The Effect of the STEM Method Using Animated Videos in Theory Solid Figure on Student Learning Outcomes

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Abstract. This study discusses the specific problems found in observations at SDN 3 Cikidang conducted by researchers. The main problem found is the use of learning media that is less than optimal so that children do not understand the learning material for building space. Another problem found is that the available teaching aids are still conventional. So that students are less interested in participating in the learning process. To answer these problems, researchers conducted experiments and observations on 4th grade students of SDN 3 Cikidang using pre-test, post-test and questionnaire instruments. According to the study's findings, employing animated movies in STEM (Science, Technology, Engineering, and Mathematics) lessons can enhance student learning outcomes and make it simpler for students to comprehend the information in construction environments. Additionally, the method employed incorporates students in the learning process so that they actively participate in it and have the chance to express their creativity and reach their full potential.

Keywords: STEM · Video Animation · Building Material · Learning Outcomes

1 Introduction

Mathematics is a science that plays a very important role in everyday life and cannot be separated from life. With mathematics that teaches students to think logically, critically and creatively, mathematics in the minds of students, especially elementary school, is scary, difficult and boring. Not infrequently students who avoid math lessons so they don't go to school, students think mathematics is not important, they think there is no benefit, so as educators must be creative in making learning media for example by using technology assistance so that they can improve understanding of concepts as examples of building spaces so that students are more understand the material, so they must use alternatives in the learning process, not only using traditional methods such as the lecture method.

Mathematics is a subject that is used since children enter elementary school to improve thinking skills and contribute to solving everyday problems[1] To be able to

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provide good concepts in mathematics subjects, teachers must be able to create appropriate learning methods so that mathematics can be fun for students[2]. Teachers can apply the concept of playing while learning or with the help of unique learning media so that it attracts students' attention to learning, but still explains the basic concepts of mathematics lessons. The solution that can be used is to use learning media. Learning media is one of the intermediaries involved by educators in developing experiences to make it simpler for understudies to figure out learning materials [3].

One of the media that can be used is learning video. [4] video media can overcome distance and time barriers, recording can be repeated if it is important to improve, and the message conveyed is fast and easy to remember [5]In general, in studying subjects that are considered difficult, students tend to show interest in learning and low achievement motivation [6]Interest in learning mathematics in students can be increased in various ways, one of which is the application of teaching aids in the form of media. The function of the media itself as a messenger / material. Media can increase students' enthusiasm in learning, so that the material presented can be absorbed properly.

Regarding the benefits of media in learning activities are explained as follows: (1) learning media acts as a good explanatory message/material during the learning process, marked by increased student interest in learning, (2) student motivation can be increased by involving students actively. Directly in applying the media during the learning process, (3) learning media can optimize the student learning process, (4) the experiences that students have are the same. [7] Learning media is a tool that acts as a messenger/material in the learning process. [8]The function of learning media is also explained who explain learning media as one of the tools used in the delivery of teaching materials. [7].

The involvement of the use of media, according to Kreyenhbuhl can make the quality of learning better. Learning media can optimize students' learning process Students have the same experience. Learning media is a tool that acts as a messenger/material in the learning process [9]. Learning media are still in the form of spatial images contained in books or blackboards. The level of effectiveness of using media is still low, indicated by most students not being able to understand the material well and have low enthusiasm. Based on these conditions, learning is not optimal.

Therefore, alternative media are needed that can attract students' interest that are tailored to student needs, one of which is the development of animated video-based audiovisual learning media. Animation is formed from a collection of moving images in the form of objects with certain effects so that they look realistic and attractive. [10] These objects can be living and non-living things. Animation looks attractive with the right color combination and supporting text, and will be more interesting with the help of audio/sound. An important role in using animated videos as a learning medium is the ability to visualize material that students cannot see or imagine.

Therefore, one of the efforts to make learning more interesting and easy to understand is to use a learning model that is given problems in everyday life using the STEM (Science, Technology, Engineering, Mathematical) learning model. The STEM learning model requires students to be able to solve problems, make innovations, find/design new things, understand themselves, do logical thinking and master technology. The goal of this education is to teach students to reflect on the problem-solving process by focusing

on real-world and actual challenges. Students who learn STEM develop deep, dynamic, and creative insights that will enable them to raise superior generations.

The integration of STEM education with acceptable exam results and learning objectives must be properly understood. The goal of STEM is to increase people's scientific aptitude and create innovative technical products so that they can compete internationally.) Propose that high-quality STEM training should promote (a) scientific inquiry and engineering design, including mathematics and science instruction (b) the incorporation of technology and engineering into science and mathematics. (c) STEM-focused collaborative learning techniques that link students and educators d) Offering a broad and diverse perspective (f) Including techniques like project-based learning. [11].

According to 21st century education, science is used extensively in the educational system, particularly in the subjects of science, technology, engineering, and mathematics. STEM refers to these four academic fields and stands for science, technology, engineering, and mathematics. STEM education keeps students engaged and offers them engaging learning opportunities. It also supports students' abilities and knowledge and can help teachers become better at planning STEM lessons for students in the classroom. [12] If a teacher can inspire students to improve and develop their circumstances for learning, learning will proceed smoothly. [13].

One of the materials that can be applied to the STEM learning model is building space because this material is related to everyday life. Where students will be encouraged to make something and solve problems. When viewed from the sample, namely elementary school students, where children of that age must be shown concrete things so that they are easy to understand. Therefore, researchers use animated video learning media so that students can better understand the material about building space.

Building space is one of the materials studied in class IV, namely discussing material about shape, volume and surface area. Building space is a form that has a certain regularity. According to the shape of the sides, the shape of the space is divided into two, namely the form of flat side rooms such as cubes, blocks, pyramids, and prisms. While the curved side of the room such as tubes, cones, and balls. In this subject, teachers rarely use media or teaching aids to instill concepts in students because they think that the time allocated for this subject is not much while the material presented is dense so they are afraid of running out of time when using media or teaching.

Based on the results of observations at SDN 3 Cikidang conducted by researchers, it was found that there were several problems. The main problem found was the use of learning media that was less than optimal so that children did not understand the learning material for building space. Another problem found is that the available teaching aids are still conventional. So that students are less interested in participating in the learning process.

2 Method

2.1 Research Design

The approach is quantitative and uses a quasi-experimental methodology. The influence of the STEM approach employing animated movies on student learning outcomes is being investigated using the quasi-experimental research method. Quasi-experimental

using all subjects in the research group (intact group) to be given treatment (treatment). Data collection techniques used are questionnaires and tests, where questionnaires are used to determine student responses to the use of learning media, while tests are used to measure learning outcomes.

2.2 Population and Samples

The research design used was a one group pretest posttest only design where the researcher only tested 1 group without a group by using a comparison using a pretest, which is a test used before being given treatment, while a posttest is a test used after being given treatment. This research was conducted at SD Negeri 3 Cikidang. The sample in this study were all fourth grade students of SD Negeri Cikidang with 2 treatments (treatment).

2.3 Data Collection Technique

Instruments in the form of tests and questionnaires were employed as part of the data gathering technique in this study. The test is divided into two parts: the pre-test, which is administered prior to therapy, and the post-test, which is administered following treatment. Students' opinions of the teaching strategies and learning tools employed were gauged using questionnaires.

2.4 Data Analysis Technique

The data analysis technique used is t test, normality test and gain test. The study was conducted by collecting the desired data using questionnaires and tests, then the next step was to process the data and analyze the data obtained from the instrument using the SPSS (Statistical Product and Servicer Solution) version 23 program. To assess student learning outcomes before and after the deployment of learning media to students, the t test was used. The purpose of the data normality test is to determine if the distribution of data within a group of data or variables is normally distributed by doing an examination of the data distribution within the group of data or variables. The normalized gain test (N-Gain) was used to gauge the improvement in the students' cognitive learning outcomes following the application of the therapy.

3 Findings and Discussion

3.1 Data Normality Test

Using a normality test, researchers can assess if the distribution of data within a group of variables or data is uniformly distributed or not (Table 1).

Table 1. Test of Normality

Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
Statistic	***df***	***Sig.***	***Statistic***	***df***	***Sig.***
,128	29	,200*	,979	29	,822
,172	29	,028	,950	29	,185

*. This is a lower bound of the true significance.

Table 2. Paired Samples Statistics

		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	***Pretest***	31,5172	29	2,62707	,48783
	Posttest	34,9655	29	2,41251	,44799

Table 3. Paired Samples Correlations

		N	**Correlation**	**Sig.**
Pair 1	**Pretest & Posttest**	29	,358	,057

3.2 Test T

The t-test was used to compare student learning outcomes before and after the use of learning media to students (Table 2).

It is known that if the pretest value is 31.5172 and the posttest is 34.96655, then the basis for making the decision is that the pretest value is smaller than the posttest so that there is a difference in the average value between the pretest and posttest (Table 3).

It is known that the sig value of 0.057 is greater than the probability value of 0.05, then it is said that there is a relationship between the pretest and posttest variables (Table 4).

H0: The mean difference between the pretest and the posttest is zero; Ha: The mean difference between the pretest and the posttest is present. If the Sig. (2-tailed) value is less than or equal to 0.05, H0 is rejected and Ha is accepted; if the Sig. (2-tailed) value is more than or equal to 0.05, Ha is rejected and H0 is accepted. According to the table, H0 is rejected and Ha is approved since the value of sig 2 tailed 0.000 is less than the probability value of 0.05, indicating that there is an average difference between the pretest and posttest.

3.3 N-Gain Score Test

The purpose of normalized gain, also known as the N-Gain score, is to assess the efficacy of a specific method or therapy in one group, whether through research that uses a control group, pre- or post-testing, or any combination of these methods (Table 5).

Table 4. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	*Std. Deviation*	*Std. Error Mean*	*95% Confidence Interval of the Difference*				
					Lower	*Upper*			
Pair 1	***Pretest posttest***	−3,44	2,86	,53126	−4,53	−2,36	−6,4	28	,000

According to the results of the aforementioned N-Gain score test computation, the experimental class's average N-gain score is 4.9472, or 5%, falling into the ineffective category. With an N-Gain score ranging from −4.76% to 14.86%. The control class's average N-gain score is 53.3355, or 53%, placing it in the less effective category. With an N-Gain score ranging from 42.47% to 60.81% (Fig. 1).

Thus, it can be concluded that the use of the STEM method using animated videos is not effective in improving learning outcomes in the mathematics subject of spatial construction in 4th grade students of SDN 3 Cikidang. Meanwhile, the use of conventional methods is less effective for improving learning outcomes in mathematics subjects in the material of spatial construction in 4th grade students of SDN 3 Cikidang.

3.4 Questionnaire

Questionnaires are used to measure students' responses to students' interest and interest in learning to build spaces using animated videos (Table 6 and Fig. 2).

In the results of the questionnaire that has been filled out by students, namely that 1 student does not agree with the use of animated video learning so that students are not interested in the learning process taking place. 7 students agree with the use of animated videos in the learning process. 21 students strongly agree with the use of animated videos in the learning process so that students look happy and interested in the learning process taking place.

Table 5. Descriptives

Kelas		**Statistic**	**Std. Error**
Eksperimen	Mean	4,9472	,75449
	95% Confidence Interval for Mean	3,4017	
		6,4927	
	5% Trimmed Mean	4,9945	
	Median	5,7143	
	Variance	16,509	
	Std. Deviation	4,06308	
	Minimum	−4,76	
	Maximum	14,86	
	Range	19,63	
	Interquartile Range	4,34	
	Skewness	−,290	,434
	Kurtosis	,936	,845
Kontrol	Mean	53,3355	1,24054
	95% Confidence Interval for Mean	50,7390	
		55,9319	
	5% Trimmed Mean	53,5240	
	Median	54,6707	
	Variance	30,779	
	Std. Deviation	5,54788	
	Minimum	42,47	
	Maximum	60,81	
	Range	18,35	
	Interquartile Range	9,35	
	Skewness	−,519	,512
	Kurtosis	−,789	,992

Fig. 1. Student activities

Table 6. Paired Samples Statistics

Category	Frequency	Percentage
1 (Strongly Disagree)	1	3%
2 (Disagree)	0	0%
3 (Agree)	7	24%
4 (Strongly)	21	73%
Amount	29	100%

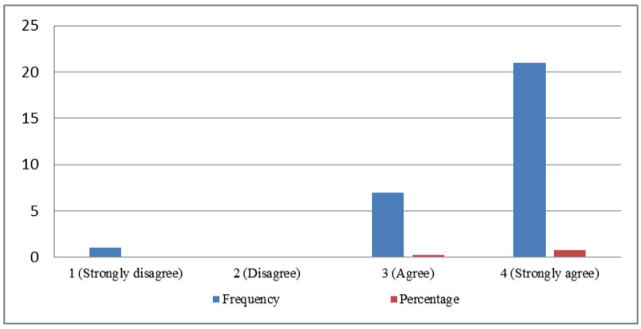

Fig. 2. Student responses to learning using animated videos

4 Conclusion

From the research results, it is known that the use of the STEM method using animated videos has an influence on student learning outcomes on building materials. From the findings of this study, based on student responses, this animated video media can increase students' interest in the learning process. Based on the analysis of the impact felt by students, namely increasing interest in learning, the material is easier to understand because it is presented in a concrete way, student motivation increases because of the

use of unique learning media. For further research, it is expected to conduct a more in-depth study of suitable methods and media that can be applied to improve student learning outcomes.

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