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Design of a Mathematical Learning Game Model for Elementary School in the Sumbang Banyumas Area

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ABSTRACT

Mathematics is an exact science that forms the basis of other sciences so mathematics is interrelated with other sciences. If a child has been taught mathematics from an early age, then the child will easily enter other branches of science such as chemistry, physics, especially mathematics itself. The lack of aids and visual aids in schools makes it difficult for teachers or teachers to convey subject matter in class, so it is very difficult for teachers to provoke student concentration during teaching and learning activities, and sometimes students play alone when the teacher is delivering lessons in class. The purpose of this research is to make a math educational game for grade III elementary schools so that students can increase their concentration in learning, and help the learning process to be interactive and not boring. The method of collecting data from this thesis uses 3 methods, namely interviews, observation, and questionnaires. The system development method used in this study is the Multimedia Development Life Cycle (MDLC). From the results of the alpha test it showed that the functionality of the game that was made was successful and from the beta test it showed that 89.49% of student respondents answered strongly agreed and 76% of teacher respondents answered in agreement. It can be concluded that this game is feasible to be used as a learning aid for students in class.

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INTRODUCTION

Mathematics is generally defined as a field of science that studies patterns of structure, change and space. So informally, it can also be referred to as the science of numbers and figures. In the formalist view, mathematics is the study of abstract structures that are defined axioms using symbolic logic and notation[1][2].

The lack of aids and visual aids in schools makes it difficult for teachers or teachers to convey subject matter in class, so it is very difficult for teachers to provoke student concentration during teaching and learning activities and sometimes students play alone when the teacher is delivering lessons in class[3]. Teachers can at least use cheap and practical tools, such as sticks, small stones, flat shapes (triangular ruler, square ruler, rectangular ruler, etc.) but this has become a necessity in an effort to achieve the expected teaching goals[4][5].

With advances in existing technology, learning media are not just books and manual props, but then move towards digital multimedia[6]. Given the conditions or situations in the learning process, students now find it difficult to understand the lessons they are participating in, one of the causes is bored with the learning conditions that do not change and the environment that affects children to be lazy to learn, because the learning carried out by the teacher conveys lessons to students directly [7]. Therefore, alternative media are needed to help the learning process so that students do not feel bored in mathematics[8].

The conventional form of learning students seem passive and the teacher is active, students are not given the opportunity to take the initiative to find their own answers and apply formulas[9]. Thus affecting student achievement. Student achievement can also be influenced by several factors such as; abilities, interests, talents, and motivation, which come from outside the student's self such as; family environment, school environment, learning facilities and student environment, and factors from the teacher, namely teaching methods, teaching concepts, learning media / tools, teacher characteristics, background, talents, social and economic conditions[10][11].

Learning difficulties in mathematics are the most common type of difficulty found in elementary school children[12]. Many students think that mathematics is the most difficult and frightening field of study. This negative assumption makes it more difficult for students to like mathematics. Even so, mathematics must still be studied because mathematics is a means of solving problems in everyday life[13].

Based on the results of interviews with teachers at Elementary School in the Sumbang Banyumas area students think that mathematics is one of the most difficult fields of study[14]. That way, with a situation like this it is used to make an educational game for students in Elementary School in the Sumbang Banyumas area so that students can better understand mathematics and it is hoped that with the method offered students can better remember, understand and understand lesson. As well as helping teachers to create a new atmosphere in delivering math lessons in class to make it more fun.

From the assessment data of Elementary School in the Sumbang Banyumas area there are problems in the assessment that do not meet the minimum standard of completeness criteria for mathematics, especially class III. As in the data on the assessment of mathematics subjects for the 2020/2021 school year which was also influenced by the Covid 19 pandemic situation at that time.

From the mathematics subject assessment data, there were 19 students, students who did not meet the minimum completeness criteria of 57.89% and students who met the minimum completeness criteria of 42.10%. So the percentage of student scores below the KKM is greater than the percentage of student scores above the KKM.

Based on the results of interviews, it was difficult for the teacher to convey the material to the children, some of the children liked to play alone, and some did not pay attention to the material being conveyed.

METHOD

In the method section the author collects data using interview techniques, documentation and literature study. The interview conducted by the researcher here was that the researcher conducted a question and answer session with the grade 3 teacher about some of the problems experienced by the teacher in delivering the lesson, so that from the interview the researcher could conclude the problems that existed in the school.

In this study, documentation was obtained from the teacher/guardian of class III at Elementary School in the Sumbang Banyumas, such as data on grade III math scores and data on math daily test scores. In this study the authors searched for data from books, research journals and printed written sources to find out more about the research to be carried out.

1. The concept stage is the stage for determining the goals and who are the users of the program (audience identification). The goals and end users of the program affect the feel of multimedia as a reflection of the identity of the organization that wants information to reach the end user. User characteristics including user capabilities also need to be considered because they can affect design making.
2. Design is the stage of making specifications regarding program architecture, style, appearance, and material requirements for the program. The specifications are made as detailed as possible so that in the next stage, namely collecting and assembling materials, new decision making is no longer needed, it is enough to use the decisions that have been determined at this stage. However, in practice, project work in the early stages will often experience adding materials or reducing application parts, or other changes.
3. Material Collecting is the stage of collecting materials according to the needs being worked on. These materials include clip art, photos, animations, video, audio, and others which can be obtained free of charge or by ordering from other parties according to the design. This stage can be done in parallel with the assembly stage. However, in some cases, the material collecting stage and the assembly stage will be carried out in a linear and non-parallel manner.
4. The assembly stage is the stage of making all multimedia objects or materials. Making applications is based on the design stage, such as storyboards, flowcharts, and/or navigation structures.
5. The testing phase is carried out after completing the assembly stage by running the application or program and seeing whether there are errors or not. The first stage at this stage is called the alpha testing stage (alpha test) where the test is carried out by the manufacturer or the manufacturer's own environment. After that, beta testing was carried out. Beta testing is testing carried out by users. So in this test, all existing software environments cannot be controlled by the developer anymore. The application will be tested on respondents, namely children.
6. At this stage, the application will be stored in a storage medium. If the storage media is not sufficient to accommodate the application, compression of the application will be carried out.

RESULT

Before making it, the author designed it into a first concept, namely by creating a navigation structure to make it easier to prepare the storyboard to be designed. The following is an overview of the structured navigation structure:

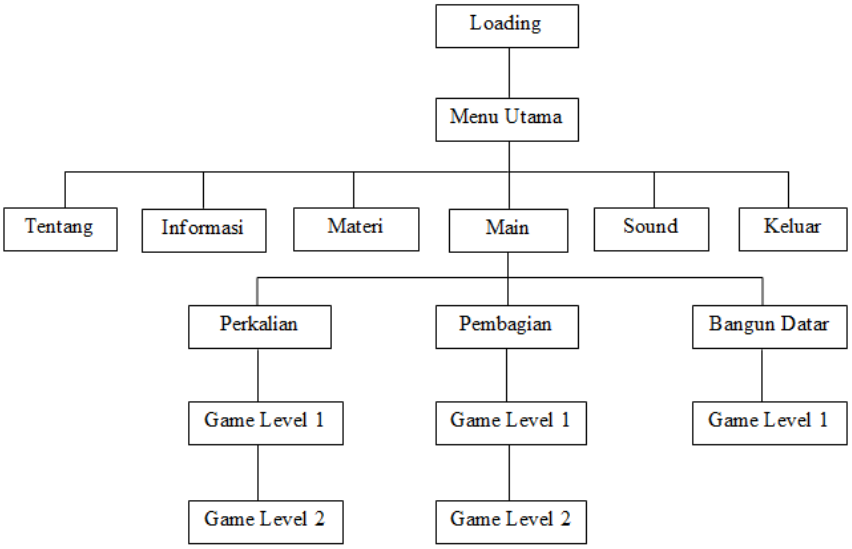

Figure 1, Navigate Structure

From the navigation structure, the next step is to arrange several designs which are directly made on the 3D Art & Animation platform. Some views that can be presented in the design include the following:

Figure 2, Execute program.

In figure 2, this is the first time the user opens the game application to be run, a loading menu will appear. This loading functions as a data reader that will be processed into a rule in a mathematical game. Next is the main menu:

Figure 3, Dashboard menu.

In this menu dashboard users can start programs to be used in math games. Users can choose material or directly enter the game as desired. Usually, because this is learning-based, users are advised to enter the material first before playing the game[15].

Figure 4, Material content

Next is material content, users can learn material through interactive content designed to make it easier for users to understand. In this content there is case-based learning accompanied by a solution. With such a model it will make it easy for users to remember the material presented.

Figure 5, Game content

After the user understands the material presented earlier, then the user can evaluate learning outcomes using an interactive game model. Learning with this game is considered effective enough to make it easier for users to learn. The current trending term is gamification modeling as it is made today.

After the design results are complete, the next step is testing the platform that has been made. The first test uses the user acceptance test. This test involves at least 19 students and 3 teachers as a population sample in 1 school. The following are the results of the tests carried out:

Table 1, Test result analysis by student

Aspect	Value					Quantity
	SS	S	C	TS	STS	
Performance	19	-	-	-	-	19
Interactive	10	9	-	-	-	19
Convinience	6	5	8	-	-	19
Easy User	13	4	2	-	-	19
Learning	11	6	2	-	-	19

Content						

Table 1, Test result analysis by teacher

Aspect	Value					Quantity
	SS	S	C	TS	STS	
Learning	-	2	1	-	-	3
Content	2	1	-	-	-	3

The test results on the Mathematics Education Game can be taken on the average index formula from student respondents as follows:

(100 % + 90.52 % + 77.89 % + 91.57 % + 87.47 %) / 5 = 89.49 %

The average index formula of teacher respondents is as follows:

(60 % + 80 %) / 5 = 76 %

So the average index formula of student respondents is 89.49%, which is in the very agree category, and teacher respondents are 76%, so they are included in the agree category.

CONCLUTIONS

Based on the results of the research and discussion that has been compiled, the following conclusions can be drawn:

A Math Education Game has been created. This game is used as a learning medium and additional teaching material for mathematics, material for arithmetic operations, multiplication, division, and flat shapes for elementary schools.

After going through the testing phase using the alpha test, the Mathematics Education Game shows the results according to the design. In the beta test, the average index formula from student respondents was 89.49% in the strongly agree category, and the results of the index formula from the teacher were 76% in the agree category, which means that this game has performance in line with expectations and is suitable for use as a learning medium. .

From the simulation results of the elementary mathematics exam which can be seen on the attachment page, the percentage of students who have fulfilled the KKM Education Game has fulfilled the KKM percentage and those who have not fulfilled the KKM percentage is 15.78%.

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