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Research Article

The Online Game Design Uses Scratch, Geogebra, and Geogebra AR Through Mathematics Education Multimedia Lectures

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Abstract.
This study aims to design online mathematics games using Scratch, Geogebra, and Geogebra AR through multimedia education mathematics courses. This study used the multimedia development life cycle. Participants in the study were 41 students (13 male and 28 female) of fifth-semester in a multimedia course in mathematics education at a university in West Java, Indonesia. The research instrument was a questionnaire through Google Forms, performance appraisal, observation, and interviews. Based on the research results it is known that Scratch, Geogebra, and Geogebra AR can be used in math game design even though previous students have not studied both, but the results are good. The author suggests that students can try out these math games at school during research or teaching practice. In addition, the authors hope that the game can be published on the internet so that it can be used by many students.

Keywords: game online, scratch, geogebra AR

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1. INTRODUCTION

The development of online games at this time is very fast. It can be seen from the internet users in the world as many as 4.54 billion people with the most users on games [1]. Therefore, there is a need for the role of education in games in Indonesia so that this nation has an identity [2]. The potential of the internet is very large to help students learn mathematics, so research is needed on math games [3]. Games are part of learning media that can be designed using the Scratch application. Scratch is an easy and attractive visual programming language that can be used by beginners (even of all ages) [4]. Through Scratch, you can learn to program without having to think about writing syntax [5] and can create media-rich interactive projects [6]. Scratch is widely used by young people [7] so it is suitable for game design in Mathematics Education Multimedia lectures.

Games can also be designed using Geogebra. According to the research results, it is known that gamification of mathematics learning can be designed through Geogebra [8, 9] Inquiry-game activity can also be implemented through Geogebra [10]. Likewise, math board games as a learning vehicle can be designed through Geogebra [11]. Furthermore, if the game is designed through Geogebra 3D, it can be displayed with augmented reality via ARCore by Google. Due to the availability of several applications and the importance of online game design in mathematics learning, this study aims to design online mathematics games using Scratch, Geogebra, and Geogebra AR through multimedia mathematics education courses.

2. RESEARCH METHOD

The research design followed Sugiarto by using the Multimedia Development Life Cycle (MDLC) development model through the following six stages [12]. First, the concept is the determination of program objectives and users. Second, design, which is making the program display plan. Third, collecting, which is the collection of materials as needed. Fourth, assembly, which is making applications based on the design stage. Fifth, testing, which is running a program to check the correctness of the program. Sixth, distribution, that is, the program is stored in a storage medium.

Research participants were a class of students consisting of 41 people (13 men and 28 women) for the 2020/2021 academic year and two teaching lecturers. The student is in the fifth semester of a multimedia course in mathematics education at the mathematics education department at a university in West Java, Indonesia. Where the lecture weighs three credits, it is carried out online, namely through the Zoom application, Whatsapp, Google Form, and e-learning. Students give consecutive presentations each week to report the progress of their game design for 16 meetings. The research instrument was a questionnaire through Google Form, performance appraisals, observations, daily journals, and interviews. Furthermore, the data were analyzed and explained according to the MDLC stages.

3. RESULTS AND DISCUSSION

The following is the game design process in multimedia education in mathematics through the Multimedia Development Life Cycle (MDLC) model.

3.1. Concept

The program is made in the form of a math game that can be played online by junior high school students. Through this game, it is hoped that students can learn mathematics with pleasure and enthusiasm so that they can understand mathematics well. The materials designed in the game in this study are integers, fractions, greatest common factor, least common multiple, set, algebra, linear equations in one variable, social arithmetic, perimeter and area of triangles/rectangles/circles, and prisms.

3.2. Design

The following is one of the results of game design by students on the concept of the circular area. Figure 1, it is known that students have made material designs on the game material area of a circle area. However, the full view cannot be written here because there are four pages on A4 size paper.

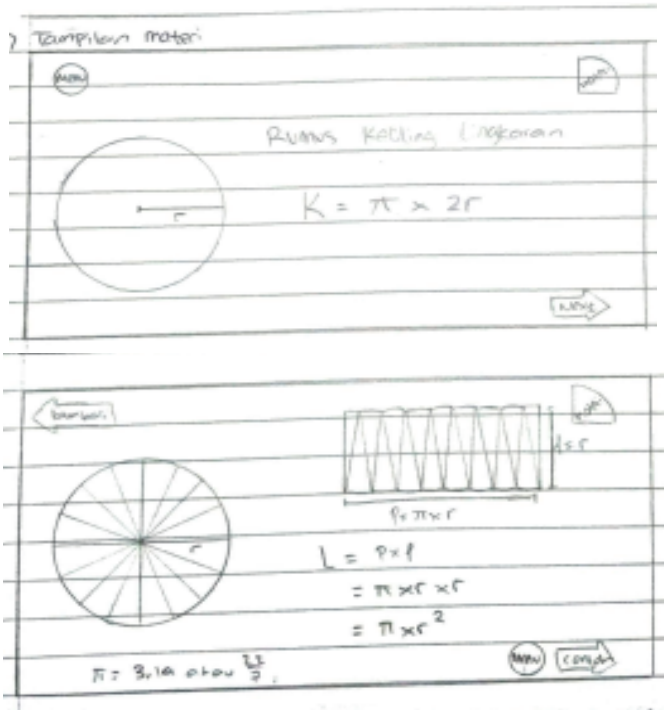

Figure 1: One of the game designs by students.

3.3. Collecting

At this stage, learning materials are collected, in the form of pictures, animated objects, or sounds. For example, in a game on the area of a circle, students determine how

to find the area of a circle. In Figure 1, it can be seen that the method chosen is an approach to the area of a rectangle.

3.4. Assembly

This stage is the process of making a game by what was made in the previous stage. The results of making a circular area media in Geogebra are as shown in Figure 2.

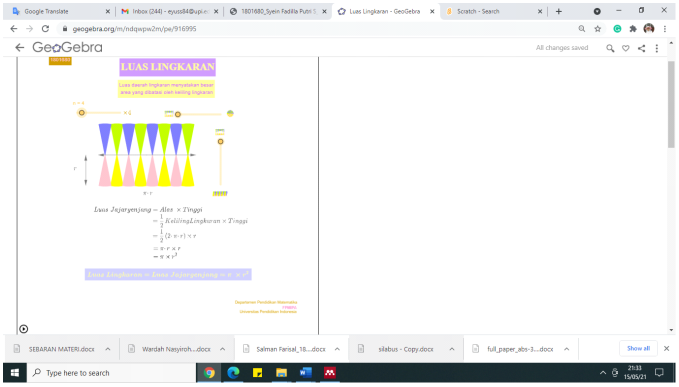

Figure 2: One of the game displays that have been designed in the geogebra application.

Eleven students designed games through Geogebra but only five programs can be seen through Geogebra AR. The remaining 30 students designed games through Scratch. Figure 3 is an example of the results of the game on the linear inequality of one variable in Scratch.

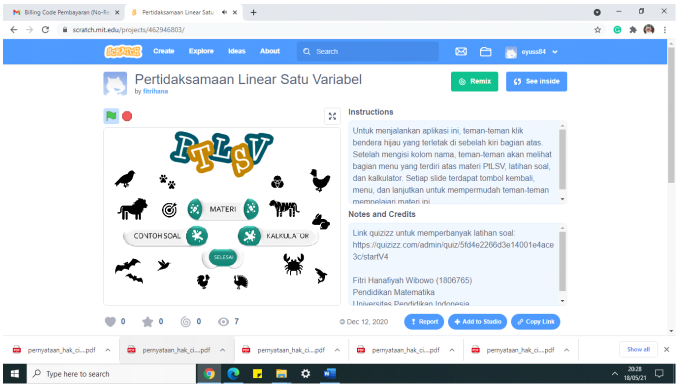

Figure 3: One of the game displays that have been designed in the scratch application.

3.5. Testing

This stage is carried out after completing the assembly stage. The trick is to run the program in either Geogebra or Scratch, and check whether the program is right or

wrong. This stage is also called the alpha testing phase (alpha test) where testing is carried out by a team of program makers (students and two lecturers).

3.6. Distribution

The distribution stage is the stage where the program is stored in a storage medium. The storage media used is Google Drive, https://www.geogebra.org/group/stream/id/VTsrD9gsh, and https://scratch.mit.edu/mystuff/#galleries. The results of the assessment of the mathematics game design process by the two lecturers are as follows.

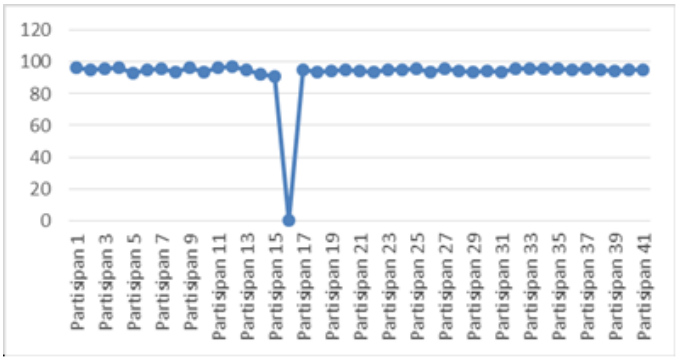

Figure 4: Acquisition of student scores at the end of the lecture.

Based on Figure 4, all students can make math games well except for one person who gets a zero score because he has never attended a lecture due to a laptop failure. Based on the results of the questionnaire, performance appraisals, observations, daily journals, and interviews, it is known that students are also seen to be very serious in working on the project, have a positive opinion on lectures, feel challenged, and get new experiences. Where are online lectures and assisted by e-learning, namely Spada UPI. The success of these lectures is supported by e-learning because it presents a rich learning environment and includes a variety of resources and solutions that can improve individual and group performance [13]. In addition, success has also been attributed to the media-rich interactive Scratch application [6], easy and attractive so that it can be used by beginners [4] to create programs without understanding writing syntax [5]. Geogebra also facilitates making games in mathematics learning [8, 10, 11] If the game is designed through Geogebra 3D, it will be more interesting to display with augmented reality through ARCore by Google.

In this study, online games have been designed and it is realized that the potential of the internet is very large in helping students learn mathematics in a fun way through games, so further research testing these games is needed [3]. Based on the results of similar research, Sudihartinih and Rachmatin reported that HTML and Flash can be used

in mathematical game design even though students had never previously studied both but self-taught and assisted by teachers produced quite good results [14]. Therefore, there are several application options in designing math games.

4. CONCLUSION

Based on the research results, it is known that the design of mathematics games through Scratch, Geogebra, and Geogebra AR can be solved properly. Even though the previous students had not studied both, the results were good. The author suggests that students can try out these math games at school during research or teaching practice. In addition, game programs can also be copyrighted and published via the internet.

Acknowledgments

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