Developing educational games using Lego Bricks-builder application for elementary school students to learn exponential number and character building

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Abstract

The era of revolution 5.0 has entered the world of education and provides disruptive challenges for teachers in realizing educational goals by utilizing digital technology to improve student competence and quality. This research is motivated by the existence of mathematics learning media that is less supportive, causing difficulties for students in understanding and solving problems related to mathematical materials, especially power numbers. The purpose of this study was to build an understanding of the mathematical concept of ranked number material by using the educational game Lego on the brick builder application in order to improve students' digital characters. This research is a type of research and development research which consists of two stages. The initial stage begins with an introduction in the form of drafting an experimental design. In the second stage, the prototype is in the form of introducing the features of the brick maker application to students and connecting them with the concept of ranking numbers and making LKS in the form of questions that will be tested on students. From the results of the study, it can be concluded that the application of educational games-based Lego on bricks builder application as a rank numbers learning media in elementary students' character can be used as a learning medium for the concept of ranking numbers. Thus, a number concept construction form is produced for elementary school students using a brick maker's application. With the use of digital technology as an effective learning media, it is hoped that it can present the character values of students.

Keywords: character education, educational games, exponential number, learning media

INTRODUCTION

The role of the teacher in the future is not only to provide knowledge to students, but also to be able to create a pleasant learning atmosphere for students. According to Ariyanti and Muslimin (2015), explaining materials to students does not have to be guided by books or modules, teachers can also create learning innovations that can work in their own interest, especially for elementary school students who are still classified as children. Teachers need to develop strategies so that the teaching and learning process can be implemented properly. However, in reality, there are still many teachers using learning models that tend to be boring during the teaching and learning process. This causes students' interest and interest in learning to be low. Especially in learning mathematics, which is considered by most students to be a difficult field. Therefore, teachers are required to be able to create new innovations for learning the media.

According to Maulidina et al. (2018), using the game method in the teaching and learning process can be used as an alternative for elementary school teachers so that students do not feel bored with learning. Learning efforts with this game approach can help students simplify their thinking patterns, especially in the field of mathematics. A mathematician named Zoltan P. Dienes, suggests that every concept in mathematics that is presented in a concrete form in the form of a game will be easy to understand well. Objects or objects in the form of games play a

very important role if they are manipulated properly in teaching mathematics. This method is in accordance with the condition of students who tend to prefer to play (Setyani et al., 2017). Thus, the game method can support the student learning process because, in addition to students being able to play, they can also hone their skills and abilities.

In this modern era, there have been many different digital game applications designed to be able to support the learning and teaching process. One of the game applications that can be used as an opportunity as a learning medium by math teachers is the brick builder application. BricksBuilder is a type of lego game that is packaged in digital form. Construction on Lego can help elementary school students with solving math problems related to numbers and powers (Munisah e, 2020). Thus, learning while playing a model is expected to make it easier for students to learn mathematics, especially in the concept of ranked numbers. The purpose of this study is to utilize the brick builder's application as an innovation in mathematics learning media on the concept of power numbers and it can be expected to be able to build students' character through the learning media.

RESEARCH METHOD

This study uses research and development methods using two stages of formative evaluation, namely the preliminary stage and the prototype stage. The purpose of this study is to build the concept of power numbers with the help of an application so that teachers can use this as an easy media tool for learning the concept of power numbers. The research subjects were two fifth grade elementary school students with the initials DA and LY. The first step is to prepare for the experiment. In this case, an initial design is needed that implements the initial ideas obtained from the literature study before designing the next activity (Zuliana et al., 2018). The prototype stage consists of self-evaluation, expert review, and one-to-one. The initial stage is to introduce features in the brickbuilder application. The second stage is to associate the concept of power number with the brick-making application. Third, the researcher asks questions for students to work on. Next on the worksheet will be the concept of exponential numbers. Researchers need information related to the use of this brickbuilder application for students; whether researchers can help students develop the concept of power numbers using lego, contained in the power number generator application; and researchers want to know how effective this media is used by students to calculate power numbers.

RESULTS AND DISCUSSION

The subjects of this study consisted of 2 elementary school students, namely DA and LY. The first stage of this research was to prepare the initial design. The prototype stage consists of self-evaluation, expert review, and one-to-one on DA and LY, then the results of the work are described in paragraph form.

Preliminary stage

The first stage begins with the initial design. The purpose of this stage is to build the concept of power numbers with the help of the brickbuilder application, so that teachers can use this application as a learning medium on the concept of power numbers. First, the researcher helps students to construct the concept of power numbers using Lego found in the brick builder's application. Second, the researcher determines and counts each number of round sides of the lego based on the brick builder's application. The number of rounded sides in the lego educational game is the point that will be used as a reference as the result of the number of the power. In this case, first, students must understand the rounded sides of the lego. Second, students must be able to arrange the Legos according to the calculations they want to calculate. Third, students must look at the arrangement of the lego and count the number of rounded sides. Look at Figure 1.
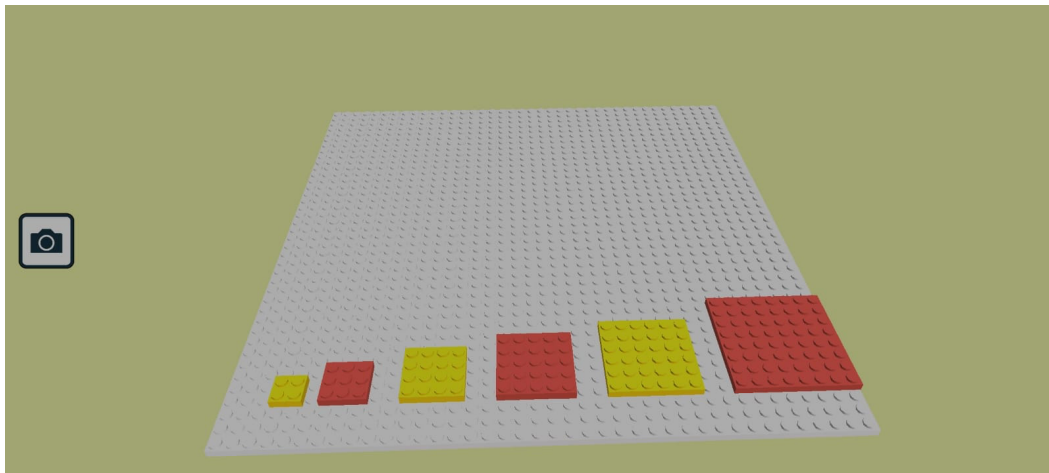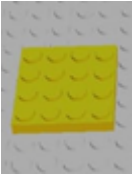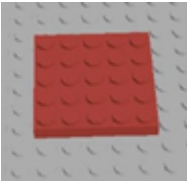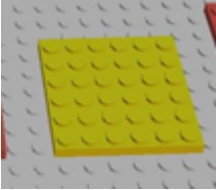
Figure 1. The concept of power numbers in the brick builder's application

The following shows the construction of the Lego educational game with the concept of exponential number.

Table 1. Lego Construction on the Concept of Powered Numbers

Bricks	Square Unit	Squared	Value
	2 x 2	2^2	4
	3 x 3	3^2	9
	4 x 4	4^2	16
	5 x 5	5^2	25
	6 x 6	6^2	36
Formula	n x n	n^2	...

Stage of prototyping

This prototype concept has been tested on two 5th grade elementary school students but has not been further validated by a team of experts.

First Trial

In the first experiment, the researcher explained the features contained in the brick builder's application to DA and LY. Second, the researcher explained the concept of exponent numbers using the application. Third, the researcher gave three different questions to DA and LY to work on. It involves two different questions that must be asked by DA and LY.

Table 2. Exercises on exponential numbers

Exercises DA	Exercises LY
1.) 3^2 = ….	1.) 2^2 = ….
2.) 7^2 = ….	2.) 4^2 = ….
3.) 6^3 = ….	3.) 5^2 = ….

From the first experiment, the two students, DA and LY, were able to solve the questions well. When viewed from the two questions, the process is almost similar to the multiplication operation. For this reason, students must first master the concept of multiplication operations. Not only that, the completion process requires students' accuracy and precision in calculating lego circles in the brick builder's application.
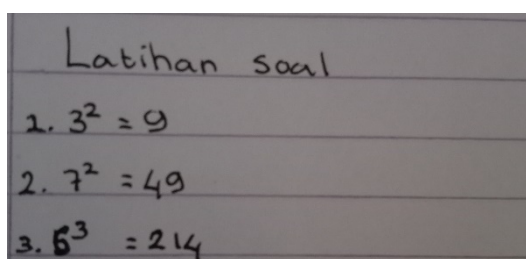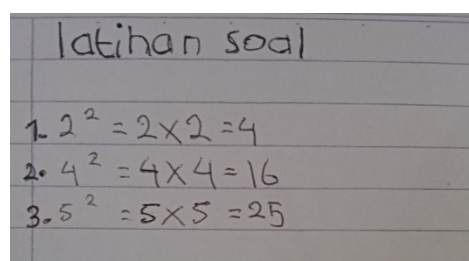

Figure 2. Answer from DA

Figure 3. Answer from LY

Based on the answers of DA and LY, there are differences in the solution flow. Where DA directly answers the results of counting circles on the lego without writing down the repeated multiplication form. And if you look at DA's answer number 3, DA is not careful in counting the circles on the lego, so the results are not the same as LY's answer. However, DA has tried his best to solve the problems according to his ability. It can be concluded that from the first experiment students needed to increase their accuracy in counting lego circles in the brick builder's application.

Second Trial

In the second experiment, researchers used a scientific approach, namely by making student activity sheets that were done individually. Students are given 35 minutes to work on 5 questions. It can be seen in Figure 4, namely the student activity sheet made by the researcher.

While in Figure 5 is a picture of DA students who are using the brick builder's application to answer questions.

Figure 4. Student Activity Sheet

Figure 5. Students using the bricksbuilder application

Based on the activity sheet above, it can be seen that the student activity sheet can train students to think systematically. DA and LY can solve problems well in a faster time. In this activity, students are expected to find solutions to existing problems.

Figure 6. DA Activity Sheet Answers

Figure 7. LY Activity Sheet Answers

Based on the answers to their activity sheets, it can be seen that the brick builder application makes it easier for DA and LY students to work on rank questions. They think that causing problems with this application can make them curious to try it. According to John M. Lennon (in Emut, 2003), learning media using game applications can attract elementary school students in the teaching and learning process. In line with that, according to Astini et al (2019), he argues that the teaching and learning process based on game applications can balance between learning and playing them, so that it can motivate students to improve knowledge and skills. So, it can be said that the second experiment in using the brick builder application as a

learning medium can run well and it is hoped that in the future teachers can create new innovations so that students are interested in learning.

Discussion

From the results of the research above, it can be seen that students can use the brick builder's application as well as a medium for learning mathematics on the concept of power numbers. This can be proven from the research results of Wandini (2017), that the application of Lego bricks in learning as a strategy to improve students' mathematical abilities in calculating numbers to exponents is said to be successful and proven correct. However, in this study, there are still shortcomings in the context of the accuracy and precision of students in counting Lego circles. So it is necessary to conduct more in-depth observations. Because this can help researchers see the characteristics of students and make learning more interesting. In this case, the author seeks to provide a worksheet that contains guidelines and tables to complete the calculation of numbers to powers. Thus, it creates curiosity in students to solve problems so that they work carefully in calculating numbers to power using the Bricksbuilder application.

The researcher will do this to make it easier for students to work on questions about rank numbers. By using this brick builder application, it is very helpful for students to work on math problems. This is because if elementary school students are given a question about the rank, of which there are many, they will have difficulty calculating the results of the rank. However, by using this application, they don't need to bother counting on their fingers, but they can easily count the circles on the Lego. With the brick builder's application, it is hoped that it can help students easily work on a number of problems.

In facing the era of society 5.0 where humans are centered on technology, it demands that teachers innovate in the form of utilizing digital technology. It cannot be denied that the existence of advanced education is marked by the use of educational media that support digital access. Thus, the BricksBuilder application is expected to be a medium for learning mathematics in the concept of power numbers. The Bricksbuilder application has a feature to compose educational Lego games with an easy-to-see, attractive and accessible interface. With that, students will be more interested in learning the concept of power numbers. In addition, this activity can build an understanding of meanings, relationships, and symbols that can be applied to fun classroom learning. Through this, this learning can present the character of students who are skilled, diligent, thorough, patient, and tenacious, which can be obtained during the student's process of understanding and counting lego circles, to be applied to the concept of the power number itself. Based on the results of research conducted by Rusmini (2020), it has been proven that the use of Lego media can instill a proper understanding of mathematical concepts and provide positive character education. In this case, the teacher should pay attention to the cultivation of good character, especially the math teacher. Because without us realizing it, it turns out that some learning in mathematics gives a bad impression, which will result in bad character for students.

CONCLUSION

Based on the results and discussion above, it can be concluded that LY and DA students are very interested in using the brickbuilder application as a medium for calculating power numbers, but only that they have difficulty calculating patterns in the brickbuilder application because of the small cellphone screen and the application that cannot be zoomed, so that it requires both students to be careful and thorough in calculating the lego contained in the application. However, the two students still felt happy and interested in using the application because within it there were very interesting features. Therefore, in the future, it is hoped that an elementary school teacher can use this brick maker application as a learning medium in the teaching and learning process in the classroom. This application helps students with building

and constructing the concept of power numbers in elementary school students. One of the advantages of the bricklayer application is that it increases students' enthusiasm for learning, because it is equipped with interesting features and makes it easier for students to solve a number of questions without having to count them manually with their fingers. In addition, through this learning, it can hone the character of students who are skilled in the use of digital technology.

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