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# Problem Based Learning Model with Animation Videos on the Topic Fractions in Elementary School

# Model *Problem Based Learning* dengan Video Animasi pada Topik Pecahan Di Sekolah Dasar

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***Abstract***

*The purpose of this study is to determine the influence of employing animated video learning materials on the learning outcomes for comparable fractions in fourth-grade math students. Research was conducted using a quasi-experimental approach with a control group that only participated in the post-test. This research used a split-class design, with some students as controls and others as experimental subjects. Right from the start, the researchers ensured the instruments were reliable and genuine. In the validity test, researchers used SPSS software, and each of the ten questions was deemed valid. A reliability test value of 0.668 was obtained by using Cronbach's Alpha. The fact that the value is higher than 0.60 indicates that the instrument is regarded as reliable. The hypothesis was tested using the t-test with a significance level (Sig.) of 0.234, which is more than the predetermined threshold of 0.05, using a significance level (α) of 0.05. Beyond that, with a t-count of 5.388 and a t-table of 2.069, the t-count is larger than the t-table. Findings showed that students in classrooms that used animated video learning mediums outperformed those in classes that used more conventional methods.*

***Keywords:*** *problem based learning, animated video, fractions, learning outcomes.*

**Abstrak**

Penelitian ini untuk mengetahui pengaruh penggunaan materi pembelajaran video animasi terhadap hasil belajar matematika pecahan pada siswa kelas IV. Penelitian dilakukan dengan menggunakan pendekatan quasi eksperimental dengan kelompok kontrol yang hanya mengikuti post-test. Penelitian ini menggunakan desain kelas terpisah, dengan sebagian siswa berperan sebagai kontrol dan sebagian lagi sebagai subjek eksperimen. Peneliti memastikan bahwa instrumen tersebut valid. Dalam uji validitas peneliti menggunakan software SPSS dan masing-masing sepuluh soal dinyatakan valid. Nilai uji reliabilitas sebesar 0,668 diperoleh dengan menggunakan Cronbach's Alpha. Hasil dari nilai tersebut lebih tinggi dari 0,60 menunjukkan bahwa instrumen tersebut sangat valid. Hipotesis diuji menggunakan uji t dengan tingkat signifikansi (Sig.) sebesar 0,234 lebih dari batas yang telah ditentukan yaitu 0,05, dengan menggunakan tingkat signifikansi (α) sebesar 0,05. Analisis pada $t_{hitung}$ sebesar 5,388 sedangkan $t_{table}$ sebesar 2,069, dinyatakan $t_{hitung}$ lebih besar dibandingkan dengan $t_{table}$. Hasil penelitian menunjukkan bahwa siswa di kelas yang menggunakan media pembelajaran video animasi lebih unggul dibandingkan siswa yang menggunakan metode pengajaran konvensional.

**Kata Kunci:** problem based learning, video animasi, pecahan, hasil pembelajaran.

## 1. Introduction

The revolution in industry as well as education 4.0 prioritizes the power of information and communication technology to improve classroom teaching. Teachers find it easier to deliver information to students due to the rapid growth of technology in the education sector (Arifin et al., 2021; Codreanu et al., 2020). Therefore, education is essential in creating exceptional human beings as it aims to provide empowering experiences and shape a society that values education. Students' ability to face daily challenges can be improved in learning mathematics using technology so that students can think critically (Wahyuningsih, 2019).

One of the common problems in schools when teaching math is helping children accept the materials and concepts taught. (Lely et al., 2020; Oktasari et al., 2022). Some children struggle to understand that 1/4 is equivalent to 0.25. Having them work with fractions and other math operations can hone students' analytical thinking and problem-solving skills (Nuriadin et al., 2013).

In the process of interviewing the homeroom teacher and when examining the odd semester student learning outcomes at SDN Sumur Batu class IV D which consists of 25 students. It was believed that there were still many students who did not achieve the KKM in mathematics, with only 11 out of 25 students successfully completing the KKM score, which was set at 70. The failure to achieve the KKM was due to the use of conventional teaching. Therefore, the researcher concluded that animated videos would be the most effective means of teaching after consulting with the homeroom teacher and discussing the learning objectives of class IV D odd semester at SDN Sumur Batu 14.

In modern education, animation is now a focus for educators and researchers who want to utilize it as an effective learning tool. They are interested in exploring the ability of animation to increase student motivation and participation in the learning process (Cahyani, 2020).

Thanks to scientific and technological breakthroughs, teachers now have more options than ever to create a wide variety of teaching materials. In an educational setting, media is defined as anything that helps students recognize a subject or develop a perspective (Audie, 2019). Courses, reading materials, and the environment around the classroom all play an important role in encouraging students' mental, emotional, and physical development, which in turn aids their learning.

Primary school students' interest in play, engagement of visual and auditory stimuli, and opportunities to explore and experiment are well represented in the selected animated video materials (Nurfadhillah et al., 2021; Sukarini & Manuaba, 2021). Educators can use media for student needs and encourage critical thinking, such as problem-based learning. This method fosters students' critical thinking skills, problem solving, and conceptual understanding by immersing them in real-world scenarios (Pranata et al., 2021; Yustianingsih et al. 2017). The solution to the problems related to mathematics education is the creation of teaching materials based on problem-based learning strategies. Animated videos can engage students and enhance their learning in this way. Educational media has the potential to captivate students, according to previous research (Alexander et al., 2020; Izzaturahma et al., 2021).

The students in this study were in grade four, and they viewed animated videos on fractions and other problem-based arithmetic concepts. Animated videos that embrace the problem-based learning paradigm are a great asset to this medium. To make fourth grade math more engaging, the content is linked to real-world challenges, which encourages children to think critically and actively. Formulate strategies for creating creative and engaging animated video materials that can capture students' interest and inspire a love of learning.


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Primary school students aged 10 to 11 years benefit greatly from animated video media as it helps them achieve a strong operational level of learning. The use of animated video content in the classroom has the potential to increase students' engagement with the subject matter, motivate them to learn more, and make learning fun (Wardani, 2019).

Based on the problems faced in learning media, especially in low-grade elementary school mathematics subjects, the researcher is interested in conducting research with the title "Problem Based Learning Model with Video Animation on Fraction Topics in Elementary School".

## 2. Literature Review

Media is one type of teaching material that uses visual and auditory components to teach students various concepts, principles, and processes (Fatmawati et al., 2018). Student understanding can be improved by utilizing video learning resources, presenting information in an interesting way, facilitating interpretation, and making it easier to receive information.

The results of this study are consistent with previous findings by (Yetama and Napitupulu, 2021), in his journal entitled "The Effect of Video-Based Learning Media on Student Learning Outcomes in Mathematics Subjects Ordinary Fraction Addition Material in Class IV SD Negeri 101771 Tembung" After conducting research, calculating data and testing hypotheses, it was concluded that video-based learning media had an effect on students' mathematics learning outcomes compared to using conventional learning media and students' mathematics learning outcomes using video-based learning media were higher than students' mathematics learning outcomes using conventional learning media in class IV SD Negeri 101771 Tembung. The equation in the study is that both apply video learning media to math learning outcomes using experimental quantitative research and are also conducted on students. Meanwhile, what distinguishes my research is the location of the research and the subject matter studied. From the previous research above, it can be concluded that animated video learning media has an influence on student learning outcomes. this shows that student learning outcomes in grade IV SD can be influenced by the learning media used.

## 3. Methods

The method used in this study used a pseudo-experimental method (quasi). Experimental research is one type of quantitative research that is very strong to measure causal relationships (Hendrayani, 2017). From a philosophical point of view, quantitative research is based on positivism, which highlights objective and measurable phenomena using methods such as structured experiments, statistical analysis, and numerical data (Sukmadinata, 2017).

Research that examines the interaction between multiple therapies under controlled conditions is known as experimental research. Some of the most common types of experimental designs include factorial designs, quasi-experiments, true experiments, and pre-experimental designs. The notion of "quasi-experimental design" is a refinement of "real experimental design" (Sugiono, 2016), in which variables that are not related to the experiment are only partially controlled.

For this investigation, the research group was divided into two parts: one control group and another experimental group. The researchers used a split approach with each of the two sets of samples. The experimental group used animated video learning materials, while the control group used more conventional means. An outline of the experimental setup used in this study is provided in Table 1.

**Table.1**. Research Design 1

| Class | Treatment | *Post-test* |
|---|---|---|
| Experiment | X | $O_1$ |
| Control | - | $O_2$ |

Information:
$O_1$: Post-test conducted by the experimental class
X : Treatment using animated video learning media
$O_2$: Post-test conducted by the control class

For the odd semester of the 2023-2024 school year, 50 eighth grade students of SDN Sumur Batu 14 Pagi participated in the study. Each fourth grade has a total of 25 students, in this study, the experimental class was taken from class IV D while the control class was taken from class IV C. This study used fractional number material.

There are three stages of the data collection process in this study: planning, implementation, and review. The process carried out in the preparation stage includes determining the research sample, making learning materials such as LKPD and teaching modules, research instruments, validating and changing instruments based on the findings of the validity test, and finally preparing research instruments. The research includes fill-in questions that aim to assess the learning process. Learning activities including student involvement are one of the elements of the implementation stage. As a final step, you need to calculate the scores, check if the data is normal and homogeneous, analyze it using an independent t-test, and write down your findings. Using the post test, we compared the performance of the two groups on an assessment of math skills including addition and subtraction of fractions. The experimental group received more instruction in this area than the control group.

## 4. Results and Discussion

The results of this study indicate that the use of learning media in the form of animated videos affects the mathematics learning outcomes of grade IV students. This can be seen from the significant difference in the average post-test score between the experimental class 77.44 and the control class 68.52. The t-test analysis shows that the value of $t_{count}$ 5.388 > $t_{table}$ 2.069, indicating rejection of $H_0$ and acceptance of $H_1$. This result shows that there is a significant difference between the mathematics learning outcomes of students who use animated video learning media compared to conventional ones. This indicates that the use of animated video learning media has a positive impact that does not occur by chance.

Digital-based educational media is content that utilizes digital technology. The utilization of such media has a significant impact on mathematics education. Compared to printed materials and manipulatives, electronic learning resources are superior. Furthermore, there is a significant effect of math application on the average. Research shows that there is a deeper understanding of ideas among abstract math students when they use digital learning tools (Wungguli & Yahya, 2020). Students learn faster and remember more information when teachers use visual aids such as pictures, illustrations and exercises during this part of the lesson. Children in this age group are cognitively mature enough to complete tasks or procedures using real objects. Children still have difficulty understanding abstract concepts when presented with virtual reality compared to real objects. This is in contrast to junior and senior high school students who have passed the formal


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operational stage of development and can reason when faced with more abstract ideas (Juwantara, 2019).

Researchers use animated video media so that students can think critically and rationally. After obtaining the results of the study, the researchers tested using SPSS to measure the validity of an objective test with the form of fill-in questions, namely by using the correlations test using SPSS which has been presented in Table 2.

**Table.2**. Validity Test

| | | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Pearson Correlation | 1 | 0.102 | 0.026 | -0.045 | 0.213 | 0.213 | 0.083 | 0.102 | .406* | 0.198 | .443* |
| | Sig. (2-tailed) | | 0.629 | 0.902 | 0.832 | 0.306 | 0.308 | 0.694 | 0.629 | 0.044 | 0.342 | 0.027 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P2 | Pearson Correlation | 0.102 | 1 | -0.116 | 0.097 | 0.348 | 0.120 | 0.044 | 1.000** | -0.042 | 0.124 | .520** |
| | Sig. (2-tailed) | 0.629 | | 0.580 | 0.645 | 0.089 | 0.569 | 0.836 | 0.000 | 0.841 | 0.555 | 0.008 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P3 | Pearson Correlation | 0.026 | -0.116 | 1 | 0.389 | 0.299 | 0.002 | 0.239 | -0.116 | 0.382 | 0.272 | .492* |
| | Sig. (2-tailed) | 0.902 | 0.580 | | 0.055 | 0.147 | 0.992 | 0.250 | 0.580 | 0.060 | 0.188 | 0.012 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P4 | Pearson Correlation | -0.045 | 0.097 | 0.389 | 1 | 0.101 | 0.043 | .676** | 0.097 | .420* | -0.137 | .544** |
| | Sig. (2-tailed) | 0.832 | 0.645 | 0.055 | | 0.629 | 0.839 | 0.000 | 0.645 | 0.037 | 0.512 | 0.005 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P5 | Pearson Correlation | 0.213 | 0.348 | 0.299 | 0.101 | 1 | 0.196 | -0.030 | 0.348 | 0.200 | 0.100 | .547** |
| | Sig. (2-tailed) | 0.306 | 0.089 | 0.147 | 0.629 | | 0.349 | 0.887 | 0.089 | 0.337 | 0.635 | 0.005 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P6 | Pearson Correlation | 0.213 | 0.120 | 0.002 | 0.043 | 0.196 | 1 | 0.016 | 0.120 | 0.156 | .470* | .458* |
| | Sig. (2-tailed) | 0.308 | 0.569 | 0.992 | 0.839 | 0.349 | | 0.941 | 0.569 | 0.456 | 0.018 | 0.021 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P7 | Pearson Correlation | 0.083 | 0.044 | 0.239 | .676** | -0.030 | 0.016 | 1 | 0.044 | 0.269 | 0.011 | .484* |
| | Sig. (2-tailed) | 0.694 | 0.836 | 0.250 | 0.000 | 0.887 | 0.941 | | 0.836 | 0.193 | 0.957 | 0.014 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P8 | Pearson Correlation | 0.102 | 1.000** | -0.116 | 0.097 | 0.348 | 0.120 | 0.044 | 1 | -0.042 | 0.124 | .520** |
| | Sig. (2-tailed) | 0.629 | 0.000 | 0.580 | 0.645 | 0.089 | 0.569 | 0.836 | | 0.841 | 0.555 | 0.008 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P9 | Pearson Correlation | .406* | -0.042 | 0.382 | .420* | 0.200 | 0.156 | 0.269 | -0.042 | 1 | 0.022 | .560** |
| | Sig. (2-tailed) | 0.044 | 0.841 | 0.060 | 0.037 | 0.337 | 0.456 | 0.193 | 0.841 | | 0.917 | 0.004 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| P10 | Pearson Correlation | 0.198 | 0.124 | 0.272 | -0.137 | 0.100 | .470* | 0.011 | 0.124 | 0.022 | 1 | .437* |
| | Sig. (2-tailed) | 0.342 | 0.555 | 0.188 | 0.512 | 0.635 | 0.018 | 0.957 | 0.555 | 0.917 | | 0.029 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| tot | Pearson Correlation | .443* | .520** | .492* | .544** | .547** | .458* | .484* | .520** | .560** | .437* | 1 |
| | Sig. (2-tailed) | 0.027 | 0.008 | 0.012 | 0.005 | 0.005 | 0.021 | 0.014 | 0.008 | 0.004 | 0.029 | |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |

The instrument is considered valid at a significance level of 0.05 It is considered valid if the $r_{count}$ obtained is higher than the $r_{table}$ achieved, and likewise it is considered invalid if the $r_{count}$

obtained is lower than the $r_{table}$ obtained. It is known that the validity test on questions 1 to 10 is declared valid because $r_{count} > r_{table}$.

This study analyzes data using the Reliable Test using the Cronbach's Alpha formula which has been presented in Table 3.

**Table.3**. Reliability Test

| | | N | % |
|---|---|---|---|
| Cases | Valid | 25 | 100.0 |
| | Excluded[a] | 0 | 0.0 |
| | Total | 25 | 100.0 |

| Cronbach's Alpha | N of Items |
|---|---|
| 0.668 | 10 |

If Cronbach's Alpha is more than 0.60, it is considered reliable. It is known that the Cronbach Alpha result is higher than the limit value of 0.668> 0.60, it is said that the data is reliable. After the reliability test, the next test is normality to determine whether the data follows a normal distribution. Based on the normality calculations shown in Table 4.

**Table.4**. Shapiro-Wilk Normality Test

| Class | | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| PostTest | Control posttest | 0.120 | 25 | .200* | 0.956 | 25 | 0.343 |
| | Experimental posttest | 0.132 | 25 | .200* | 0.920 | 25 | 0.052 |

With 25 participants and a significance level of 0.05, the experimental group's post-test findings were Sig. = 0,052. Normally distributed data is indicated by Sig. < 0.05 and the data result is 0.052 < 0.05. The control group post-test score is Sig. = 0.343 with a sample size of 25 people and a significance level of 0.05. The data can be considered normal because Sig. 0.343 > 0.05. It is known that the significance level of all data in the Kolmogorov-Smirnov and Shapiro-Wilk tests is more than 0.05, which means it is considered normal

After calculating normality, the next step is to calculate homogeneity. The findings during the Homogeneity Test are shown in Table 5.

**Table.5**. Variance Homogeneity Test

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| PostTest | Based on Mean | 1.455 | 1 | 48 | 0.234 |
| | Based on Median | 1.205 | 1 | 48 | 0.278 |
| | Based on Median and with adjusted df | 1.205 | 1 | 42.765 | 0.278 |
| | Based on trimmed mean | 1.451 | 1 | 48 | 0.234 |

The significance values are obtained as follows: Obtained sig value on based on mean 0.234 > 0.05, based on median 0.278 > 0.05, based on median with adjusted df 0.278 > 0.05, and based on trimmed mead 0.234 > 0.05. Because the sig. value > 0.05, the data distribution is homogeneous.


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After the normality and homogeneity tests, the t-test was used to compare the means of two groups to determine if the difference between them was statistically significant. The results of the t-test are shown in Table 6.

**Table.6**. Independent Samples Test

| | | Levene's Test | | t-test for Equality of Means | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Significance | | Mean Difference | Std. Error Difference | 95% Confidence Interval | |
| | | F | Sig. | t | df | One-Sided p | Two-Sided p | | | Lower | Upper |
| Post Test Results | variances assumed | 1.455 | 0.234 | -5.388 | 48 | 0.000 | 0.000 | -8.9200 | 1.6555 | -12.2486 | -5.5914 |
| | variances not assumed | | | -5.388 | 45.468 | 0.000 | 0.000 | -8.9200 | 1.6555 | -12.2534 | -5.5866 |

Based on the output above, it is known that the sig value. levene's test for equality of variances is 0.234> 0.05 So it can be interpreted that the data variance between the control class and the experimental class is homogeneous or the same. So that the interpretation of the "independent samples test" output table above is guided by the value contained in the "equal Variances Assumed" table. Based on the output table "independent samples test" "equal variances assumed" known sig value. (2-tailed) of 0.01 <0.05 So as the basis for decision making in the independent sample test it can be concluded that $H_0$ is rejected and $H_1$ is accepted. Thus it can be concluded that there is a significant or real difference between the average student post-test results in the control class and the experimental class.

Furthermore, from the output table above, it is known that the "mean difference" value is -8.9200. This value shows the difference between the average student post-test results in the control class and the average student post-test results in the experimental class. And the difference is -12.2486 to -5.5914 (95% confidence interval of the difference). The results of the t test are $t_{count} > t_{table}$ which is 5.388> 2.069 and sig <0.05, so based on the basis of decision making through comparison with the t table it can be concluded that which means $H_0$ is rejected and $H_1$ is accepted, which means there is an average difference in post test results between the control class and the experimental class or in other words the application of learning using animated media has an influence on learning outcomes.

According to the data obtained in the related data collection process, it is shown in Table 7, which is based on the findings of the researcher's data analysis and hypothesis testing.

**Table.7**. Learning Outcome Test 1

| Category | Experiment Class | Control class |
|---|---|---|
| Valid | 10 | 10 |
| Mean | 77,44 | 68,52 |
| Median | 77 | 70 |
| Mode | 75 | 65 |
| Std. Deviation | 5,11 | 6,50 |
| Range | 15 | 23 |

After data analysis and hypothesis testing are completed, conclusions can be drawn. The experimental class fraction post-test learning results showed an average of 77.44 with a range of

70 to 85. The mean was also at 77 with a standard deviation of 5.11. On the other hand, the control group as a whole obtained an average post-test score of 68.52, with a range of 57-80. With a standard deviation of 6.50, mean 70, and mode 65.

Based on the findings of this study, fourth grade students of SDN Sumur Batu 14 Pagi benefited from the use of animated films as learning media, especially in fraction subjects. This can be seen from the experimental group that obtained superior scores compared to the control class that did not use animated videos. In addition to the final score, it can be seen that students who learn using animated video media are more enthusiastic and excited than students who only learn using books. The T test results obtained $H_1$ is accepted and $H_0$ is rejected because the $t_{count}$ value of 5.388 greater than the $t_{table}$ value of 2.069. This finding indicates that students' math learning outcomes fluctuate significantly depending on whether they use animated video learning media or not. This suggests that the beneficial effect of using animated video learning materials was not a coincidence but rather the result of different teaching approaches in the two groups.

## 5. Conclusion

The findings of this study indicate that the use of animated videos as a learning tool can affect the learning outcomes of mathematics regarding fractions in grade four at SDN Sumur Batu 14 Pagi. The use of videos as learning media shows a positive and beneficial influence, and there are differences in grades between students who use videos as learning media and students who do not. Students who received learning with animated videos showed a higher increase in grades compared to students who followed conventional learning. For future research, it is recommended that the animated video-based learning method be tested in other subjects to prove its success in various learning contexts.

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