



Development Animation 3D in Science and Mathematics Subjects for People with Intellectual Disabilities in Extraordinary Schools

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Abstract. Students with mental retardation are students who have intellectual retardation where sometimes when the teacher explains it is very difficult to understand. With the advancement of technology, teaching and learning activities for students with mental retardation can be created so that they are more interested in the subjects of Natural Sciences and Mathematics in particular. One of them is by using Virtual Reality. Based on this, 3 Dimensional Blender Animation was made in science and mathematics subjects for mentally retarded in elementary schools using the blender application for the Modeling process and Verge3D for the Coding process. The result of this research is a website that runs on a VR device. With the 3D Blender Animation, it is hoped that it will be able to create a visual picture of Science and Mathematics subjects, so that it can be used as a learning medium for students with intellectual disabilities. Making objects in this learning media using basic objects such as cubes, cylinders, and planes. To design an object in Blender software, several techniques are used, namely extrude, scale, drag or move, rotate and loop cut slide techniques. In making this animation, it consists of three science materials, namely Human Internal Organs, Human Five Senses, Plants and their Photosynthesis Process. And for the Mathematics material, it consists of three materials, namely counting the basketballs in the basket, multiplication and division. Each material is accompanied by a different sound explanation.

Keywords: 3 Dimensions · Blender · Science · Mathematics · Verge3D · Virtual Reality

1 Introduction

Education is one of the conscious efforts to develop Human Resources (HR), because without education humans cannot have and follow the development of Science, Technology and the Arts. This is in accordance with Law number 20 of 2003 concerning the National Education System (Sindiknas) [1]. People with mental retardation are one of the extraordinary children who have intelligence and limited intellectual intelligence

functions that are significantly below their chronological age and limitations on adaptive skills [2]. Learning Natural Sciences is important, because it will provide insight into natural knowledge to students. Likewise with learning Mathematics, it is important because it can hone students' creativity and thinking patterns logically and systematically [3]. The students with mental retardation have intellectual retardation so that their thinking abilities are low, their memory is weak, it is difficult to think abstractly and logically, therefore they need special services in providing educational services [4]. With the advancement of technology, teaching and learning activities for students with mental retardation can be created so that they are more interested in the subjects of Natural Sciences (IPA) and Mathematics in particular. One of them is by using Virtual Reality. Virtual Reality is a technology that allows a person to perform a simulation of an object using a computer that is able to evoke a three-dimensional atmosphere so that it makes the user feel as if he is physically involved [5].

Based on this background, the writer wants to develop a 3-dimensional animation as a learning tool for Children with Disabilities in Special Schools so that they are more interested in learning Natural Sciences and Mathematics. This case has been described previously, the problems that will be discussed in this Final Report are as follows are; The results of software design with 3 Dimensional Modeling and Coding methods, and how to use 3-dimensional animation using Virtual Reality on Interactive Websites as a means of learning science and mathematics for people with mental retardation, next will be Code QR Code is a two-dimensional matrix code in which it is capable of storing information up to thousands of alphanumeric characters. The QR code consists of various dots and a space that has been arranged into a box, and each element in it also has its own meaning which makes it easier to scan by a smartphone.

2 Design System

Block diagrams are one of the most important parts of the process design, because with the block diagram it can be seen how it works the network as a whole. So that the block diagram will produce a system that can work according to the design. System block diagram describes the sequence of processes from the beginning to the end of the system. Here is the block overall diagram.

Based on the block diagram in the image below, regarding the design of the system above, it can be explained that Blender has a role as software to create 3D object modeling in Natural Sciences and Mathematics Learning. After modeling is complete, basic animation is made on 3D objects that have been designed to make them look more real. Next is the animation coding process through Verge3D software. In this software there are many puzzles that can be used to compile programming as coding from modeling 3D objects that have been created. To make this puzzle is quite difficult because you have to pay attention to every existing modeling so that it fits and there are no errors when the coding results of the puzzle will be run (Fig. 1).

Then proceed with creating a wordpress.com website account using e-mails and passwords. Then the account can be used and enter the process of uploading 3D animation to the website. This wordpress.com website does not require coding anymore, because everything is available for free on the website.

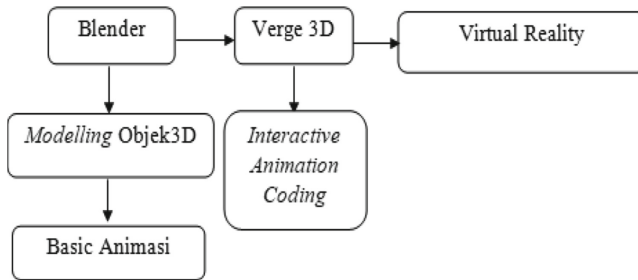


Fig. 1. Blok Diagram System Blender Animation 3D in Science and Mathematics Subjects for People with Intellectual Disabilities in Extraordinary Schools

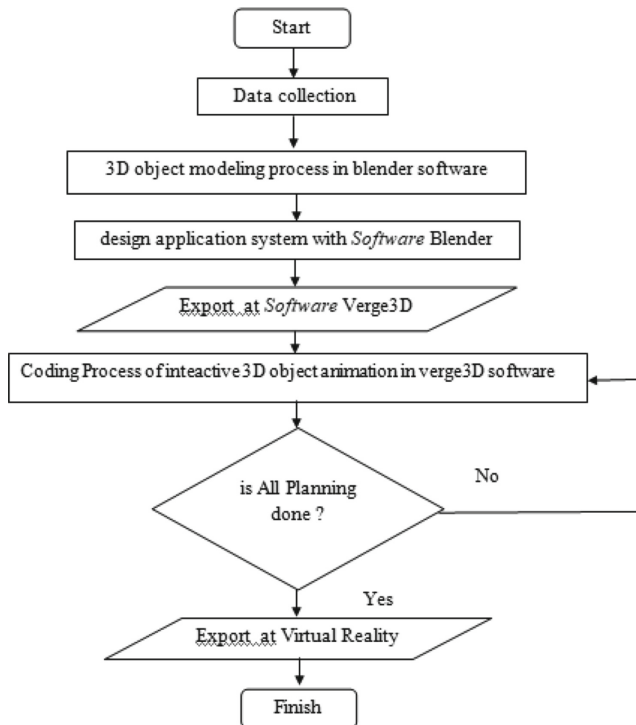


Fig. 2. Blender Animation 3D in Science and Mathematics Subjects for People with Intellectual Disabilities in Extraordinary Schools

From the Flowchart of the 3D animation design system carried out by researchers, for the process of making 3D blender animation in the subjects of Natural Sciences and Mathematics using Virtual Reality, it begins to collect data. Where the data is in the form of natural science and mathematics subject matter for people with mental retardation, the materials that the author uses for this animation focus more on subject matter that is still basic and analyze animations that can attract the interest of people with mental

Table 1. Process scenario and explanation

No.	Scenario	Description
1	Runing VR mode	Is the process of running VR mode by clicking the available button
2	Entering the study room	Is the process of entering the learning room
3	Showing material from the science and mathematics learning module	It is a process of displaying science and mathematics learning materials by clicking on objects on the scren
4	Preparing learning objects	It is the process of preparing leraning objects as fruits,etc. by clicking on objetcs on the scren.
5	Begening and implementation learning	Begening and implementation learning
6	Ending science learning	Is the process of ending science learning that has been completed
7	Repeating math learning	Is the process of repeating mathematics learning by clicking on certain objects
8	Showing learning help	It is the process of displaying learning aids by clicking on certain objects

retardation in learning natural sciences and mathematics. If the data has been received, the Modeling process is carried out using the Blender application based on the data that has been taken. In addition to the object creation process, in the Blender application, basic animation is also made. Once completed, the 3D modeling is exported to Verge3D software for the interactive animation coding process. Then the interface coding process is carried out to add some views according to the design. When the modeling and coding process is complete, then the next process is to export it to an interactive website so that it can be accessed in VR glasses, for more details it can be seen in the Fig. 2.

For the animation design Blender Animation 3D in Science and Mathematics Subjects for People with Intellectual Disabilities in Extraordinary Schools, need scenario design to run animation, for more details it can be seen int the following scenario Table 1. Where the scenario process explain the working principle of Virtual Reality as if the students were doing learning in an extraordinary school classroom by Karya Ibu, in Palembang. In addition to displaying visualization of science and mathematics learning, this tool will also be equipped with audio from these materials on an interactive web display. After that, the 3D object has been cerated the user will need additional devices namely VR glasses to help users enter and interact directly in the 3D.

3 Current Result

As explained earlier, that to design animations for science and mathematics learning, the author uses Blender software to create room objects and learning objects. The steps for designing or creating animations are doing modeling designs in Blender software.

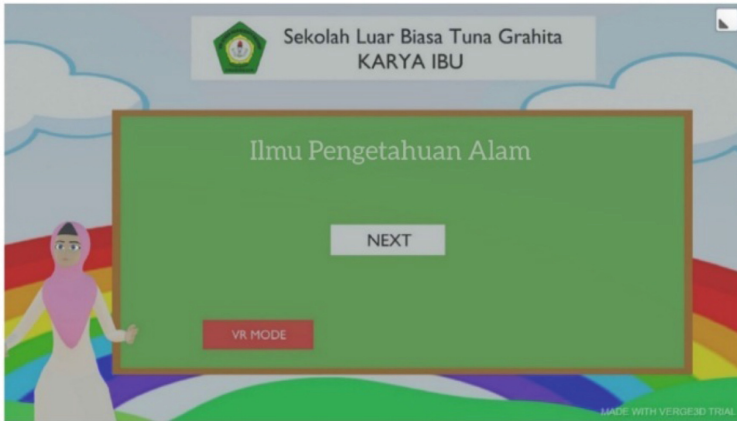


Fig. 3. Main view of natural science learning

This modeling design is carried out on an object-by-object basis, such as designing tables, chairs, teachers, blackboards, etc. For each object that has been designed, then texturing and material are carried out. Then, combine all the modeling designs such as tables, etc. to form a room with the “append” feature in Blender. The interactive animation coding process was continued through Verge3D software for programming. Then export to virtual reality so that modeling and coding can be seen as if it looks real using virtual reality. Main Animation is the animation movement that is owned by each circuit module. The movement of the animation can occur because of the logic created by using the arrangement of puzzles in the Verge3D software.

Results the Natural Science Learning Software Design

In learning natural science consists of several materials, among others such as organs in humans the five senses of man, plants and the process of photosynthesis, the following is an illustration when you will start learning mathematics.

Next, will show the logic for material objects of human internal organs, where the object is clicked, the object description will be deleted. Then the camera will be directed to start animation of recognizing human internal organs accompanied by a voice explaining the material, see Figs. 3 and 4.

Results design of human internal organs include organs such as the heart, lungs, stomach, intestines, liver and so on. This material is important so that students can know about the internal organs and their functions, to see the results of the design using android, please scan the QR code, as given in the Fig. 5.

Next, scenario viewing results of the animation design for five human senses. When the objects description will be deleted, then the camera will be directed to start the animation of the introduction of the five senses of humans accompanied by sound to explain the material (Fig. 6).

Next, scenario viewing results of the animation design photosynthesis process. Where the logical display for plant material objects and the process of photosynthesis. Puzzles are displayed for the scenario of repeating the photosynthesis process because the

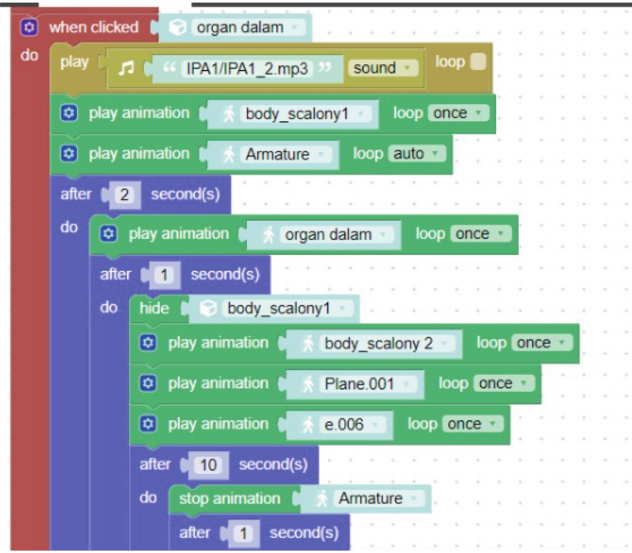


Fig. 4. Viewing coding in puzzles for human organs



Fig. 5. QR code animation complete of human internal organs design



<https://v3d.net/9fc>

Fig. 6. QR Code animated human senses

explanation is already in the dubbing, for puzzles, the plants move alternately. The camera will be directed to start an animation of recognizing plant parts and the process of photosynthesis accompanied by a voice explaining material, please scan QR code Fig. 7.



<https://v3d.net/9fo>

Fig. 7. QR code animation of plants and photosynthesis process

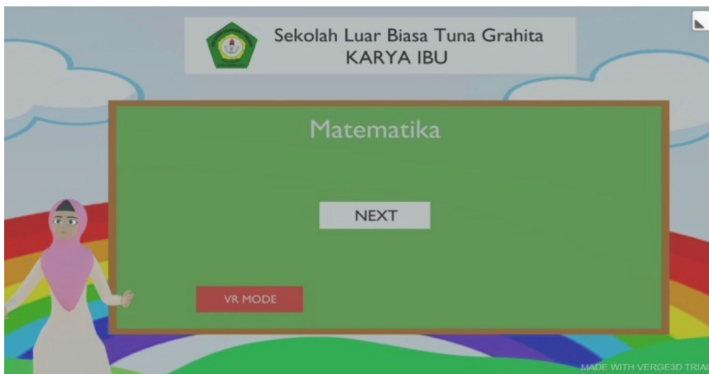


Fig. 8. Main view of mathematics learning

Results the Mathematics Learning Software Design

In this paper, will show the results design mathematics learning consisting of several materials that will be presented, including counting basketballs, multiplication, and division. The following is an illustration when will start learning mathematics. The following is a logical display for the material object to count the number of basketballs in the basket. Shown repeating puzzles for basketball counting animations, form results of this material design include the object of basketball in the hope that it will attract the interest of people with mental retardation to learn mathematics accompanied by sound explanations of the material, form more details, please scan QR code Figs. 8, 9, and 10.

Next, scenario will be display results of the logical display for multiplication material. Click multiplication on the initial screen, then learning will begin. The multiplication material used is very basic, using 6 football objects. The results of this multiplication material design is $3 \times 3 = 9$, where the object used is the ball of the foot to make it look more attractive. When the main screen appears, click multiplication to start learning, and click next again to know the results of multiplication. Use VR mode to active virtual reality. For more details, please scan QR code (Fig. 11).

for the results of calculation with division will be displayed logic for the material division. Click the distribution box on the screen VR, then learning will begin, the division material used fish and cat objects, for more details, please scan the QR code (Fig. 12).

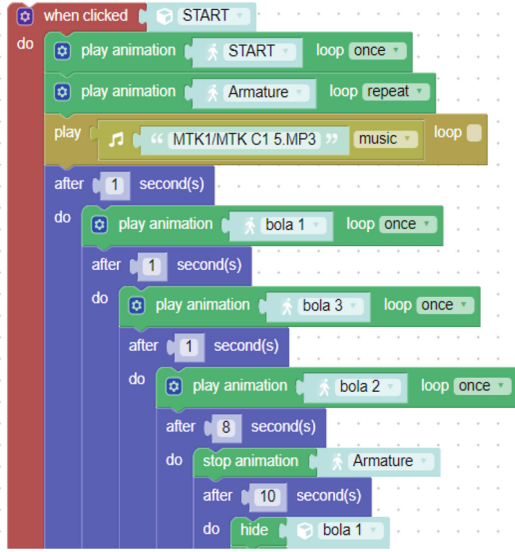


Fig. 9. Viewing coding in puzzles for counting basketballs



<https://v3d.net/9e0>

Fig. 10. QR code animation counting basketball material



Fig. 11. QR code animation multiplication material



Fig. 12. QR code animation material division

4 Conclusion

Making objects in this learning media using basic objects such as cubes, cylinders, and planes. To design an object in Blender software, several techniques are used, namely extrude, scale, drag or move, rotate and loop cut slide techniques. In making this animation, it consists of three science materials, namely Human Internal Organs, Human Five Senses, Plants and their Photosynthesis Process. And for the Mathematics material, it consists of three materials, namely counting the basketballs in the basket, multiplication and division. Each material is accompanied by a different sound explanation. The Main Modeling Design of each material is the same, it's just different in the learning object of each material, such as the science material of human internal organs, of course the animation and modeling made are parts such as the heart, lungs, kidneys, esophagus, pancreas, etc. And for the science material, the five senses of animation and modeling made are the sense of sight (eyes), the sense of smell (nose), the sense of touch (skin), the sense of hearing (ears) and the sense of taste (tongue).

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