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Development of Renderforest Technology-Based Mathematics Learning Videos

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ABSTRACT

This study aims to develop a mathematics learning video based on Renderforest technology. The research method used is creating learning videos based on Renderforest technology for seventh-grade junior high school students. The material chosen is comparison. The research process is design, development, and implementation. The instrument used is a questionnaire with the ARCS model. Assessments in the instrument include attention, relevance, confidence, and satisfaction. Data collection techniques were with student responses. The results of this study are the use of learning videos, students feel the benefits, are easy to use, help in learning mathematics, and provide satisfaction.

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Introduction

The 21st century is very popular with changes in the development of science and technology, which result in changes in the learning paradigm, marked by changes in curriculum, media, and technology [1]. The various competencies students need in the current era of globalisation are called 21st-century skills, and the concept of education is known as 21st-century learning [2]. 21st-century skills include creative thinking, critical thinking and problem-solving, communication, and collaboration [3]. Today's education must be based on

these four skills so that the characteristics of 21st-century learning can be achieved [4]. Thus, 21st-century skills need to be applied in schools.

Learning activities in educator schools need to prepare learning tools to support the learning process [5]. There are many ways to become creative and innovative educators in the learning process, one of which is utilising learning media in the learning process [6]. Learning media is growing because educational practitioners feel a positive impact on students [7]. Learning media can stimulate students' thoughts, feelings, attention and abilities or skills to encourage learning and achieve practical learning goals [8]. Learning media can also promote students' interest in education [9]. Therefore, the use of learning media is essential in the learning process.

The 21st-century learning is technology-based, which is developing rapidly [4]. The learning process in the 21st century must include technology that focuses on creativity, critical thinking, communication, and collaboration [10]. One of the demands of 21st-century learning is integrating technology as a learning medium to develop students' learning skills [1]. 21st-century learning is constructional and utilises technology [11]. The skills of the 21st century combine cognitive abilities, attitudes, skills, and information and communication technology (ICT) assignment abilities to face competition in the 21st century [12]. Technology-based learning tools with educator competencies are essential for achieving educational goals [13]. Students must also master various competencies in the 21st century era [14]. Thus, education in the present involves learning technology.

Learning using technology is one of the solutions to solving education related to implementing learning [15]. Because by utilising technology as a learning medium, students are more interested in listening to material [16]. Students will also be more active in observing, demonstrating, and doing more [17]. In addition, the benefits of using learning technology are flexibility in time and place, cost-effectiveness, students can repeat the module if they do not understand, and the administration process is automatic [18]. However, schools still use printed learning media, namely books and student worksheets [8].

One of the technology-based learning media is the Renderforest application. The Renderforest application is an intelligent video maker that enables educators to create professional-quality videos [19]. This software provides free video production services that can be accessed online [20]. Thus, the Renderforest application can be used to create mathematics learning videos. Based on the problems above and the supporting theory, this research is to develop Renderforest technology-based math learning videos.

Literature Review

A. Learning Media and Mathematics

Video learning is a type of media that uses the power of sound and images [21]. The benefits of learning videos are that they can increase students' interest in learning because participants can watch pictures and sounds and repeat the video if they do not understand [3]. In practical learning, Usman and his team emphasised crucial factors when incorporating instructional videos into education [22]. Educators are responsible for meticulous preparation, mapping out the content conveyed through the videos. This involves a thoughtful selection of instructional video materials that align with the desired educational objectives. The choice of media becomes pivotal in shaping the attainment of these goals.

Furthermore, educators are advised to gauge the temporal dimension of the learning videos. Recognising the duration of these videos aids in orchestrating the pacing of the educational journey, ensuring that the students' engagement remains optimal. Upon the culmination of the video-based learning session, educators are encouraged to embark on a post-analysis phase. This involves introspection as educators reflect upon the effectiveness of the video lesson and its resonance with the students. To delve deeper into the students' comprehension, educators are prompted to engage the students in discussions, posing relevant questions that unveil the extent of their grasp on the subject matter.

In essence, integrating instructional videos into education calls for a well-coordinated choreography. Educators must prepare comprehensively, factor in time intricacies, and culminate each session with a reflective dialogue to fine-tune the learning process. These concerted efforts paved the pathway to successful and engaging learning experiences. As Ref. [23] pointed out, the merits of employing learning videos as educational tools are compelling and diverse. Firstly, within the classroom setting, learning videos stand out for its inherent efficiency. This approach streamlines the educational process, enabling teachers to maximise their instructional time. Secondly, adopting videos as a pedagogical aid injects a dynamic quality into the learning environment. Students are no longer passive recipients but active participants, capitalising on enhanced learning opportunities. The potency of videos in clarifying complex subjects is another notable advantage. The visual and auditory elements inherent to videos facilitate a lucid exposition of intricate concepts, ensuring that the material is comprehensible to a broad spectrum of learners.

Catering to the diverse learning styles each student harboured constitutes another benefit. Videos inherently address this multiplicity, ensuring that various learning modalities are catered to, fostering a holistic learning experience. Integrating videos alleviates educators' onus to adhere to the lecture-based teaching model strictly. This departure from conventional

methods lightens the educators' load, fostering a more engaging and interactive learning atmosphere.

Researchers refer to the opinions of several experts to explain mathematics; this is due to the broad scope of mathematics material and its role in the discourse of human science, so the opinions expressed differ—the definition of mathematics as outlined by various experts. Mathematics systematically studies logic, encompassing shapes, quantities, and interconnected concepts. They categorise mathematics into algebra, analysis, and geometry. Mathematics is a cognitive framework characterised by structured conventions and logical proofs. It's akin to a language employing precisely defined terms and symbols to represent ideas, prioritising symbolic representation over audible communication. Mathematics explores patterns and relationships, functioning both as a mode of thought and a language. It's seen as an art and a tool encompassing multiple dimensions. Mathematics is not just an isolated knowledge but a means to aid human comprehension and mastery of real-world challenges. Its purpose is to facilitate an understanding of social, economic, and natural issues. These experts collectively portray mathematics as a discipline that delves into logical patterns, relationships, and systematic thinking. It operates as a language, an art, and a tool, enhancing our grasp of the world and its intricacies.

Based on the definitions and opinions described above, mathematics is an art, a language of a human mindset, which is then expressed with certain symbols. Mathematics is also the science of logic, ideas and concepts interconnected to solve problems in mathematics and other everyday sciences. In this study, the mathematics in question is school mathematics. Mathematics is one of the subjects that students must follow. According to Ref. [24], school mathematics is mathematics taught in schools, namely in primary and secondary education. Thus, lessons will be given at each level of education in stages, starting from the basic level to the in-depth story. Once the importance of mathematics is taught in schools to students, mathematics must function as it should. The functions of mathematics subjects in schools are as follows:

- Tool. Students are given experience using mathematics to understand or convey information, for example, through equations or labels in mathematical models to simplify story problems or mathematical description problems.
- Mindset. Learning mathematics is forming a mindset in understanding, understanding and reasoning. The reasoning process that is developed is an inductive and deductive mindset.

- Science or knowledge. Mathematics is always looking for the truth and is willing to rectify the fact that it is being accepted if an opportunity is found to try to develop discoveries as long as it follows a valid mindset.

Thus, school mathematics is taught in elementary, junior high and high school, which differs from what is taught in universities. The function of mathematics is as a tool, mindset, and knowledge or knowledge used as a reference in learning mathematics.

B. Renderforest application

Applications are software for specific purposes, such as processing documents, managing Windows, and games [25]. The Renderforest application is an intelligent video maker that enables educators to create professional-quality videos [19]. The steps for using the Renderforest application [21] are as follows:

- Login on the web: https://www.renderforest.com/
- Then enter https://www.renderforest.com/templates
- Sign in using Google or email
- Create a video by clicking *Create* video
- Create video intros.
- Preview if you will see the video that has been made.

Methods

The research method used is development with the results of video learning based on Renderforest technology. The material that will be explained is comparison. The subjects in this study were 7th-grade students of junior high school at 2nd semester. The learning objectives to be achieved were that students could solve problems related to comparisons of values, comparisons of importance, and scales.

The learning model used is PBL. This learning model becomes a learning approach to apply problems that exist in the real world as a context for students to practice problem-solving skills. The learning method used is nano learning, namely in the learning process using a variety of exciting activities with a short duration of about three minutes with the help of information technology. This lesson is formed in a fast, concise, and clear video. The process for obtaining Renderforest technology-based learning video results includes design, development, and implementation.

The initial step taken by the researcher is to design the product. In this step, the researcher makes a design, namely determining the material to be explained through the video and an overview of creating a learning video using Renderforest. The material chosen is a Comparison of 7th-grade, 2nd semester. After designing the product, the researcher develops the product, which is making a learning video using Renderforest. Finally, the researcher

implements the results of learning videos for students. The video that has been made is then shown to students.

The instrument was a questionnaire with the ARCS model, measured by a Likert scale. Assessment in the instrument includes attention, relevance, confidence, and satisfaction. Data collection techniques were used with student responses, which were then analysed. The data obtained was analysed based on graphic images with the help of MS Excel, which then described each result in the picture.

Results and Discussion

A. Draft of the Media

Making learning videos in this study begins with determining the material. The material chosen is a comparison of class VII SMP. This comparison material is designed to be three videos for three minutes each. The goal is that students do not get bored. The subtitles of the comparison material compare values in the first video, turning values in the second video, and the scale in the third video. The learning objectives are conveyed at the beginning of the video, namely in comparison of values.

There are many templates in Renderforest. At this design stage, the researcher also determines the template that will be used to make the video. The following is the initial template that the researcher chose.

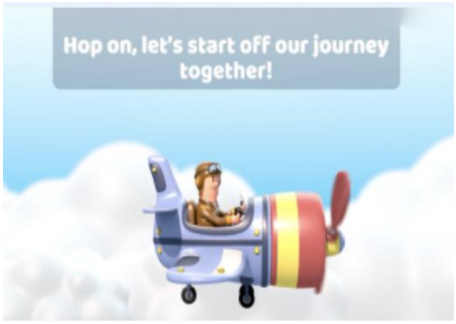


Fig. 1. Initial view of the first video



Fig. 2. The initial display of the second video

B. Media Development

The development stage in this research is making a video. Videos created using Renderforest are accessed online. Several steps were taken by researchers in making learning videos using Renderforest as follows:

- Go to Google, then type Renderforest. After that, click video animation, then sign in to register for an account at Renderforest.

- Click the Create Video menu and choose the type of animated video you want. Then click Create. There are various kinds of video templates available. The researcher chose the template according to Figures 2, 3 and 4.
- The third step is to create a video with the selected template. This step writes the contents of the material that will be broadcast into several scenes after that vote. How to vote by clicking music then clicking add voiceover.
- Click preview to see the video that has been made. After that, click free preview and wait for the process until the video is complete.
- Download videos.

The following is a scene created by the researcher.

1. The first video is about Worth a comparison



Fig. 3. Initial display of the first video



Fig. 4. Submission of learning objectives



Fig. 5. Asking for prior knowledge of the meaning of comparison



Fig. 6. Illustration of the comparison



Fig. 7. Ask for prior knowledge of the meaning of comparison worth



Fig. 8. Illustration of worth comparison

2. The second video explains about a Comparison of turning values



Fig. 9. The second preview of the video



Fig. 10. Asking for prior knowledge of the meaning of value-turned-comparison



Fig. 11. Illustration of reverse value comparison



Fig. 12. Problems example

3. The third video explains the Scale



Fig. 13. The third preview of the video



Fig. 14. Asking for prior knowledge of the meaning of the scale



Fig. 15. Illustration of scale



Fig. 16. Problems example

The learning video above has been uploaded on the "Phututur Mathematics" YouTube channel. A worthwhile comparison video can be seen at the link: https://youtu.be/sC3NCCQnvUc. A comparison video of turning values can be seen at the link: https://youtu.be/D_NkMVcGYxY. The scale video can be seen at the link: https://youtu.be/GZ_3EERtb6E.

C. Learning Media Implementation

The next stage to realise the research objectives is to implement the product. This product is implemented for students of 7th-grade video learning functions as multimedia learning. Researchers used the PBL learning model. The steps for PBL, according to Ref. [20], are shown in Fig. 17.

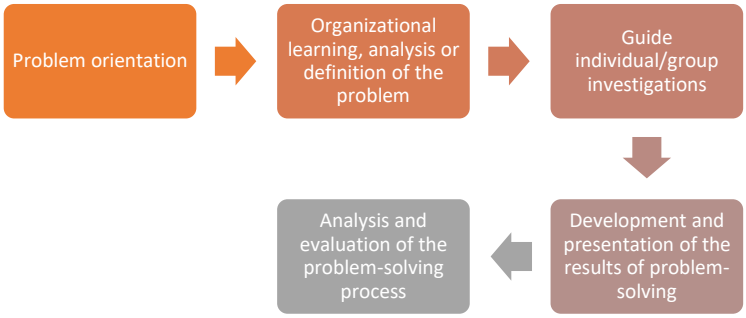
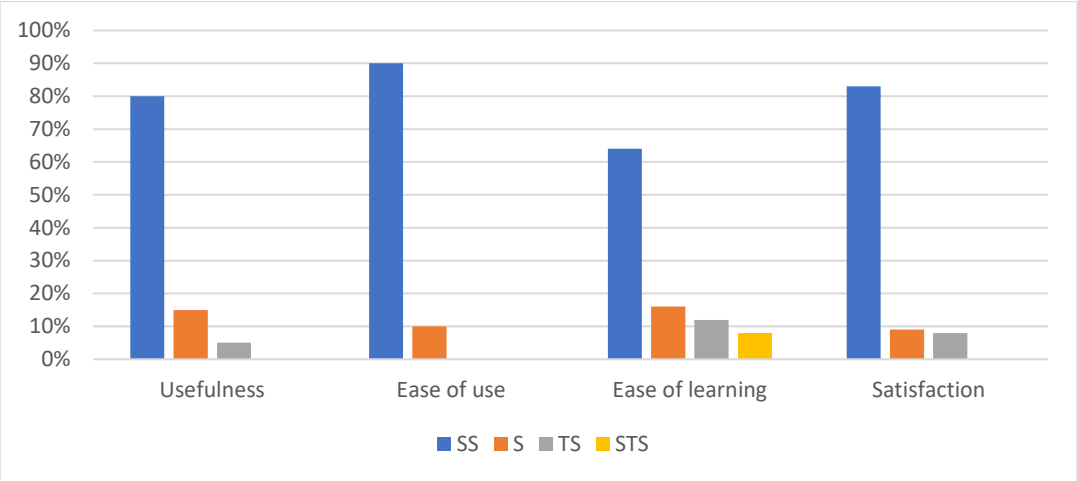


Fig. 17. Problem-based learning steps

Researchers prepare learning using the PBL model. First, the researcher shows the learning video that has been made, wherein there are questions about prior knowledge in the video. To find these answers in the video, illustrations of fundamental problems are presented. Furthermore, the researcher facilitates students to understand the real issues raised, namely identifying what students know, what students need to know, and what needs to be done to solve the problem. Researchers guide students to collect data/information through videos and direct explanations.

Furthermore, students are given examples of questions in the video. Then, the researcher guides students to determine the most appropriate problem-solving from the various problem-solving alternatives that students find. Students compile a report on the results of solving the problem. Finally, the researcher facilitates students to reflect or evaluate the problem-solving process that has been carried out.

The next stage is to evaluate the use of learning videos using a questionnaire. The responses assessed by students were usefulness, ease of use, ease of learning, and satisfaction. The results of the questionnaire evaluation can be seen in Fig. 18.



Remark: SS (Strongly Agree); S (Agree), TS (Disagree), STS (Strongly Disagree)

Fig. 18. Evaluation result

Based on the evaluation results, it can be concluded that 95% of students feel the benefits of learning mathematics using learning videos, 100% of students stated that the learning videos were straightforward to use and operate, 80% of students noted that the use of learning videos made it easier for them to understand the material, but due to the short duration of the videos not all students could follow the explanations in the videos carefully. As a result of this, some students needed clarification about the material. Finally, 92% of students are satisfied with learning videos. Based on the evaluation results, learning videos using Renderforest technology is very beneficial for students, easy to use, helps to learn and provides satisfaction for students.

Conclusion

Based on the discussed research on the development of Renderforest technology-based mathematics learning videos, it's evident that students find these videos useful, user-friendly, and effective for learning mathematics, resulting in high satisfaction levels. However, a limitation of the study is the relatively short duration of the learning videos. It's recommended that future researchers focus on designing more comprehensive learning videos to address this aspect.

Conflict of Interest

The authors declare that there is no conflict of interest.

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