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### Development of Codular-Assisted Android-Based Mathematics Media to Increase Student Motivation and Learning Outcomes

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**ABSTRACT**  
Research on the development of codular-assisted android-based mathematical media was carried out to increase student motivation and learning outcomes in learning mathematics. This research refers to the ADDIE model, which consists of 5 stages: analysis, design, development, implementation, and evaluation. The research was conducted on 30 class IX students at MTS Muhammadiyah 1 Malang. The study results show that the validity value of the media is 88.4%, with a very good category. So that this android media meets the criteria and is very suitable for use in learning. As for the test results on student learning outcomes, this media can improve student learning outcomes by increasing the average test results, namely the pre-test 41.67 and the post-test 91.67, which shows that the data results make the data distribution homogeneous. The student learning motivation questionnaire as a whole with the pre-test results found 93.33% who had motivation in the good criteria, and the remaining 6.67% were in the fewer criteria. In the post-test, 83.33% had very good motivation, and the remaining 16.67% were in good criteria. This shows an increase in student motivation after using Android-based media. So it can be concluded that the use of android-based mathematics media with the material Build a Curved Side Room (Tube) developed in this study is valid and can increase motivation and student learning outcomes. This study proves that learning media can increase motivation and learning outcomes. Therefore, the results of this study can be used as an alternative to learning mathematics, especially to increase student motivation and learning outcomes.

**Keywords:**  
Android-based math media,  
Learning outcomes,  
Student's learning motivation.



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**A. INTRODUCTION**  
In today's information and communication era, smartphones have become increasingly sophisticated technology. For this reason, a smartphone is no longer an obligation but has become a necessity for everyone (Nurhikmah, H. et al., 2021). The most widely used smartphones are Android-based smartphones (Qohar et al., 2021). Android is a technology that is widely used in learning (Yaniawati et al., 2021). Through android, students can easily open the learning applications they want. Therefore, students can quickly and more effectively use these Android-based applications in learning. Mathematics learning is one of the subjects that can take advantage of this application.  
Mathematics is a subject that has an important role in life Ashari et al. (2020), considered the most feared subject by most students (Kumullah & Tayibu, 2021). Where mathematics


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 Moh. Mahfud Effendi 2

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## ABSTRACT

**Article History:**

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**Keywords:**

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## A. INTRODUCTION

In today's information and communication era, smartphones have become increasingly sophisticated technology. For this reason, a smartphone is no longer an obligation but has become a necessity for everyone (Nurhikmah, H. et al., 2021). The most widely used smartphones are Android-based smartphones (Qohar et al., 2021). Android is a technology that is widely used in learning (Yaniawati et al., 2021). Through android, students can easily open the learning applications they want. Therefore, students can quickly and more effectively use these Android-based applications in learning. Mathematics learning is one of the subjects that can take advantage of this application.

Mathematics is a subject that has an important role in life Ashari et al. (2020), considered the most feared subject by most students (Kumullah & Tayibu, 2021). Where mathematics

itself is a subject related to concepts that are still abstract (Ardhiyah & Radia, 2020). This abstract concept causes students to tend to think of mathematics as a difficult and frightening subject because it only counts and is related to formulas and numbers that are still abstract (Hidayatullah & Suprpti, 2020). Students think that mathematics is a difficult thing and in the end, many of them do not like mathematics (Suddin & Deda, 2020). So many students are less interested in mathematics. Build a curved side room (tube) is material that students are less interested in learning mathematics (Yongxing Huang et al., 2021). Based on the results of observations and interviews with teachers, it was found that many students had problems understanding the material, especially distinguishing the sides of the tube, memorizing the formula for the surface area and volume of the tube, and so on, which made students feel confused and difficult. As a result, their low motivation to learn mathematics results in less than-optimal learning outcomes.

In the process of learning mathematics, students must have the motivation to learn to support their willingness to learn (Fatayan et al., 2022). With the existing motivation, they can improve their learning outcomes well (Fuqoha et al., 2018). In another sense, with an inner intention to encourage students to learn, these students can obtain the desired learning outcomes. From these learning outcomes, a student can find out their capacity and abilities after the learning process takes place (Lin et al., 2017). For this reason, so that students can understand the material explained by the teacher, they need something that can support and assist them in the learning process so that they can increase motivation and achieve good learning outcomes (Firdayati et al., 2021).

Android-based learning media is the right choice to increase student motivation and learning outcomes in learning (Elshareif & Mohamed, 2021). Where the learning media is in the form of a suitable application implemented as a mathematics learning media (Latifa et al., 2020). The software used to create Android-based learning media is a codular website. Codular is a web-based program that can be used to create android learning media in the form of applications with block programming without the need for coding (Nugraheny & Wahyuningsih, 2022). For this reason, this website is very effective as material for making learning applications.

Research in the form of developing Android-based mathematical media has been carried out a lot. Research in the form of developing Android-based mathematical media has been carried out a lot. As was done by Sulistio & Qohar (2020) entitled "Development of Instructional Media "Game Math Comic Story" Based on Android on Number. "The results of this research are to produce android media in the form of games in the form of comics, and websites to create these media using appsgeyser.com. Meanwhile, in this study, it produced android-based media in the form of an application with a website to make this media, namely codular. Then, research by Jubaerudin et al. (2021) entitled "Development of Android-Based Interactive Media Assisted by Articulate Storyline 3 in Mathematics Learning During a Pandemic". The results of this study state that the media that has been developed is feasible and meets valid criteria to be used as a medium for learning mathematics. However, the media using the Articulate Storyline 3 software still has some weaknesses in some of the appearance and features that exist. Therefore, researchers want to develop a learning media with an attractive appearance with several existing features by using codular website

software, which was carried out in a study entitled "Development of Codular-Assisted Android-based Mathematics Media to Increase Student Motivation and Learning Outcomes."

4 By the explanation/description above, this study aims to develop codular-assisted android-based mathematics media to find out increased motivation and student learning outcomes in learning mathematics on build a curved side room (tube). So the product of this research is android-based mathematics media which can increase students' motivation and learning outcomes in mathematics.

## B. METHODS

8 This research is a type of research and development (R&D). This study aims to produce and develop a product in the form of an Android-based mathematics learning media named "Bcurstube Math." Bcurstube Math stands for Build a Curved Side Room Tube Math. The development model used in this research is the ADDIE model, which consists of 5 stages: analysis, design, development, implementation, and evaluation (Tarigan et al., 2021).

At the analysis stage, three analyses were carried out: problem analysis, curriculum analysis, and learning media analysis. Problem analysis is carried out to find out the problems that occur in the field and find out the facts that happen in the field by conducting interviews. Curriculum analysis is carried out to determine core competencies and basic competencies which aim to determine learning content and determine student achievements in learning materials. Analysis of learning media is used to determine the media used in schools to create effective and efficient learning media.

Furthermore, the design stage aims to design or design learning instruments and media that will be developed. This stage includes making a grid on the instrument, making media designs, compiling materials, practicing questions and answers, and quizzes. Apart from that, the researchers also made backgrounds, images for view flippers, icons, application menus, and navigation buttons used in Android media designs. For this reason, researchers design optimally to produce attractive media.

The development stage is carried out by making the product according to the design that has been made. The learning media is made using codular website software, and other supporting elements such as Canva and PowerPoint. After the media has been developed, then the media is validated by experts. The validation results from these experts are used as a basis for determining whether the media is appropriate or not used or tested for students in learning.

At the implementation stage, a pre-test was administered, which was used to measure students' initial abilities, as well as a motivational questionnaire to measure students' motivation towards mathematics. Then do trials on students by applying the android media. And the next step is giving a post-test to measure the increase in students' abilities after the application of the android media and a motivational questionnaire to see an increase in students' motivation towards mathematics after the application of the android media.

In the final stage, namely evaluation, the process of analyzing the results of the data is carried out to assess the increase in learning outcomes and student learning motivation. Data analysis on student learning outcomes was analyzed using the T-Test using SPSS. Meanwhile, data analysis on students' learning motivation used descriptive statistical analysis. The



analysis on the T-Test test has hypothesis  $H_0$ , namely, there is no effect on the use of android-based mathematics media in improving student learning outcomes and  $H_a$  there is an effect of using android-based mathematics media in improving student learning outcomes. The conclusion on the T-Test test if the significance value of the t-test is  $> 0.05$  then  $H_0$  is accepted and  $H_a$  is rejected. This means that there is no effect of using Android-based mathematics media in improving student learning outcomes. Then if the significance value of the t-test  $< 0.05$  then  $H_0$  is rejected and  $H_a$  is accepted. This means that there is an effect of using Android-based mathematics media in improving student learning outcomes.

The subjects in this study were 30 class IX students at MTS Muhammadiyah 1 Malang. This study's data sources came from several lecturers, teachers, and students. The instruments used are motivational questionnaires, media validation questionnaires, learning tests, and documents. Data collection techniques in this study were interviews, questionnaires, tests, and documents. Observations or interviews were carried out at the analysis stage to obtain data regarding the learning process and the media used in the learning process. While the questionnaire was given to several validators, namely three lecturers and one teacher, to provide an assessment and a response to the learning media that the researcher had developed. In addition, the questionnaire was also used to measure the increase in student motivation. The test is used to measure the ability to increase student learning outcomes after giving trials on learning media. The test is carried out by giving a pre-test at the beginning before carrying out the media trial, and the post-test is given at the end after the students are tested. And documents are used for analysis to determine the RPP used in schools.

## C. RESULT AND DISCUSSION

### 1. Analysis Stage

At this stage, there are three analyzes obtained in the study. Based on observations and interviews, the first analysis, namely problem analysis, found the problem that students need effective and efficient learning media and low student motivation in learning mathematics which results in less than optimal student learning outcomes. The second analysis is curriculum analysis, the curriculum used at MTS Muhammadiyah 1 Malang is using the 2013 revised 2016 curriculum. And the last analysis is the analysis of learning media, that the school uses contextual learning, so it needs Android-based media that students can use to increase motivation and learning outcomes. According to Adrizal et al. (2020) android media is a medium that can increase student motivation and learning outcomes with media characteristics that have attractive, practical, and flexible visualizations. Based on this, researchers are interested in developing Android-based learning media in the form of learning applications. The application is called "Bcurstube Math." The application contains material, practice questions, and also quizzes to assist students in learning the material for Build a Curved Side Room (Tube).

## 2. Design Stage

At the design stage, the researcher made the instruments used in the learning media trials, including several grids such as media feasibility questionnaires, learning motivation questionnaires, pre-test and post-test questions, and interview guidelines. And also designed some content for learning media such as Core Competencies, Basic Competencies, Materials, Practice Questions, and Discussions, as well as Quizzes related to Basic Competencies, Materials, Practice Questions, and Discussions, as well as Quiz related to Building a Curved Side Room (Tube). Next, create several icons for displaying menus on learning media and also prepare several images for the background and images for the view flipper.

## 3. Development Stage

At the development stage, the design and manufacture of the android media are carried out using codular website software. In addition, media creation is also assisted by using other applications, namely Canva and PowerPoint. After the media has been designed and the media is ready, the media can be installed on android using the exported link on the Kodular website software.

The initial appearance of the media will show the initial appearance of the start. Pressing the start button will display several main menu displays consisting of profile menus, instructions, KI/KD, materials, exercises, and quizzes. The profile menu displays a short description of the android media creator's bio. Then the menu instructions will explain how to use the menu button on each display. The KI/KD menu will display several descriptions regarding Core Competencies and Basic Competencies regarding the material presented, namely Build a Curved Side Room (Tube). Furthermore, the material menu contains several sub-menus consisting of sub-chapter coverage on the Material of Build a Curved Side Room (Tube). Students can alternately press the sub-menu button on the display, which will display the contents of each material. The practice menu contains practice questions and also a discussion of the answers to these questions. In this menu, students can actively fill in answers in the space provided before students see the discussion of answers. On the last menu, the quiz contains evaluation questions to measure students' abilities after using the android media.

After the media is developed, the researcher then validates the feasibility of the android media, which aims to determine the validity of the android media. The validation process was carried out by four validators, namely three lecturers and a teacher. The results of the validation are calculated using percentages with the following formula (Anshori & Novianingsih, 2021).

$$\text{Percentage} = \frac{\text{Total score obtained}}{\text{Total maksimum score}} \times 100\% \quad (1)$$

After calculating the percentage, then analyzed based on the eligibility criteria of the media (Fadiana et al., 2021), as shown in Table 1.

**Table 1.** Media Eligibility Criteria

No.	Score (%)	Eligibility Category
1.	76% - 100%	Very Good
2.	51% - 75%	Good
3.	26% - 50%	Less
4.	< 26%	Very Less

The table of media feasibility results obtained from media validation by several validators, as shown in Table 2.

**Table 2.** Media Feasibility Results

No.	Validator	Score (%)	Eligibility Category
1.	Validator 1	77.6%	Very Good
2.	Validator 2	86.8%	Very Good
3.	Validator 3	97.3%	Very Good
4.	Validator 4	92.1%	Very Good
Total Average Score (%)		88.4%	Very Good

Table 2 above shows that the total average overall score is 88.4% which is in the very good category. So it was decided that this android media met the eligibility criteria of the media and were very suitable for learning mathematics.

#### 4. Implementation Stage

This stage is applied to learning mathematics class IX with a total of 30 students. In the early stages of implementation, a pre-test and an initial motivation questionnaire (pre-test) were given to students, which aimed to find out students' initial understanding and also find out students' motivation towards mathematics before the media trials were carried out. At this stage, several students were unable to attend, so they did not take part in filling out the motivational questionnaire and also the pre-test. Then a trial was carried out by applying android-based mathematical media with material to build a curved side room (tube) for students. The trial process is carried out by distributing links to students to download the Android-based application on each student's smartphone. Then students are directed to open the media and open all existing menus and complete the practice questions and quizzes in the application. Furthermore, the last step is to give a post-test and final motivational questionnaire (post-test) to students to find out the increase in student understanding and increase in student motivation after the application of the media.

#### 5. Evaluation Stage

This stage is the last stage in the media development process, namely by carrying out the process of analyzing the results of the data obtained from the previous stages. The results of the assessment of the learning outcomes test and also filling in the student learning motivation questionnaire are used as the basis for determining the effectiveness of the product being developed. Learning outcomes tests are given to students to obtain information related to students' understanding of the material that has been given. The table of results of

the analysis of student learning outcomes tests using the T-Test, which is calculated using SPSS, as shown in Table 3 and Table 4.

**Table 3.** Result of Paired Samples Statistic T-Test

		Paired Samples Statistics		
		Mean	Std. Deviation	Std. Error Mean
Pair 1	PreTest	41.67	37.639	15.366
	PostTest	91.67	20.412	8.333

**Table 4.** Paired Samples T-Test Result

		Paired Samples Test						
		Paired Differences				t	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	PreTest - PostTest	-50.000	31.623	12.910	-83.186	-16.814	-3.873	.012

The results obtained after carrying out the T-Test test were that there was a significant difference between student learning outcomes, with an average pre-test score of 41.67 and a post-test of 91.67. Then the pre-test standard deviation value was 37.639 and the post-test standard deviation was 20.412, this shows that the data results make the data distribution more homogeneous as indicated by  $20.412 < 37.639$ , these results can make class abilities more homogeneous as seen from the standard deviation of the post-test is smaller than the pre-test. As well as obtained sig. (2-tailed)  $< 0.05$ . So it can be concluded that there is a significant difference between learning outcomes in the pre-test and post-test, so there is an influence on the use of android-based mathematics media in improving student learning outcomes.

To determine whether there is an increase in student motivation, student learning motivation is measured using two tests, namely the initial motivation questionnaire (pre-test), which is carried out before the media trial, and the final motivation questionnaire (post-test) which is carried out after the media trial. The table of results of student learning motivation before and after the trial is presented, as shown in Table 5.

**Table 5.** Pre-test and Post-test Results of Student Learning Motivation

No.	Score Intervals (X)	Number of Students				Criteria
		Pre-test	Score (%)	Post-test	Score (%)	
1.	$60 < X \leq 80$	0	0	25	83.33%	Very Good
2.	$40 < X \leq 60$	28	93.33%	5	16.67%	Good
3.	$20 < X \leq 40$	2	6.67%	0	0	Less
4.	$1 < X \leq 20$	0	0	0	0	Very Less
Total		30	100%	30	100%	

Based on Table 5 above, information was obtained that in the pre-test results, there were 28 students out of 30 students with a percentage score of 93.33% who had motivation in the good criteria, the remaining two students with a percentage score of 6.67% were in the fewer

criteria. In the post-test, there were 25 students out of 30 students with a percentage score of 83.33% had very good motivation, and the remaining five students with a percentage score of 16.67% were in good criteria. This shows an increase in student motivation after using Android-based media. Thus it can be concluded that the use of android-based mathematics media with the Material of Build a Curved Side Room (Tube) developed in this study can increase student learning motivation.

#### D. CONCLUSION AND SUGGESTIONS

Based on the results of the research and discussion that has been carried out, it can be concluded that the android-based mathematics media named "Bcurstube Math" is declared valid and can be used in learning. This validity was obtained based on the assessment of 4 validators who were in the very decent category. So that the media can be used by students in learning mathematics. Based on the results of tests conducted on student learning outcomes tests, it was found that the average pre-test and post-test scores increased. This shows that there are significant differences between student learning outcomes so there is an influence on the use of Android-based mathematics media in improving student learning outcomes. The results of the pre-test and post-test on the student learning motivation questionnaire obtained the highest results in the good criterion category. This shows that the use of android-based mathematics media developed in this study can increase student learning motivation. So it can be concluded that the android-based mathematics media developed by researchers on the Material of Build a Curved Side Room (Tube) can increase student motivation and learning outcomes.

In this study, researchers suggest teachers use android-based media to increase student motivation and learning outcomes. The goal is that students can easily understand the material and are interested in learning mathematics on curved side chambers (tubes). Through Android-based media students can easily study wherever and whenever because the media can be accessed easily. Therefore, it becomes important in choosing the right and appropriate mathematics learning media for students.

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