

## USAGE OF SCRATCH IN MAKING GAME-BASED MATHEMATICS LEARNING MEDIA TO IMPROVE STUDENTS' MATHEMATICAL SKILLS

Barra P. Pradja<sup>1</sup>, Nisvu Nanda Saputra<sup>2</sup>

<sup>1,2</sup>Pendidikan Matematika, Universitas Muhammadiyah Tangerang  
e-mail: [barrapradja@gmail.com](mailto:barrapradja@gmail.com)

### Abstract

This research is to see the use of *Scrath* as a media creation tool for Game-based mathematics learning to improve mathematical abilities, the improvement of mathematical abilities assessed is problem-solving and mathematical reasoning. This type of research is development research using the ADDIIE model (*Analysis, Design, Development, Implementation, Evaluation*) the research subject is grade VIII junior high school students and the research location is at SMP Dharma Siswa Kota Tangerang with 33 research subjects. Game-based Learning Media before being implemented was validated by experts, the validation results stated that the media was in the valid category and could be used in schools. After being implemented in schools, it is known that game-based learning media can improve mathematical reasoning skills and mathematical problem-solving skills are at a good level.

**Keywords:** Scratch, problem-solving, mathematical reasoning

### Abstrak

Penelitian ini untuk melihat penggunaan *scrath* sebagai alat pembuatan media Pembelajaran matematika berbasis game untuk meningkatkan kemampuan matematis, peningkatan kemampuan matematis yang dinilai adalah pemecahan masalah dan penalaran matematis. Jenis penelitian merupakan penelitian pengembangan dengan menggunakan model ADDIIE (*Analysis, Design, Development, Implementation, Evaluation*) subjek penelitian adalah siswa kelas VIII SMP, lokasi penelitian di SMP Dharma Siswa Kota Tangerang dengan subjek penelitian sebanyak 33 orang. Media Pembelajaran berbasis game sebelum diimplementasikan dilakukan validasi kepada para ahli, hasil validasi menyatakan bahwa media dalam kategori valid dan dapat digunakan di sekolah. Setelah diimplementasikan disekolah diketahui bahwa media Pembelajaran berbasis game dapat meningkatkan kemampuan penalaran matematis dan kemampuan pemecahan masalah matematis berada pada taraf baik.

**Kata kunci:** scrath, pemecahan masalah, penalaran matematis

## INTRODUCTION

Today's technology is developing rapidly, all aspects are currently using and utilizing technological developments. The development of technology must be used properly. The world of education, especially the current learning process, is also influenced by these technological developments. There are so many types of applications and software that can be used in the learning process. Technology in Learning if utilized properly will be able to help improve the quality of education, especially the learning process. Indeed, technology if used properly can have a positive effect on users. The use of technology can be applied to all levels and all subjects. Technology can be used in the learning process by developing devices in the form of learning media. The use of learning media can have a good influence on improving students' abilities. According to (Hasiru et al., 2021) effective learning media can be used to

help the mathematics learning process so that the teaching and learning process can run optimally. This opinion is supported by the (Salsabila & Setyaningrum, 2019) that game-based learning media is effective in improving students' cognitive abilities.

Currently, students are very close to technological devices such as computers or smartphones. This certainly cannot be avoided, therefore this condition can be put to good use. We don't need to prohibit children from following developments and using smartphones. But we only need to direct students from using smartphones as a medium of play to smartphones as a means to learn. So that the condition experienced by students is playing while learning. Playing games while learning can provide enormous benefits (Karo-karo & Rohani, 2018), the use of game media in the teaching and learning process can provide the following benefits: (1) convey information clearly; (2) increase student motivation to learn; (3) overcome limitations such as sensory limitations, space and time.

In mathematics learning, the difficulty often experienced by students is to understand concepts or basic material that is abstract. From observations made in the field, it is known that the cause of this is that the learning process carried out is still teacher-centered and the use of learning media is still very lacking. This condition causes students to not be able to understand concepts well and cannot develop their way of thinking as a result of which students' ability to solve problems and mathematical reasoning is still relatively low. This is because students in the learning process students are accustomed to receiving rather than discovering the concept.

Problem-solving and mathematical reasoning skills are abilities that must be mastered by students. based on the results of the PISA Mathematics survey in 2018, Indonesia's ranking in PISA is ranked 73 out of 79 countries (Ministry of Education and Culture, 2019). From these results, it is known that the problem faced by students is not developing mathematical skills properly. So the development of mathematical abilities, namely problem-solving and mathematical reasoning abilities, must be well developed.

In Learning, two types of Learning devices are known, namely Learning devices based on materials or tools for making them (Rini, 2020). Learning devices developed based on paper, this learning example textbooks, student activity sheets, and learning devices developed using technological assistance such as software, animation, games, and others.

To overcome problems and so that learning objectives can be achieved and can develop student abilities, a learning device or learning media is needed that can present abstract concepts into concrete and increase enthusiasm and remaining participation in learning is to develop game-based learning media.

The creation of game-based learning media can be developed with the help of various applications or software that already exist. In this research game-based learning media will be developed using and utilizing scratch applications. The scratch application is a visual programming application for the learning environment that can be used by beginners, namely teachers without having to master a relatively complicated programming language. According to (Iskandar & Raditya, 2017) the Scratch application makes it easy for everyone from various elements and backgrounds to create game animations and games as well as their own interactive stories and simulations.

Scratch is an app developed by the Lifelong Kindergarten Group of the MIT Media Lab of the Massachusetts Institute of Technology. Scratch is a programming application that can be mastered and run without the need for complicated programming languages.

The use of scratch will be made it easy to create programs by arranging command blocks visually. Making a program from scratch users simply drag and drop a block on the module. Scratch can be run easily without having to master complicated programming languages. Scratch learning can be used to create very interesting learning media including mathematics learning (Iskandar & Raditya, 2017). The use of scratch can lead students to create their own interactive stories, animations, and games with code, thus inviting students to think creatively, systematically, and collaboratively, this is very suitable for the needs in mathematics learning. The scratch application can be used both offline and online. Here's the initial look at the scratch application

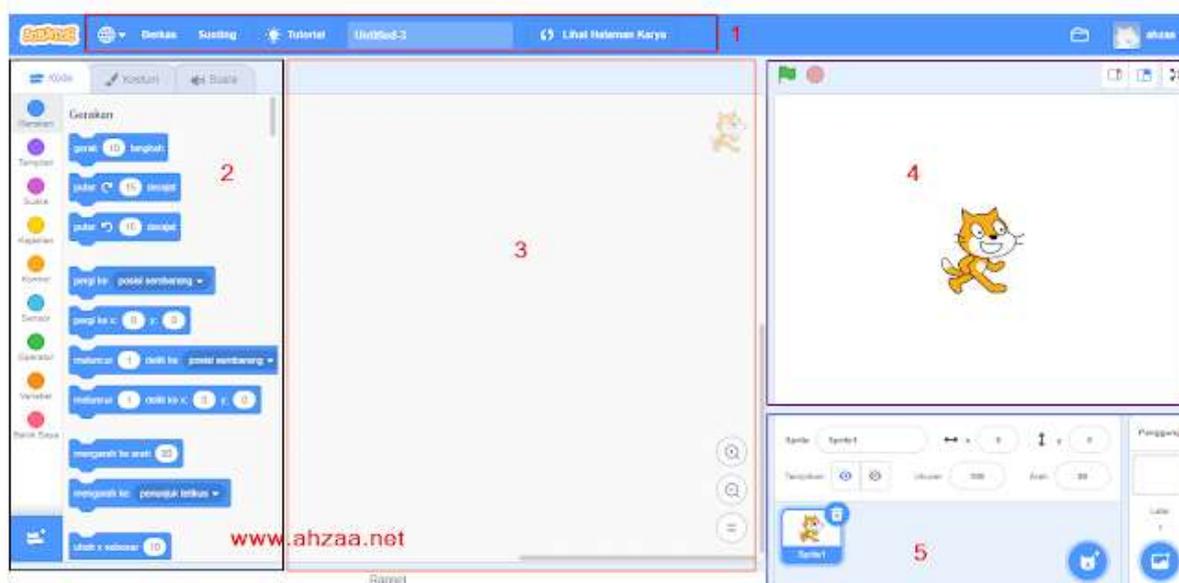


Figure 1. Scratch

Learning Media is a means to convey messages in Learning which can present concepts in concrete. So that it can instill critical and creative characters as support for learning. This is following the opinion (of Nugroho et al., 2017) state that the use of learning media can increase students' creative, logical, and critical thinking in learning. According to (Purwanti, 2015) Learning media can be used as a tool to convey information and knowledge and build interaction between educators and students.

The selection of learning media must pay attention to the following factors, namely objectivity, teaching programs, and program targets. Learning media used and chosen in mathematics learning must be able to change the perception of students so that they can convey messages precisely, clearly, and easily understood. According to (Maharani et al., 2018) the use of appropriate learning media can increase student participation in learning. Therefore, the use of media in learning is an obligation and must.

Problem-solving ability is an ability that must be possessed by students to get used to finding solutions if faced with problems in everyday life. According to (Sri Sumartini, 2015) mathematical problem solving consists of five indicators, namely (1) Problem identification and data coverage; (2) create mathematical models (3) choose a solving strategy; (4) interpret; (5) apply meaningful mathematics. While the indicators of mathematical reasoning according to (Agustin, 2016) are analyzing situations, planning the solving process, solving problems systematically, and drawing conclusions

Based on the description above, the problem formulation of this study is how to develop game-based learning media using scratch applications, and whether this game-based learning media can improve students' problem-solving and mathematical reasoning skills.

## **METHODS**

The type of research is development research with the ADDIE development model (Analysis, design, Development, Implementation, Evaluation). The purpose of this study aims to produce products in the form of learning devices, namely game-based learning media that can be used to improve problem-solving skills. The research subjects were grade 8B students at Dharma Siswa Junior High School with a total of 34 people. The research will be conducted in early March 2023. The data collection instrument used student response questionnaires, teacher response questionnaires, problem-solving ability tests, and mathematical reasoning. Products developed in the form of game-based learning media using scratch applications.

## **RESULTS AND DISCUSSION**

### **Analysis Phase**

At the analysis stage, researchers collect the needs of students and teachers and the problems faced in schools. The analysis was carried out by observation and interview techniques as well as the provision of initial tests. From the results of observations and interviews conducted with students and teachers, it is known that students still have difficulty understanding and remembering the concepts being taught by the teacher. Students have difficulty in doing problems that are problem-solving and mathematical reasoning. The results of interviews and observations on teachers, learning tools, and learning materials used by teachers are still conventional, namely, teachers use learning devices and materials that have been provided by schools such as textbooks, LKS obtained from publishers, where the LKS still presents with a material summary structure, sample questions and followed by practice questions. From the interview, it is also known that teachers rarely use learning media, the learning media used by teachers is only in the form of PowerPoint and learning videos.

### **Design Phase**

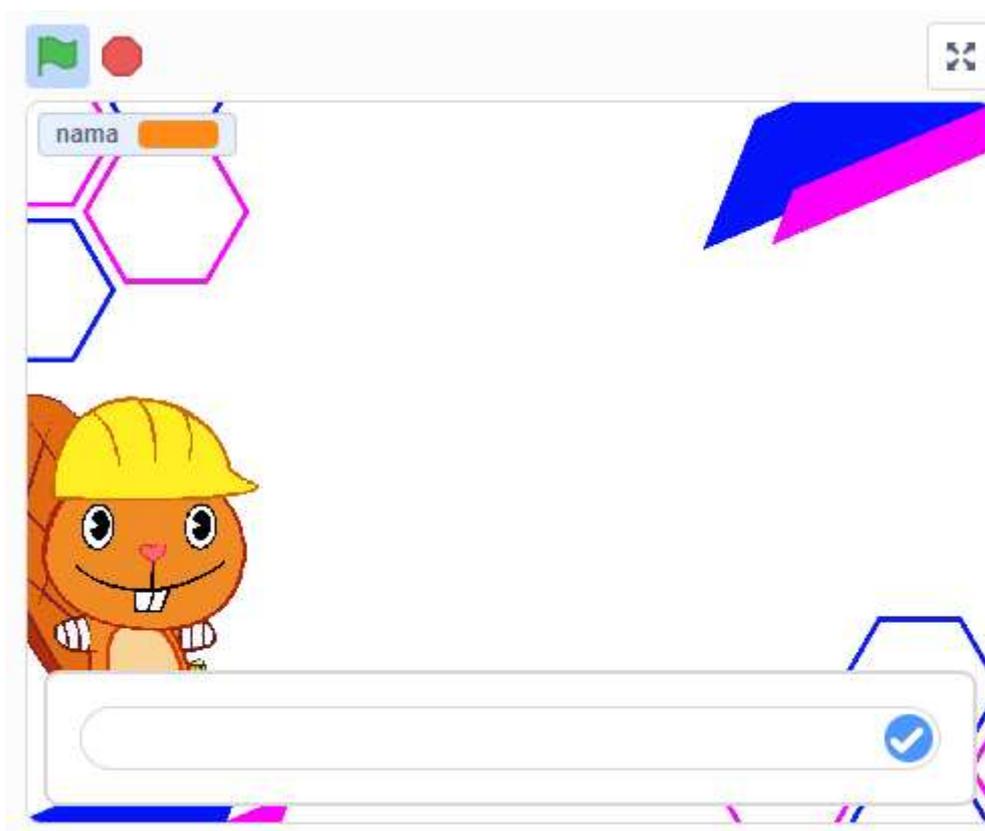
Based on the results obtained from the analysis stage, it can be concluded that one of the shortcomings in the learning process is the unavailability of learning media that can improve students' ability to solve problems and mathematical reasoning. Therefore, an

interactive learning media will be developed using the scratch application. This interactive learning media maintenance aims to make the learning carried out into student-centered learning. In this initial design, media was developed using the scratch application, learning media using games as a means of presenting the material. The material chosen is to build a flat side space.

### Development Phase

The development stage produces game-based learning media using scratch. The game-based media development stage starts with collecting the materials needed to create media, including creating an account that will be used in making game-based learning media. Media creation is done on the website <https://scratch.mit.edu/>.

The media developed is interactive so that there is an interaction between learning media and students that aims at student-centered learning. here is the initial view of game-based learning media



On the second page after the front page of the media, it is equipped with game instructions to facilitate students in operating the media



The next page goes into the game where students should be able to find flat-sided spaces in everyday life.



On the second page after the front page of the media, it is equipped with game instructions to facilitate students in operating the media

After the media is declared complete and has undergone revisions and improvements. The product from the development is validated by experts. The following validation results can be seen in Table 1 below :

**Table 1: Game-Based Media Validation Results**

No	Assessed aspects	Average Score
1	Media Display	3.5
2	Media use	3.6
3	Media creation	3.65
4	Media use	3.4
5	Usefulness	3.6
Total validity score		3.55

Based on Table 1, it is known that the average score of validator assessment results for all aspects is 3.55, which is how many are in the valid category, so it can be concluded that game-based media can be declared valid. Validation is only done in one stage because there are no major revisions from experts, only a few small inputs and the media has been improved based on input from experts.

Furthermore, validation of the learning media material was carried out. The results of the validator assessment can be seen in the following table 2 :

**Table 2: Material Expert Validation Results**

No	Assessed aspects	Average score
1	Material	3.45
2	language	3.3
Average total score		3.37

Based on Table 2 above, it is known that the results of the material expert assessment obtained an average score of 3.37 which is in the valid category. The assessment of the material expert provided some input and the media was revised based on the results of input from the material expert.

### **Implementation Phase**

In the implementation stage, game-based media is applied in the classroom learning process, the goal is to see if game-based media can improve problem-solving and mathematical reasoning skills. At the implementation stage, the activity begins with giving a pretest to students to see if the initial ability of students has not been carried out Learning using game-based learning media. After the initial test was carried out, they continued learning using game-based learning media for as many as 4 meetings with material to build a

flat side room. After 4 lessons were conducted, the final stage of the meeting was post-tested. Implementation phase using one group pre-test design – post-test design.

**Table 3: Schematic of one group pre-test – post-test design**

Pre Test	Treatment	Post-test
$T_1$	X	$T_2$

To see the effectiveness of game-based learning media using a comparison of N-Gain values using the formula

$$NGain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

To see the classification of N-Gain scores can be seen in the following table:

**Table 4: Gain Value and Its Classification**

Gain	Classification
$G \geq 0.7$	high
$0,7 > G \geq 0.3$	Keep
$G < 0.3$	Low

Based on the calculation results of the pretest and posttest, N-gain results of 0.73 were obtained, a value based on the classification in Table 4 can be concluded that the increase in ability is in the high category

Furthermore, data analysis obtained from student response questionnaires after using game-based learning media in the learning process can be seen in the following table:

**Table 5: Results of Student Response Questionnaire Analysis**

No	Assessed aspects	Maximum score	Earned score	Percentage
1	Instructions	40	36	90
2	Display	40	34	85
3	Material	40	33	82,5
4	Questions and Sample Questions	40	36	90
<b>Average</b>				<b>86</b>

Based on the table above, it is known that the average student response to learning using game-based learning media is 86 percent, and how much in the category is very good?

## **Evaluation Phase**

Based on the results of development from the beginning to the implementation stage, there are several inputs from experts which then become material for revising the developed product. In the implementation of Learning several stages of Learning cannot be carried out optimally because some devices cannot operate properly.

## **Discussion**

Learning Media is developed using scratch applications, the type of media developed is game-based media that aims to improve problem-solving and mathematical reasoning skills. Learning Media developed is validated to material experts and media experts. From the results of the experts' assessment, it is known that the media is already in the valid category and can be used in the learning process. The results of media expert assessments obtained an average of 3.55 while material experts obtained an average of 3.37.

Learning using game-based media was carried out 4 times which began with the pre-test and ended with the post-test. Pretests and posttests are conducted to see the improvement of students' problem-solving and mathematical reasoning skills. based on the results of the analysis of the pretest posttest using N-Gain analysis, it is known that the effectiveness of the increase is 0.73 which is in the high category. The use of game-based learning media can improve students' mathematical reasoning and problem-solving skills because game-based learning media can provide stimulus to students so that students are more active in the learning process. This is my opinion (Buchori, 2019) states that the use of interactive learning media can improve students' mathematical abilities, one of which is mathematical reasoning ability and problem-solving ability. The results of research from (Arifin et al., 2020) that the use of learning media using technology can improve students' mathematical abilities.

## **CONCLUSION**

Based on the previous description, it can be concluded that learning media developed using game-based scratch applications is declared valid based on the results of assessments conducted by media experts and material experts. And based on student response questionnaires, it is known that the use of game-based learning media in learning is already in the good category. The use of game-based learning media in learning can improve students' problem-solving and reasoning skills.

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