning media has a positive impact on students. Students experience an increase in learning motivation after using android-based learning media (Tyasana, 2019: 9). Not only increase learning motivation, but Android-based learning media also reduce boredom. The use of learning media makes students get rid of boredom, so students find it easier to accept the material presented by the teacher (Budiman, 2016: 181). Android-based learning media can be used by teachers to optimize the learning process. Through android-based learning media, students understand better by directly feeling, touching, and experiencing the media themselves.

Learning media is used to complete and assist teachers in conveying information or material. Learning becomes more effective when using learning media as a tool (Nurseto, 2011: 21). The use of android-based learning media aims to ease teachers in delivering the material to be understandable, interesting, and fun for students. Using learning media is expected to provide a new and different learning experience from the previous. Furthermore, various media provide a stimulus to students in the learning process to explore students' mathematical abilities optimally.

Based on the above explanation, this research aims to identify the process, validity, and practicality of learning media assisted by the android studio to explore the mathematical abilities of seventh-grade junior high school students. This learning media applied to class VII students of SMP Negeri 2 Sumpuh and is expected to suit the learning process.

## METHOD

The method of this research is Research and Development (R&D). The research and development used in this study use a 4D model which stands for Define, Design, Development, and Dissemination. Sugiyono (2016: 297) states that research and development is a research method used to produce a certain product and to identify the effectiveness of the product.

The research conducts in junior high school. The subjects in this research are seven grader students in the limited trial phase of 4 students and the big group test of 31 students. The object of this research is the learning media of mathematics assisted by android studio.

The instrument in this research is used to identify the validity dan practicality of the developed mathematics media learning. This research used an instrument in a form of a validation sheet of material experts and media experts, also use practicality questionnaires to the students. The data collection technique has two ways, using validation sheet of material expert and media expert, and also the questionnaire. The data analysis conducts to obtain suitable learning media which fulfill the validity and practical criteria. The data analysis technique uses descriptive qualitative analysis (Gunawan, 2013: 11).

## RESULTS AND DISCUSSION

The final product of this research is a mathematics learning media named Gapat (segitiga dan segiempat). This study uses a 4-D model development procedure which includes four stages, defining, designing, developing, and disseminating. Below us the research stages conducted:

### *Stage of Define*

#### *Preliminary Analysis*

In this research, the preliminary analysis phase was based on a literature study of articles from research results in some journals, and the experiences of teachers and students in the learning process. Furthermore, discovering an alternative solution to the specified problems. The results are students' mathematical abilities in triangle and rectangular material are still not optimal. The analysis shows that the teacher was not optimal in involving learning media in the learning process, and found that the teacher was not optimal in mastering technology used in the learning process.

#### *Formulation of Learning Objectives*

Based on the preliminary analysis, the learning objectives to be achieved are as follows: (1) Students can understand triangle and rectangular material (2) Students can apply triangle and rectangular material (3) students able to achieve the expected basic competencies. Based on this description, the researcher aimed to explore students' mathematical abilities in the triangle and rectangular material through learning media. In this research, the media is expected to assist the student in understanding, applying, and achieving basic competence.

### *Stage of Design*

#### *Test Compilation*

At this stage, the researcher compiled five questions as follows (1) Understanding mathematical concepts, operations, and the relation; (2) Mentioning the nature and mathematics principles and the relation of the natures; (3) Creating examples and not examples; (4) Expressing the concepts by using shapes and graphics; (5) Modeling the concepts and interpreting into denotations and ideas. The indicator was chosen by considering the triangle and rectangular material is the material that needs to be mastered by the students. The indicator helps the students in improving mathematical abilities in the triangle and rectangular material by presenting it in mathematics learning media assisted by android studio.

#### *Media Selection*

This stage aims to discover the media to be used and developed, and the media is learning media. The developed learning media is an android studio on triangles and rectangular. The media chosen is android-based aims to facilitate the learning process since this media is very relevant in this century and not much technology has been developed for seventh graders.

#### *Format Chosen*

This stage is to identify the components needed in designing android-based mathematics learning media assisted by android studio. The components are background and menu features. The selected software is the android studio which is supported by other software, PowerPoint 2016 and Microsoft word 2016. This software has its respective functions, and the android studio is used in compiling mathematics learning media. Powerpoint 2016 is used in making a learning video on the triangle and rectangular material, and Microsoft Word 2016 was used to create the materials, projects, and evaluation of triangles and rectangular.

#### *Initial Design of Learning Media*

The design stage produces an application design in the form of a flow chart as shown in Figure 1.

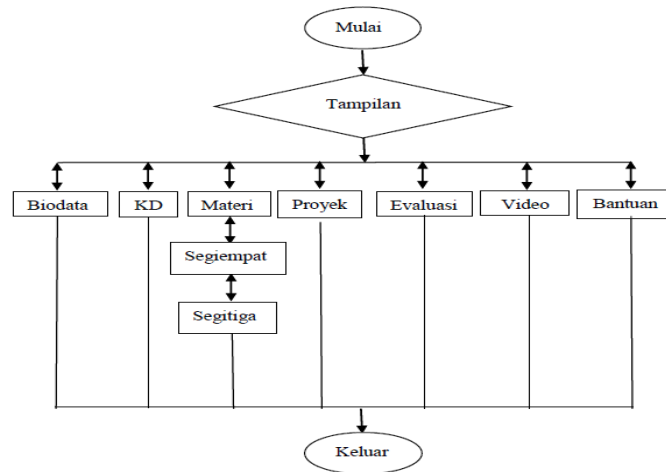


Figure 1. Media design flowchart

**Development Stage**

There are three stages as follows (1) Application development, at creating the learning mathematics media assisted by Android studio such as starting to make biodata, basic competence, materials, projects, evaluations. This process uses Microsoft Word 2016 software. Furthermore, for the learning videos using Powerpoint 2016 software, and then starting to create the mathematics learning media assisted by android studio. The created application contains materials, projects, evaluations, and learning videos. The identity of the learning media application is seen in table 3.

Table 3. Application identity

Component	Description
Name of learning media	Gapat (segitiga dan segiempat)
Material	Triangles and rectangular for Class VII second semester
Content of media	The start page, the menu consists of the author's bio, basic competence, materials, projects, evaluations, videos, assistance, and the exit button

The software chosen in preparing this learning media is Android Studio which is supported by other software, PowerPoint 2016 and Microsoft Word 2016. Android Studio composed mathematics learning media, PowerPoint 2016 created the learning videos of the triangle and rectangular material, and Microsoft Word 2016 created materials, projects, and evaluating triangles and rectangular. The features of this software are complete and easy in using and creating this learning media. The display of android-based learning media can be seen in Figure 2.



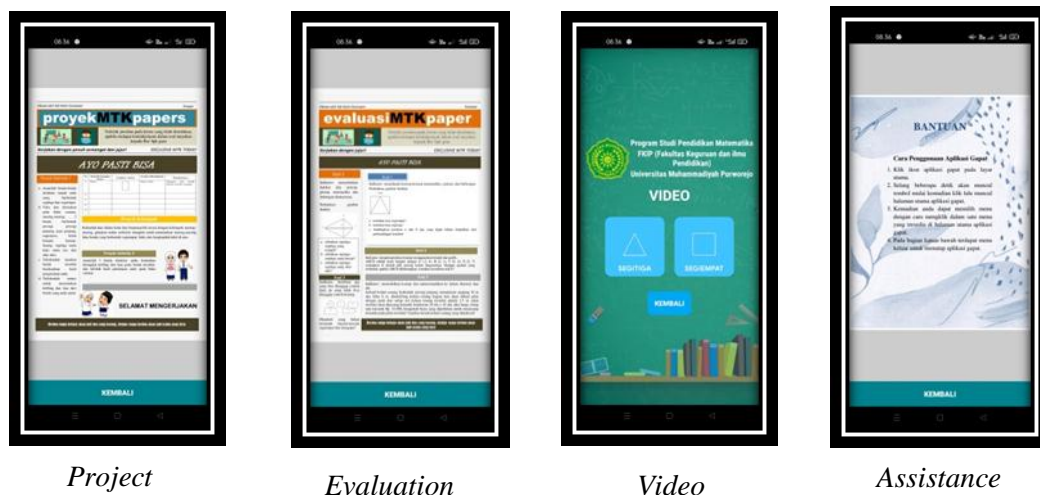


Figure 2. Application display

The next stage is (2) Validation, at this stage the created media is examined by the validators of material experts and media experts to identify the level of validity of the mathematics learning media products assisted by the android studio as learning media. The results of material expert validation can be seen in Figure 3.



Figure 3. Graphics of validation by material experts

The graphic in Figure 3 shows that in the aspect of content feasibility, validator 1 evaluated the average of 3.25, meaning that the feasibility of the content is valid. While validator 2 evaluated the average of 4 which means that the feasibility of the content is very valid. Furthermore, in the linguistic aspect, the two validators evaluated the average above 3.25, which means that the linguistic aspect is very valid. In the presentation aspect, the two validators evaluated above 3.25 which means that the presentation aspect is very valid.

The next stage of the validation of mathematics learning media experts assisted by the android studio is reviewed and assessed by media experts. The media expert's assessment concerning the visual display aspect and the software engineering aspect. The results of media expert validation can be seen in Figure 4.

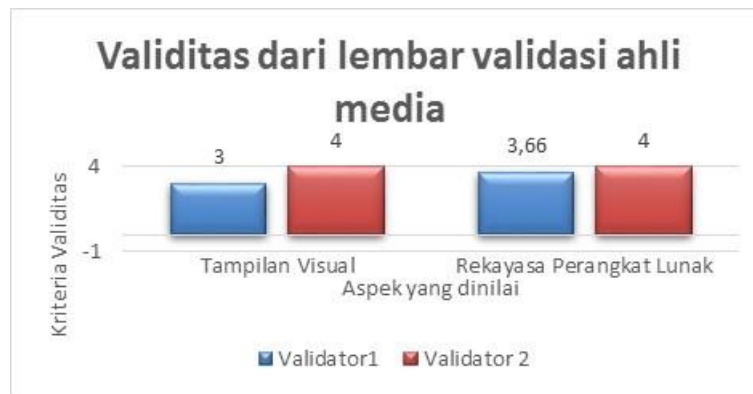


Figure 4. Graph validation by media experts

Based on the graphic shown in Figure 4, shows that in the visual aspect, validator 1 evaluates with an average of 3.00, which means that the visual aspect is valid, while validator 2 is evaluated with an average of 4, which means the feasibility of the content is very valid. Furthermore, on the software engineering aspect, the two validators evaluated with an average above 3.25 which means that the software engineering aspect is very valid.

The overall average results of the assessment of the material validators are 3.57 with the criteria of "very valid". While the overall average results of the assessment of the media validators are 3.66 with the criteria of "very valid" and received suggestions for product improvement. (3) development trials, after the product was revised through the suggestion from the validator, the next stage was a small group trial for students to identify the response given to the Gapat learning media.

After revising the learning media, a limited trial was conducted to identify the student's response to the developed Gapat learning media. The limited trial consisted of 4 students of class VII C who were selected heterogeneously. The trial was conducted by explaining the Gapat learning media. After finished, then the students test the learning media. The students also write a suggestion to improve the developed media that has been. The results of the limited trial can be concluded as follows:

- There are still typos in some parts, on the material menu, namely rectangular and the project menu, kites, and squares.
- The color on the material menu is dominated by dark blue and light blue.

The next action is to conduct a large group trial. A large group trial conducts to identify the practicality of the media that had been developed. This trial consisted of 31 students of class VII-A. The trial by giving students a media practicality questionnaire to fill out, then explaining about the Gapat learning media. After that, the students test the learning media and fill out the questionnaire on the practicality of the media. The test results can be seen in table 4.

Table 4. Large Group Trial Results

T	STS	TS	Frequency			Skor	Achievement	Description
			RR	S	SS		Level (%)	
1	2		5	22	2	23,0	74,19	Practical
2			7	22	2	23,8	74,77	Practical
3			8	14	9	25,0	80,64	Practical
4		1	10	14	6	23,6	76,12	Practical
5		2	13	13	3	19,4	62,58	Practical
6		2	13	13	3	19,4	62,58	Practical
7	1	1	9	15	5	23,0	74,19	Practical
8		2	11	11	7	23,2	74,89	Practical
			Average				72,49	Practical

Based on the data in table 4, the average percentage is 72.49% with practical criteria. Based on the obtained data, the learning media developed has practical criteria and can be used as a medium for student learning in mathematics subjects in junior high school.

#### *Stage of dissemination*

This stage conducts through limited distribution for the mathematics teacher as reference stuff for teachers to develop android-based learning media and distributed to class VII junior high school students as learning resources.

Mathematics learning media assisted by the android studio on the triangle and rectangular material can be used as a source of student learning to explore students' mathematical abilities by (1) Students can understand triangle and rectangular material. The display of materials and videos can be seen in Figure 5.

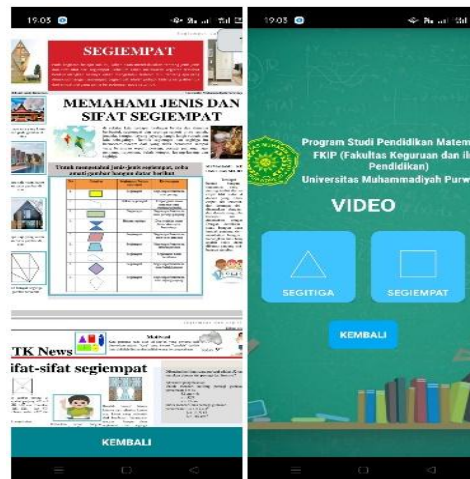


Figure 5. Display of materials and videos

The material menu contains explanations of triangles and rectangular to attract students in learning and expecting the students can understand easily. This media not only describes the material but also provides explanations using videos for the students to understand the material more optimally. (2) Students can apply the material of triangles and rectangular. The project menu display can be seen in Figure 6.



Gambar 6. Tampilan proyek

After students can understand the material of triangles and rectangular, the students are expected to be able to apply it in daily life. In this media, there is a menu "Project" or assignment



for the students to improve their ability in applying the material. (3) students can achieve the expected basic competencies. The evaluation menu display can be seen in Figure 7.

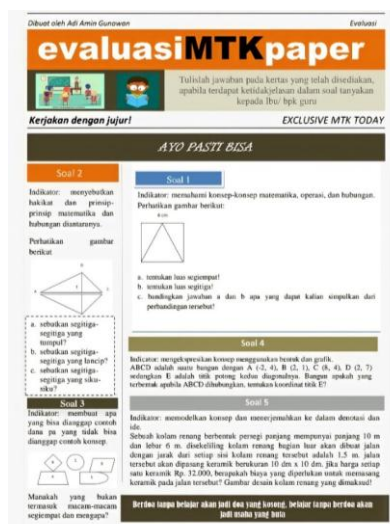


Figure 7. Display of the evaluation menu

In this media, the evaluation menu can be used by students to find out and explore students' mathematical ability, especially on the triangle and rectangular material. The evaluation menu consists of five questions: 1) understanding mathematical concepts, operations, and relationships, 2) mentioning the nature of mathematical principles and the relations between them, 3) creating the considered examples and not examples, 4) expressing concepts using shapes and graphics, and 5) modeling concepts and translating into denotations and ideas. After students understand and applied the triangle and rectangular material, the students are expected to master the material optimally. In this media, there is an evaluation menu that is used to determine students' mathematical abilities after mastering the material learned through the media.

The final result of this research is the mathematics learning media assisted by Android studio to explore the mathematical abilities of seventh-grade junior high school students is valid and practical as a learning resource. The presentation of learning media is easy for the students to learn, especially during the covid-19 pandemic that happened in Indonesia. The results of research show that android-based applications are very useful and help the teachers in delivering the material for the students during a pandemic (Hapsari, 2021: 30). Therefore, teachers can apply the use of smartphones to support innovative learning. In addition, more teachers in schools are implementing the use of mobile devices to support more innovative learning in the classroom to achieve maximum results (Sitompul, 2020: 616).

Mathematics learning media assisted by the android studio can be used by class VII SMP students as an effort to make the learning process innovative and creative. This is supported by the results of A. Syakroni's research. The android-based learning is learning using media in the form of applications run on the android system as an effort to make the learning process more innovative and creative (Rahman et al, 2020: 2). Therefore, the learning media of mathematics assisted by android studio becomes more interesting so that students can receive learning material optimally. This is supported by the results of AN Khomarudin's research, through technological sophistication, the learning becomes more interesting and the educators more creative in utilizing technology. In addition, the students better in the ability in receiving (Rahman et al, 2020: 2).

## CONCLUSION

The conclusion of the media learning development is to explore the mathematical abilities of class VII SMP students using 4-D development that includes four stages, (1) define, (2) design, (3) develop, (4) disseminate. The results of the learning media were declared feasible based on the results of the material expert's assessment with an average value of 3.57 with a very valid category and media experts evaluated an average value of 3.66 with a very valid category. Furthermore, the

assessment of the practicality of the media conducted to the students obtained an average value of 72.49% with the practical category based on large group trials. The result shows that the development of mathematics learning media assisted by the android studio can be used as a source for the student in learning mathematics. Furthermore, this media can be used to explore students' mathematical abilities because the students are focused and have strong characteristics at the evaluation stage.

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