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Achieving Effective Math Learning with Animated Video-Based Media: A Study on 11th-Grade Students

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ABSTRACT

This study aimed to develop animated video-based learning materials tailored to the learning trajectory of 11th-grade students in the second semester. The Renderforest application facilitated the creation of these instructional videos. The research employed a developmental approach utilizing the ASSURE model. The research participants comprised 11th-grade students. Data collection methods included questionnaires and semi-structured interviews conducted indirectly. The study's outcomes were primarily based on student feedback and validation by media experts. The developed instructional media demonstrated feasibility and practicality, as confirmed through validity and practicality assessments. Media expert validation yielded an average score of 3.7, indicating that the instructional video met the criteria for being excellent and suitable for educational use. Additionally, the students' responses yielded an average score of 3.8, meeting the requirements for being excellent and convenient for instructional purposes. These materials align with the student's learning trajectory and can enhance the overall learning experience in the educational context.

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Introduction

Mathematics education plays a crucial role because mathematics is a vast field in all aspects of life. Through mathematics education, students are expected to become individuals who can think logically, precisely, critically, creatively, innovatively, imaginatively, and work diligently. With these expectations, mathematics education becomes an essential aspect of the advancement of education in Indonesia. The achievement of mathematics education can be seen through students' ability to complete mathematics assignments [1], apply the goals of mathematics education in their daily lives [2], and make mathematics an integral part of their lives [3]. Technological advancements have had various impacts on education.

Regarding enhancing human resources, education is expected to create students who can think critically and solve problems. In the 21st century, individuals must possess competencies such as creativity, critical thinking, independence, teamwork, information literacy, communication, and self-directed learning [4]-[7]. Therefore, creative thinking is an essential skill that students must have.

Media is a vital aspect of the learning process. With instructional media, the learning process can be organized and planned according to needs to ensure success. The role of teachers is essential in this regard because they must develop suitable instructional media and keep up with technological advancements. Ref. [8] emphasizes that teachers should use technology in schools, and Ref. [9] reveals that technology makes learning more engaging and meaningful. Hence, teachers must incorporate technology into instructional media, and one solution is using animated video media. Video learning media is an audiovisual medium where objects can move with corresponding sounds. Videos can present information effectively and efficiently [10]. Audiovisual content can motivate and inspire students to learn [11]. Renderforest is one of the applications that facilitate the creation of animated videos.

Based on the constructivist learning paradigm, the principle of mediated instruction holds a strategic position in achieving optimal learning events [12]. Optimal learning events are indicators of achieving optimal student learning outcomes. Optimal learning outcomes also reflect the quality of education. Quality education requires professionally capable and ready teachers to play their role in school and society [13], [14]. In this era of rapid technological development, teacher professionalism requires not only the ability to teach students but also the ability to manage information and the learning environment to facilitate student learning activities. The success of mathematics education is closely tied to the teacher's role in designing the learning process. An ideal learning process must be connected to planning and instructional design. Teachers' instructional design should consider students' learning trajectories in line with student-centred learning approaches [15]. Learning trajectories

represent the sequence of thinking skills and understanding students go through during the learning process. Learning trajectories help teachers apply appropriate models, teaching strategies, instructional materials, and assessments according to students' thinking stages [16].

However, based on observations conducted at SMK Negeri 1 Karanggayam, the achievement of 21st-century competencies is not optimal, and the use of video learning media is yet to be widespread, especially for three-dimensional materials in the second semester of 11th-grade vocational high school. Therefore, based on the learning trajectory, this research aims to enhance students' creative thinking through animated video media in three-dimensional learning. Through innovative video learning media with the Renderforest application, teachers hope to achieve 21st-century creative thinking and knowledge-building competencies. Video media has a significant impact on student learning outcomes. Video learning has advantages such as promoting independent education, being communicative and repeatable, providing detailed and complex presentations, and enabling comparisons between two or more scenes [10]. These advantages make abstract mathematics education more concrete, engaging, and effective in enhancing students' understanding. Learning with video actively engages students, allowing them to transfer knowledge, leading to deeper and more complex understanding. Therefore, video learning can provide a more complicated experience, enhancing students' creative thinking abilities.

Due to teachers' lack of attention to teaching methods and students' limited participation in the learning process, student learning outcomes could have been higher. It is undeniable that teaching methods significantly influence student learning outcomes. To address this issue, a more student-friendly instructional design is needed to facilitate educators in explaining materials and prevent monotony or boredom using the ASSURE instructional model.

Methods

The research method employed in this study is developmental research. The product developed in this research is an animated video using the Renderforest application. This research was based on the components of developmental research, which include analysis, design, development, implementation, and evaluation. The design model used in this development is the ASSURE model (Analyze Learners, State Objectives, Select methods, Media and Material, Utilize material, Require learner Participation, Evaluate and revise). This model was chosen to create effective and efficient learning activities, especially in learning activities that utilize media and technology.

The data collection techniques used in this research are observation and interview techniques. Observation was used to assess the effectiveness of the developed animated video media. Indirect interview techniques were used to determine the validity and practicality of

the vibrant video media. Observation is employed to evaluate the effectiveness of the developed animated video. This technique systematically observes how the footage was used in the learning process and its impact on student engagement and comprehension. Indirect interviews are conducted to assess the validity and practicality of the animated video media. This technique includes using questionnaires and expert validation sheets.

Surveys are administered to gather feedback from teachers and students regarding their experiences with the animated video in the learning process. This feedback helps in assessing the effectiveness and user-friendliness of the video. Expert validation sheets were used to collect input and evaluations from subject matter experts who evaluated the animated video's quality, accuracy, and alignment with educational objectives and standards.

The data collection procedure for evaluating using Renderforest animated videos involves indirect interviews. These interviews consist of discussions with mathematics subject area teachers and students to gauge their responses to the instructional content. The research process adheres to the stages of developmental research, with each step contributing to the development and evaluation of the animated video as a learning tool. The data collected through observation and interviews will be analyzed to assess the effectiveness and practicality of video animation in enhancing students' creative thinking in three-dimensional mathematics learning.

Result

The research method employed in this study is developmental research, which aims to create a specific product and test its effectiveness. Research is needed to develop a particular product, and a needs analysis was conducted to test its efficacy for broader societal use. Thus, developmental research has a longitudinal nature.

The development procedure for Renderforest animated video in this study adopts the ASSURE model, which consists of six stages. Each stage of the development procedure is described as follows.

1. Analyzing Learners: This stage involves analyzing the characteristics of Grade XI students at SMK Negeri 1 Karanggayam, the target users of the video learning material. Learners' features include visual, auditory, and kinesthetic learners, each with distinct traits related to their learning preferences and styles.
2. Stating Standards and Objectives: Considering the characteristics of the learners and the expected competency requirements, the research focuses on three-dimensional materials, as they require high-order thinking skills, fostering creative thinking in students. This learning development aims to enhance students' creative thinking in line with the demands of the 21st century.

3. Selecting Strategies, Technology, Media, and Materials: The selection of strategies, technology, media, and materials aims to make learning more effective and efficient, providing flexibility to learners and avoiding monotony. Problem-based learning was chosen as the strategy because it enhances students' creative thinking. Renderforest, an online software application, is selected as the technology for creating animated learning videos. It allows easy access through platforms like YouTube, preventing students from downloading large files and potentially filling up their device storage.
4. Utilizing Technology, Media, and Materials: The researcher begins designing the learning video during this stage. Videos were chosen for their ability to present information effectively and efficiently. Renderforest, as an online software for creating animated videos, facilitates the development of instructional materials. In this research, the animated video lasted approximately 3 minutes and was divided into three parts, each with its corresponding YouTube link.

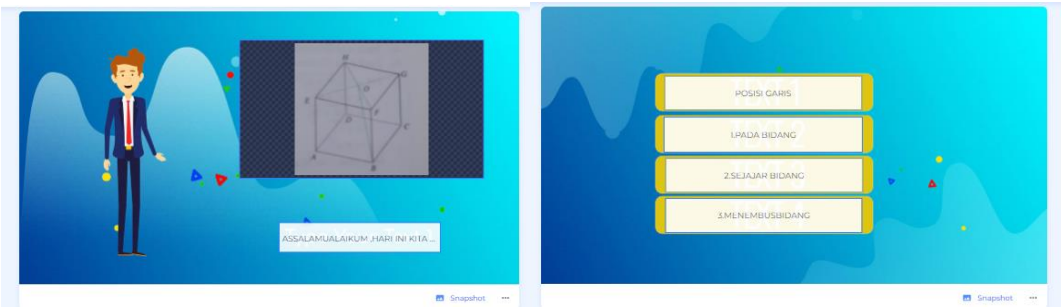


Figure 1. The scene images for Part 1 (https://youtu.be/XKjcXqP_kdA)

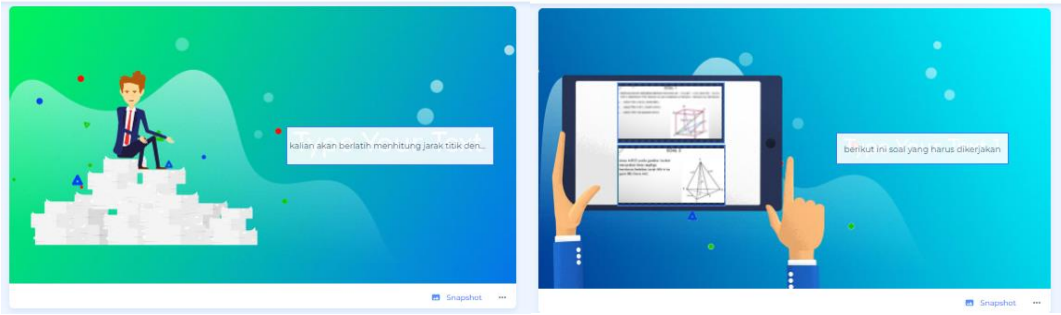


Figure 2. The scene images for Part 2 (https://youtu.be/GJu6pm0OOJY)

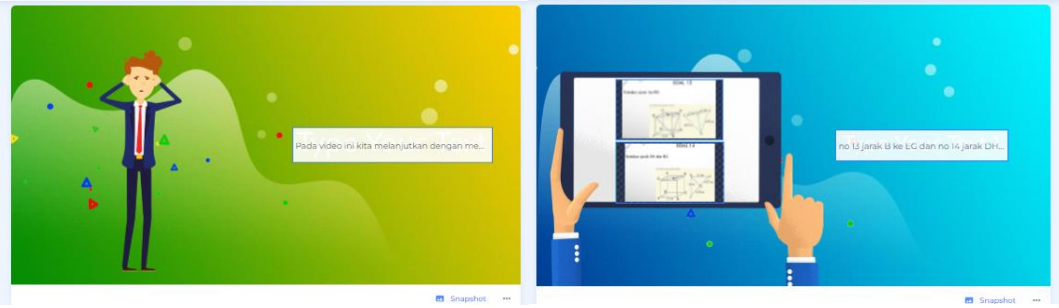


Figure 3. The scene images for Part 3 (https://youtu.be/_3PVuyAtWug)

5. Requiring Learner Participation: This stage of the learning design is intended to engage learners interactively in following the planned lessons. Students were directed to solve problems independently or in groups based on what was presented in the instructional animated video regarding three-dimensional materials.
6. Evaluation and Revision: This stage represents the two fundamental aspects of developing the quality of goal-oriented learning and the expected competencies of learners, especially high-order thinking skills, particularly creative thinking. Data analysis for validity consists of three aspects: (1) video validation by two experts in the field of Information Technology and Communication, with video revisions based on their feedback; (2) revision of the instructional video based on validator input; and (3) classroom trial of the video. Data analysis for practicality consists of two aspects: (1) the response of mathematics teachers to the module and instructional video as learning resources and (2) students' response to the use of the module and video during classroom instruction.

Table 1. Criteria for Validity and Practicality of Animated Videos

No	Interval	Criteria
1	$\bar{x} > 4.2$	Sangat Baik
2	$3.4 < \bar{x} \leq 4.2$	Baik
3	$2.6 < \bar{x} \leq 3.4$	Cukup Baik
4	$1.8 < \bar{x} \leq 2.6$	Kurang Baik
5	$\bar{x} \leq 1.8$	Tidak Baik

Where:
$\bar{x}$ = Mean score
xi = Score of indicator statement i, where i = 1, 2, 3, ..., n
n = Number of assessment items

Table 2. Assessment by Media Experts

No.	Criteria		Score	
		Validator 1	Validator 2	Average
1.	Media design	4	4	4
2.	Language use	4	2	3
3.	Operation	4	4	4
	Average	4	3.3	3.7

Table 3. Assessment by Student Responses

No.	Criteria		Score	
		1st Student Group	2nd Student Group	Average
1.	Media design	4	4	4
2.	Language use	4	3	3.5
3.	Operation	4	4	4
	Average	4	3.7	3.8

Based on the tables above, the results of media expert validation show an average score of 3.7, indicating that the instructional video meets the criteria for being excellent and suitable for use. Meanwhile, the student responses yield an average score of 3.8, meeting the requirements for being perfect and ideal for use in instruction.

Discussion

Based on previous research, implementing the Problem-Based Learning (PBL) model based on instructional videos has proven to enhance students' problem-solving skills, particularly in mathematics. Problem-solving is beneficial for students as it helps them see its relevance to other aspects of learning. Therefore, the PBL model based on instructional videos, designed to develop mathematical problem-solving skills, is highly suitable as it challenges students to analyze problems [17]-[19].

However, it is worth noting that some students expressed difficulties in understanding and applying the provided instructional videos, primarily due to time constraints, including the perceived short duration of the videos. Nonetheless, some students found the learning activities to be engaging. According to one student, the activities were "exciting." Some students also suggested that the video explanations should be more straightforward. Other students shared a similar sentiment, stating that the "procedure in the video should be clarified" to improve their comprehension of the learning content.

Based on the presented findings and discussions concerning using Renderforest animated videos, it is evident that using instructional videos effectively enhances students' understanding of three-dimensional concepts. These findings align with previous research [20]-[22]. Both studies mentioned that instructional videos were more effective than traditional teaching methods that did not incorporate instructional videos [10]. The research indicates that PBL models based on instructional videos, such as those created using Renderforest, offer a practical approach to improving students' problem-solving skills and understanding of complex mathematical concepts, specifically in three-dimensional mathematics.

Conclusion

This research has demonstrated the effectiveness of implementing Problem-Based Learning (PBL) models based on instructional videos, particularly those created using

Renderforest, in enhancing students' problem-solving skills and understanding of complex mathematical concepts, specifically three-dimensional mathematics. The findings from this study align with previous research, confirming that instructional videos offer a valuable tool for enhancing the learning experience. They provide an engaging and interactive medium for students to explore mathematical concepts and apply problem-solving skills. While most students found this approach beneficial and exciting, some highlighted the importance of more straightforward explanations and longer video durations to support their comprehension. Integrating instructional videos into the learning process can address modern education's evolving needs, particularly in promoting high-order thinking skills, such as creative thinking and problem-solving, which are essential in the 21st century.

Conflict of Interest

The authors should declare that there is no conflict of interest.

References

[1] Faber, J. M., Luyten, H., & Visscher, A. J. (2017). The effects of a digital formative assessment tool on mathematics achievement and student motivation: Results of a randomized experiment. *Computers & education, 106*, 83-96.

[2] Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2017). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement?. *Eurasia Journal of Mathematics, Science and Technology Education, 14*(2), 569-578.

[3] Hwa, S. P. (2018). Pedagogical change in mathematics learning: Harnessing the power of digital game-based learning. *Journal of Educational Technology & Society, 21*(4), 259-276.

[4] Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(1), 33-35.

[5] Garcia, R., Dante Tan, R., Florendo, J., & Santos, N. (2020). 21st century soft skills in student-centured learning among first-year college students: a comperative study. *InternationalJournal of Recent Advances in Multidisciplinary Research*, *7*(10), 6338-6341.

[6] Karatas, K., & Zeybek, G. (2020). The Role of the Academic Field in the Relationship between Self-Directed Learning and 21st Century Skills. *Bulletin of Education and Research*, *42*(2), 33-52.

[7] Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & De Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in human behavior*, *72*, 577-588.

[8] Spiteri, M., & Chang Rundgren, S. N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. *Technology, Knowledge and Learning*, *25*, 115-128.

[9] Gillett-Swan, J. (2017). The challenges of online learning: Supporting and engaging the isolated learner. *Journal of Learning Design*, *10*(1), 20-30.

[10] Anshari, M., Almunawar, M. N., Shahrill, M., Wicaksono, D. K., & Huda, M. (2017). Smartphones usage in the classrooms: Learning aid or interference?. *Education and Information Technologies*, *22*, 3063-3079.

[11] Rodríguez-Almagro, J., Prado-Laguna, M. D. C., Hernández-Martínez, A., Monzón-Ferrer, A., Muñoz-Camargo, J. C., & Martín-Lopez, M. (2021). The impact on nursing students of creating audiovisual material through digital storytelling as a teaching method. *International journal of environmental research and public health*, *18*(2), 694.

[12] Kay, D., & Kibble, J. (2016). Learning theories 101: application to everyday teaching and scholarship. *Advances in physiology education*, *40*(1), 17-25.

[13] Lewallen, T. C., Hunt, H., Potts-Datema, W., Zaza, S., & Giles, W. (2015). The whole school, whole community, whole child model: A new approach for improving educational attainment and healthy development for students. *Journal of School Health*, *85*(11), 729-739.

[14] Malik, R. S. (2018). Educational challenges in 21st century and sustainable development. Journal of Sustainable Development Education and Research, 2(1), 9-20.

[15] Gover, A., Loukkola, T., & Peterbauer, H. (2019). Student-centred learning: approaches to quality assurance. *EUA (European University Association)*.
[16] Rangkuti, A. N. (2015). Developing a learning trajectory on fraction topics by using realistic mathematics education approach in primary school. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *5*(5), 13-16.
[17] Purwaningsih, E., Sari, A. M., Yuliati, L., Masjkur, K., Kurniawan, B. R., & Zahiri, M. A. (2020, March). Improving the problem-solving skills through the development of teaching materials with STEM-PjBL (science, technology, engineering, and mathematics-project based learning) model integrated with TPACK (technological pedagogical content knowledge). In *Journal of Physics: Conference Series* (Vol. 1481, No. 1, p. 012133). IOP Publishing.
[18] Tawfik, A. A., & Lilly, C. (2015). Using a flipped classroom approach to support problem-based learning. *Technology, Knowledge and Learning*, *20*, 299-315.
[19] Setyani, W. A., & Darmawan, A. S. (2021, March). The Implementation of Audio Visual Media in Problem Based Learning Model to Improve the Problem Solving Skills. In *6th International Seminar on Science Education (ISSE 2020)* (pp. 563-568). Atlantis Press.
[20] Aeni, A. N., Nofriani, A. N., Fauziah, I. A., & Fauzi, I. A. (2022). Pemanfaatan Media Animasi Berbasis Aplikasi Renderforest Dalam Membentuk Kepribadian Islami Bagi Siswa Sekolah Dasar Kelas 4. *Jurnal Pendidikan Dan Teknologi Indonesia*, *2*(6), 279-287.
[21] Riskadewi, K. N. (2023). Integrating Problem-Solving Skills in Developing Trigonometric Ratio Learning Videos for Right-Angled Triangles. *Jurnal Praktik Baik Pembelajaran Sekolah dan Pesantren*, *2*(02), 80-87.
[22] Tumangger, W. R. (2023). Pembelajaran Berbasis Masalah Berbantuan Renderforest untuk Mendorong Kemampuan Berpikir Kritis. *Jurnal Praktik Baik Pembelajaran Sekolah dan Pesantren*, *2*(02), 70-79.

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