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The Effect of Student Worksheets (LKPD) Assisted by Animated Videos on Students' Problem-Solving Abilities, Learning Motivation, and Cognitive Learning Outcomes

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Abstract: This study aims to determine the effect of animated video-assisted student worksheets (LKPD) on problem-solving skills, learning motivation, and cognitive learning outcomes of eleventh-grade students at SMA Negeri 3 Palu. This study employed a quantitative method with a quasi-experimental design, with a non-equivalent pretest-posttest control group design. The population was all eleventh-grade science students at SMA Negeri 3 Palu, with a sample size of 72 students selected using purposive sampling. Data analysis was conducted using descriptive statistics analysis techniques to describe the effect of animated video-assisted LKPD through pretest and posttest data. Furthermore, inferential statistics analysis was conducted using analysis of covariance to test the research hypotheses. The results of descriptive analysis on each measured variable show that the experimental class taught using animated video-assisted student worksheets achieved higher scores than the control class. This is also proven through significant hypothesis testing on each variable, namely on problem-solving ability ($p = 0.03$), learning motivation ($p < 0.01$), and cognitive learning outcomes ($p < 0.01$). Through the results of this analysis, it can be concluded that animated video-assisted student worksheets have an effective effect in improving students' problem-solving abilities, learning motivation, and cognitive learning outcomes.

Keywords: Animated Video; Cognitive Learning Outcomes; Learning motivation; Problem-Solving ability; Student Worksheet.

Introduction

According to Law Number 20 of 2003 concerning the National Education System of the Republic of Indonesia, education is a conscious and planned effort to create a learning atmosphere and process so that students can actively develop their potential. Education is expected to not only shape an intellectually intelligent Indonesian society but also one capable of facing the changing times, particularly the current 21st century (Harahap, 2020). The 21st century is a century that demands quality from all efforts or performance carried out by humans. Along with the ongoing development of the times and increasingly modern civilization, society is required to be able to compete and adapt to the process of transformation to become quality and reliable human resources (Yusmar & Fadilah, 2023). In the 21st century, science and technolgy continue to advance and influence life (Sadiah et al., 2025). Furthermore, the essence of 21st-century learning is connecting learning materials to real life, one way to do this is through biology. Biology, which deals with living things and their environment, requires students to learn through scientific activities and emphasizes hands-on experience, thus encouraging the development of 21st-century skills (Febrianti et al., 2025).

Based on learning achievement data shown by PISA in 2015, Indonesia received s acore of 403 and was ranked 64th out of 69 participing countries (Pratiwi,

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2019). In the 2018 PISA data, there was a decline in the science achievement cores of Indonesian students, with an average score of 396, and ranked 71st out of 29 countries. This achievement score is far below the OECD average of 489. Furthermore, in the 2022 PISA data there was another decline wih Indonesia's average score of 383 and ranked 67th out of 81 countries. The survey shows that 66% of indonesian students have science achievements at level 1, and none have science achievements at level 6 or level (Ivanka & Setiawan, 2025). The low achievement based on this analysis indicates the need for improvements in the education system in Indonesia that requires students to have competency in learning and innovation skills, mastery of media and information as well as life and career skills.

Education essentially aims to develop students' potential to develop critical and creative thinking skills, as well as solve problems they face in everyday life. In the context of high school, teachers are required not only to transfer knowledge but also to facilitate students to be active and motivated in participating in learning, and to construct their own understanding. This is in line with research conducted by Mardiana et al. (2024), which states that teachers no longer only play a role as information providers but also as facilitators who encourage students to think critically, creatively, communicate, and collaborate. Regarding the use of technology in the learning process, technology is a key factor in supporting successful learning in schools. Advanced technological developments have made it easier for students to access technology-related learning materials, enabling them to more easily understand the material presented by teachers (Soleh et al., 2019). Furthermore, to address the challenges of today's digital learning, which encourages the use of creative, effective, and efficient learning media, digital media is essential for achieving student learning success (Irwan et al., 2019).

Natural science is a learning concept that studies all natural phenomena related to human life, plants, animals and inimate objects (Kristi & Andriani, 2023). Teaching materials and learning media that are still dominant and do not provide enough space for discussion cause students to explore their ideas less, which impacts learning outcomes, problem-solving abilities, and a lack of student interest and attention during the learning process. Furthermore, students who tend to memorize material concepts but do not truly understand the deeper meaning of the material taught cause them difficulty when faced with contextual questions or problems. This problem will certainly have an impact on each student's learning outcomes. The problem-solving approach refers to the development of childrens brain function and creative thinking skills ro rezognize problems and find solutions (O'Reilly et al., 2022).

Therefore teachers as facilitators should be able to facilitate students by considering the learning situation and conditions. Current technological developments have provided various innovative learning media that can help students understand the material taught in a more enjoyable and meaningful way. The teaching and learning process is inseparable from the strategies, methods, and media used by teachers (Achmad et al., 2021). One of the teaching materials widely developed and utilized by teachers in the learning process is the student worksheet (LKPD). A student worksheet (LKPD) is a teaching material containing material, summaries, and instructions for completing learning tasks that students must complete to achieve established core competencies. Teachers can develop LKPDs by considering the situation and conditions of the learning environment they face. Innovative and creative LKPD, while keeping up with technological developments, will facilitate teachers in directing and implementing learning, while students can learn independently by working on each problem given. Quality worksheets will facilitate teachers in guiding students in discovering concepts through individual and group activities.

The decelopment of science and technology cureently continues to develop rapidly and become more advanced, so this has triggered the use of the situation as a reference in the world education (Wardana & Adlini, 2022). Student worksheets (LKPD) supported by animated videos are one such systematically designed teaching material designed to guide students through learning activities. Equipped with animated videos accessible through YouTube links and QR codes, students can view moving visuals that present concepts related to the topic being taught. The QR codes on the LKPD can be accessed using a QR code scanner applucation, smartphone camera or google lens (Utami et al., 2024). Through the animated videos, students can find answers to each question in the LKPD. This allows students to not only read the text and answer the questions but also be guided to analyze the answers based on the animated videos they observe. This aligns with research by Muthia et al. (2025), which found that animated videos are effective in improving students' problem-solving skills. In the current era of technological development, students are more interested in using smarthphones as a means of entertainment and playm so this has an impact on learning activities (Taqiyyah et al., 2023).

Memorable learning isn't just about conveying information; it requires engaging actions to capture students' attention. Integrating student worksheets (LKPD) with animated videos allows students to not

only read and write but also observe more concrete conceptual visualizations of the material being taught. With engaging animations, students can be more motivated to participate in learning, understand the material in depth, and solve problems. Student worksheets supported by animated videos are effective because they can help, simplify, and engage students' interest in the learning process (Ningrum et al., 2023). This finding is further supported by research conducted by Margaretha et al. (2024) at SMA Negeri 4 Tanjung Jabung Barat, which showed that STEM-based e-LKPD supported by animated videos can improve students' critical thinking skills.

The results of initial observations and interviews conducted at SMA Negeri 3 Palu showed that the learning process faced by biology teachers still faces several problems. Based on the interview results, it was found that problem-solving abilities, learning motivation and student learning outcomes are still relatively low, this can be seen from some students who are still passive in participating in the learning process, such as low student involvement in class discussions, lack of interest in the material being taught, and a tendency to simply memorize but not truly understand the concept of the material being taught.

Biology is a branch of science that is abstract and complex, requiring a deep understanding and strong visualization skills. The complexity of biological material requires a learning approach that can facilitate students in building an integrated and meaningful understanding (Arini et al., 2026). The results of a student questionnaire in research conducted at SMA Negeri 1 Cangkrringan students proved that 72.5% of students considered the material on the body's defense system to be complex material in class XI (Delvita et al., 2025). material to be complex material. In addition to conceptual challenges, student motivation in learning biology is also a problem because it often requires extensive memorization. Therefore, this is why technology is needed to visualize abstract concepts and make biology learning more engaging and interactive (Zebua & Malik, 2025).

Based on the aforementioned issues, innovation is needed in the form of creating teaching materials that keep pace with current technological developments. Student worksheets (LKPD) aided by animated videos are one innovation that has the potential to address student learning challenges at SMA Negeri 3 Palu. The novelty of this research is the implementation of using student worksheets assisted by animated videos which are used to measure three variables, namely problem-solving abilities, learning motivation and cognitive learning outcomes. So this research need to be caried out because it is rare to find research that measures three variables at once in one treatment. Science education, especially biology, is a subject that plays a crucial role and is expected to prepare students to face all challenges in the global era. Students need to be prepared with learning that can equip them with good competencies by taking into account current developments in both science and technology, enabling them to think critically, logically, creatively, and collaboratively. Based on these conditions, this study aims to determine whether there is an effect of the use of student worksheets (LKPD) aided by animated videos on problem-solving abilities, learning motivation, and students' cognitive learning outcomes.

Method

Research Type

This research employed a quantitative method with a quasi-experimental approach. Quasi-experimental research is research that approaches real experiments, testing the influence of one variable on another variable (Carter et al., 2024). The design employed was a Pretest-Posttest Nonequivalent Control Group Design. This design involved two groups: an experimental class treated with animated video-assisted student worksheets (LKPD), and a control class treated with student worksheets (LKPD).

Research Time and Location

This research was carried out in the odd semester of the 2025/2026 academic year in January-February 2026. The location of this research was at SMA Negeri 3 Palu, Dewi Sartika street No.104, South Palu District, Palu City, Central Sulawesi Province.

Research Design

The design used in this research was the pretest-posttest Nonequivalent control design group. This design involved two groups, namely an experimental class treated with student worksheets (LKPD) assisted by animated videos and a controll class as a comparison treated with student worksheets (LKPD).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment	O1	X	O2
Control	O3	C	O4

Information:
X: Treatment with animated video LKPD
C: Treatment with LKPD
O1: Pretest for the experimental class
O2: Posttest for the experimental class
O3: Pretest for the control class
O4: Posttest for the control class

Population and Sample

The population in this study was the entire study group class XI science SMA Negeri 3 Palu with a total of 177 students. The sampling technique in this research used a purposive sampling technique. Where the sample selected through the researcher's consideration to take two equivalent classes based on initial academic ability, which was obtained through the average score of students report cards.

Research Instrument

The test intrument used in this research is a test instrument to measure problem-solving ability, and cognitive learning outcomes, as well as a likert scale questionnaire (1-5) used to measure students learning motivation., which have been validated by experts and underwent reliability testing before implementation.

Reseacrh procedure

This research procedure consists of three stages, namely the observation stage, preparation, implementation and final stage.

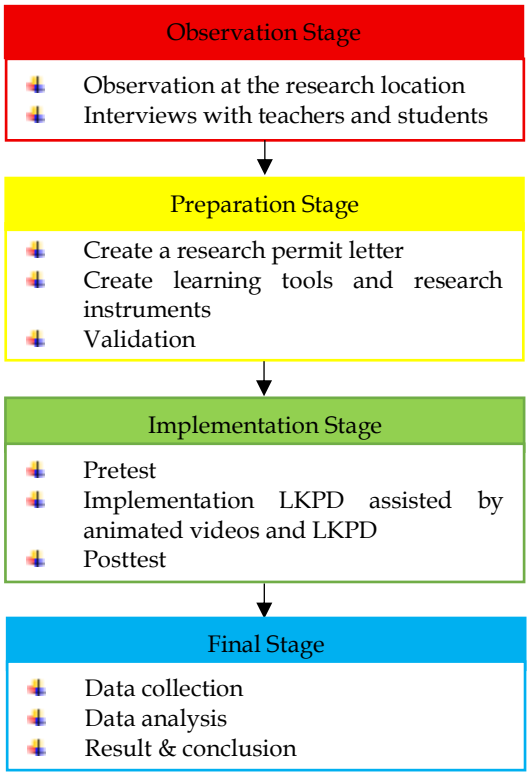

Figure 1. Research Procedure

Data Analysis Techniques

Data analysis was carried out using descriptive statistics analysis techniques, which aims to describe the effect of LKPD assisted by animated videos on problem-solving abilities, learning motivation and cognitive learning outcomes based on the results of the pretest and posttest. Next, an inferential statistics analysis wil be carried out to test the research hypothesis using covariance analysis (ANCOVA) with pretest scores as covariates and posttest scores as dependent variables at a significance level of 5% ($\alpha = 0.05$) which is carried out separately for each dependent variable. The ANCOVA test was conducted through prerequisite tests, namely the Shapiro-Wilk Test for normality and the Levene Test for homogeneity.

Result and Discussion

This study consisted of six meetings. At the first meeting, a pretest was given, then in the second to fifth meetings, a learning process was carried out using the material on the human immune system by providing treatment in the form of the use of LKPD assisted by animated videos in the experimental class and treatment in the control class in the form of the use of regular LKPD. At the final meeting, a final test (posttest) was given to determine whether there was an increase in problem-solving abilities, learning motivation and cognitive learning outcomes of students. The following illustrates the treatment of student worksheets (LKPD) assisted by animated in the experimental class and student workshhets in the control class.

Figure 2. Experimental Class Treatment

Figure 3. Control Class Treatment

Problem-solving ability

Data from the results of descriptive statistics analysis of students' problem-solving abilities in experimental class XI B3 which was given treatment of

student worksheets (LKPD) assisted by animated videos and control class XI B4 which used student worksheets (LKPD) can be seen in Table 2.

Table 2. Descriptive Statistics Analysis of Problem Solving Ability

Descriptive statistics	Animated Video LKPD		Class LKPD	
	Pretest	Posttest	Pretest	Posttest
Number of Samples (N)	36	36	36	36
Lowest Value	30	60	30	55
Highest Value	75	100	70	95
Mean	50.69	80.69	50.56	76.53
Standard Deviation	11.47	8.96	11.57	9.17

Based on Table 2, it is known that the results of measuring the problem-solving abilities of students who use student worksheets (LKPD) assisted by animated videos in the pretest data obtained an average value of 50.69 ± 11.47, with the lowest value of 30 and the highest value of 75. While in the posttest data obtained an average value of 80.69 ± 8.96, with the lowest value of 60 and the highest value of 100. The results of measuring the problem-solving abilities of students who use student worksheets (LKPD) in the pretest data obtained an average value of 50.56 ± 11.57, with the lowest value of 30 and the highest value of 70. While in the posttest data obtained an average value of 76.53 ± 9.17, with the lowest value of 55 and the highest value of 95.

The results of the inferential statistics analysis with normality tests, homogeneity tests and hypothesis tests of students' problem-solving abilities are as follows.

Table 3. Normality Test of Problem Solving Ability

Statistics	Animated Video LKPD		Class LKPD	
	Pretest	Posttest	Pretest	Posttest
Sig.	0.35	0.17	0.11	0.19
Information	Normal	Normal	Normal	Normal

Based on Table 3, the results of the normality test of problem-solving ability were obtained with a pretest significance value for the experimental class of 0.35 and a posttest significance value of 0.17. While the pretest significance value in the control class was 0.11 and a posttest significance value of 0.19. The normality test data showed a Sig. (α) value > 0.05 so it can be concluded that the problem-solving ability values of the experimental class that used student worksheets (LKPD) assisted by animated videos and the control class that used student worksheets (LKPD) came from a normally distributed population.

Table 4. Homogeneity Test of Problem Solving Ability

Statisttics	Animated Video LKPD	Class LKPD
	Pretest	Posttest
Sig.	0.80	0.81
Information	Homogeneus	Homogeneus

Based on Table 4, the results of the homogeneity test of problem-solving ability were obtained with a pretest significance value of 0.80 and a posttest significance value of 0.81. The homogeneity test data showed a Sig. (α) value > 0.05 so it can be concluded that the problem-solving ability values of the experimental class using student worksheets (LKPD) assisted by animated videos and the control class using student worksheets (LKPD) had homogeneously distributed data.

Table 5. Hypothesis Test of Problem Solving Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1826.843[a]	2	913.421	14.885	.000
Intercept	11688.918	1	11688.918	190.478	.000
Pretest	1514.343	1	1514.343	24.677	.000
LKPD	304.137	1	304.137	4.956	.029
Error	4234.268	69	61.366		
Total	451000.000	72			
Corrected Total	6061.111	71			

Based on Table 5, the results of the ANCOVA test on problem-solving ability showed a significance value of F = 4.956 and a Sig. value of p = 0.029 (the significance value is less than 0.05), so H0 is rejected. This indicates that there is a significant influence of LKPD assisted by animated videos on students' problem-solving abilities.

Animated video worksheets (LKPD) are one of the teaching materials that integrate technology, making the learning process more effective, especially in supporting students' biology problem-solving abilities. Scanning the QR code on the LKPD makes it easier for students to view the material in the form of a collection of moving images and audio, making it seem lively. LKPDs assisted by interesting and interactive animated videos can attract students' attention more than LKPDs that simply display the concepts of the material to be learned. When students are more involved in the learning process, they will be more focused and motivated in receiving the material presented. This is in accordance with research conducted by Hindiyati et al. (2022) which states that to improve the quality of learning in solving a problem, relevant media is needed to be used, one of which is animated videos. Through animated videos, the teaching materials given to students are clearer for

students to understand, because in the learning process students are encouraged to use their senses through visual and auditory stimuli. This is reinforced by Ayuni et al. (2024) stated that the use of Android-based learning media is a technology integration that supports the learning process specifically to improve students' problem-solving abilities.

Biology learning requires a deep understanding of abstract and complex concepts. However, teachers often employ conventional learning strategies during the learning process, resulting in students becoming passive and unaccustomed to problem-based questions. However, with the availability of various media and advanced technology, teachers can help address various student learning challenges. Therefore, the use of Student Worksheet (LKPD) teaching materials and the provision of animated videos can help students understand material with a high level of difficulty. This is supported by research conducted by Chao et al. (2025), which states that animation is an innovative learning strategy that is effective in conveying complex concepts. Another opinion expressed by Asiyah et al. (2021) is that conventional learning methods used by teachers can make students passive, thus under-stimulating their problem-solving abilities. With animated videos, various student learning problems can be overcome compared to only providing material in the form of text or reading (Franiatte et al., 2025). Students who have problem-solving skills can solve every problem in their lives (Ichsan et al., 2023; Mahanal et al., 2022).

Problem-solving skills can be enhanced by learning biology through the immune system. One of the learning outcomes in the independent curriculum on the immune system is that by the end of phase F, students will be able to analyze abnormalities that occur in the immune system. In this material, students are not only required to understand the components and working mechanisms of the immune system, but they are also invited to investigate cases of abnormalities or disorders of the immune system that commonly occur in the community and communicate the results of their investigations comprehensively. The student worksheets distributed to groups include case studies that they need to understand. Animated videos can help them process their knowledge more deeply and answer questions through the case studies provided. This is in line with research conducted by Tendrita et al. (2024) which states that animated videos can explain complex biological processes in a more engaging and easy-to-understand way. Through dynamic visualization, students can directly and clearly see how biological mechanisms occur. Animated videos are audio-visual media that can attract students' attention, depict objects in more detail, and help them understand difficult material and solve problems (Apriansyah et al., 2020).

Learning Motivation

Data from the results of descriptive statistics analysis of students' learning motivation in experimental class XI B3 which used student worksheets (LKPD) assisted by animated videos and control class XI B4 which used student worksheets (LKPD) can be seen in Table 6.

Table 6. Descriptive statistics Analysis of Learning Motivation

Descriptive statistics	Animated Video LKPD		Class LKPD	
	Pretest	Posttest	Pretest	Posttest
Number of Samples (N)	36	36	36	36
Lowest Value	54.40	69.60	52.80	66.40
Highest Value	72.00	88.00	72.00	87.20
Mean	63.47	79.1	63.31	74.24
Standard Deviation	4.67	4.58	5.24	4.85

Based on Table 6, it is known that the results of measuring students' learning motivation using student worksheets (LKPD) assisted by animated videos in the pretest data obtained an average value of 63.47 ± 4.67, with the lowest value of 54.40 and the highest value of 72.00. While in the posttest data obtained an average value of 79.1 ± 4.58, with the lowest value of 69.60 and the highest value of 88.00. The results of measuring students' learning motivation using student worksheets (LKPD) in the pretest data obtained an average value of 63.31 ± 5.24, with the lowest value of 52.80 and the highest value of 72.00. While in the posttest data obtained an average value of 74.24 ± 4.85, with the lowest value of 66.40 and the highest value of 87.20.

The results of the inferential statistics analysis with normality tests, homogeneity tests and hypothesis tests of students' learning motivation are as follows.

Table 7. Normality Test of Learning Motivation

Statistics	Animated Video LKPD		Class LKPD	
	Pretest	Posttest	Pretest	Posttest
Sig.	0.09	0.12	0.20	0.06
Information	Normal	Normal	Normal	Normal

Based on Table 7, the results of the normality test of learning motivation were obtained with a pretest significance value for the experimental class of 0.09 and a posttest significance value of 0.12. Meanwhile, the pretest significance value in the control class was 0.20

and a posttest significance value of 0.06. The normality test data showed a Sig. (α) value > 0.05 so it can be concluded that the learning motivation values of the experimental class that used student worksheets (LKPD) assisted by animated videos and the control class that used student worksheets (LKPD) came from a normally distributed population.

Table 8. Homogeneity Test of Learning Motivation

Statisttics	Class	
	Animated Video LKPD	LKPD
	Pretest	Posttest
Sig.	0.35	0.79
Information	Homogeneus	Homogeneus

Based on Table 8, the results of the homogeneity test of learning motivation were obtained with a pretest significance value of 0.35 and a posttest significance value of 0.79. The homogeneity test data showed a Sig. (α) value > 0.05 so it can be concluded that the learning motivation values of the experimental class that used student worksheets (LKPD) assisted by animated videos and the control class that used student worksheets (LKPD) had homogeneously distributed data.

Table 9. Hypothesis Test of Learning Motivation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1489.369[a]	2	744.685	105.987	.000
Intercept	304.843	1	304.843	43.387	.000
Pretest	1070.800	1	1070.800	152.401	.000
LKPD	397.467	1	397.467	56.569	.000
Error	484.808	69	7.026		
Total	425051.520	72			
Corrected Total	1974.178	71			

Based on Table 9, the results of the ANCOVA test on learning motivation showed a significance value of F = 56.569 and a Sig. value of p <0.001 (the significance value is less than 0.05), so H0 is rejected. This indicates that there is a significant influence of LKPD assisted by animated videos on students' learning motivation.

The increase in learning motivation is seen based on the learning motivation indicators. The indicator shows the curiosity of each student when watching the animated video. The relevance indicator shows the enthusiasm of students to answer the questions available in the LKPD by sharing the information they obtained after watching the animated video. The self-confidence indicator is seen from the results of each group's work in conveying what they have learned through presentation and discussion sessions. While the final indicator, namely satisfaction, is seen from each group that successfully completed their responsibilities by answering questions given by other groups and submitting assignments through the distributed LKPD. Motivation is the basis for students to obtain maximum learning results, where the learning results obtained will then be used as a basis for determining the achievement of expected competencies (Putri et al., 2025).

Changes in student learning motivation are seen throughout the process of working on LKPD assisted by animated videos until the presentation stage, then measured through a learning motivation questionnaire distributed to students. As research conducted by Kleftodimos (2024) states that the use of animated videos in learning can result in higher student enthusiasm, involvement, and satisfaction. This aligns with research conducted by Mashuri & Budiyono (2020), which found that animated videos are an innovative audio-visual medium that can replace conventional methods, enhancing students' learning experiences, making them more engaging and rewarding. Multimedia-based learning, such as animated videos, can increase intrinsic motivation (Qianyi & Zhiqiang, 2024).

In an experimental class taught using student worksheets (LKPD) supported by animated videos, students were more engaged in the learning process. The shared group worksheets and animated videos, accessible to each student via QR code scanning, stimulated student motivation to collaborate with their group mates. Students were able to be more active in sharing information through the animated videos they watched, and answering questions based on case studies presented in the worksheets. This aligns with the opinion expressed by Putra et al. (2021), who stated that in today's modern era, students prefer technology-related learning, thus requiring learning media that can encourage greater student engagement. Research by Wahyudi et al. (2025) states that integrating interactive learning media with a contextual approach can improve motivation and learning outcomes. Animation can enhance learning design by transforming static content into a dynamic and engaging visual experience, effectively capturing students' attention through concise concepts (Praveen & Srinivasan, 2022). Animated videos are designed in such a way and are interesting in the process of delivering learning material, so that seeing interesting things from the videos can foster students enthusiasm foe learning (Fyfield et al., 2019).

Cognitive Learning Outcomes

Data from the results of descriptive statistics analysis of cognitive learning outcomes of students in experimental class XI B3 which used student worksheets (LKPD) assisted by animated videos and control class XI

B4 which used student worksheets (LKPD) can be seen in Table 10.

Table 10. Descriptive Statistics Analysis of Cognitive Learning Outcome

Descriptive statistics	Class			
	Animated Video LKPD		LKPD	
	Pretest	Posttest	Pretest	Posttest
Number of Samples (N)	36	36	36	36
Lowest Value	40	68	44	68
Highest Value	76	96	80	96
Mean	59.33	83.67	61.11	79.44
Standard Deviation	8.89	7.96	9.54	7.16

Based on Table 10, it is known that the results of measuring the cognitive learning outcomes of students who used student worksheets (LKPD) assisted by animated videos in the pretest data obtained an average value of 59.33 ± 8.89, with the lowest value of 40 and the highest value of 76. Meanwhile, in the posttest data, an average value of 83.67 ± 7.96 was obtained, with the lowest value of 68 and the highest value of 96. The results of measuring the cognitive learning outcomes of students who used student worksheets (LKPD) in the pretest data obtained an average value of 61.11 ± 9.54, with the lowest value of 44 and the highest value of 80. Meanwhile, in the posttest data, an average value of 79.44 ± 7.16 was obtained, with the lowest value of 68 and the highest value of 96.

The results of the inferential statistics analysis with normality tests, homogeneity tests and hypothesis tests of students' cognitive learning outcome are as follows.

Table 11. Normality Test of Cognitive Learning Outcome

Statistics	Class			
	Animated Video LKPD		LKPD	
	Pretest	Posttest	Pretest	Posttest
Sig. Information	0.16 Normal	0.07 Normal	0.37 Normal	0.08 Normal

Based on Table 11, the results of the normality test for cognitive learning outcomes were obtained with a pretest significance value for the experimental class of 0,16 and a posttest significance value of 0.07. Meanwhile, the pretest significance value in the control class was 0.37 and a posttest significance value of 0.08. The normality test data showed a Sig. (α) value > 0.05 so it can be concluded that the cognitive learning outcomes of the experimental class that used student worksheets (LKPD) assisted by animated videos and the control class that used student worksheets (LKPD) came from a normally distributed population.

Table 12. Homogeneity Test of Cognitive Learning Outcome

Statisttics	Class	
	Animated Video LKPD	LKPD
	Pretest	Posttest
Sig. Information	0.45 Homogeneus	0.30 Homogeneus

Based on Table 12, the results of the homogeneity test of cognitive learning outcomes were obtained with a pretest significance value of 0.45 and a posttest significance value of 0.230. The homogeneity test data showed a Sig. (α) value > 0.05 so it can be concluded that the cognitive learning outcomes of the experimental class that used student worksheets (LKPD) assisted by animated videos and the control class that used student worksheets (LKPD) had homogeneously distributed data.

Table 13. Hypothesis Test of Cognitive Learning Outcome

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1162.060[a]	2	581.030	12.624	.000
Intercept	5574.185	1	5574.185	121.112	.000
Pretest	841.171	1	841.171	18.276	.000
LKPD	426.406	1	426.406	9.265	.003
Error	3175.718	69	46.025		
Total	483232.000	72			
Corrected Total	4337.778	71			

Based on Table 13, the results of the ANCOVA test on cognitive learning outcomes showed a significance value of F = 9,265 and a Sig. value of p = 0,003 (the significance value is less than 0,05), so H0 is rejected. This indicates that there is a significant influence of LKPD assisted by animated videos on students' cognitive learning outcomes.

Many factors contribute to improved cognitive learning outcomes for students, one of which is the use of integrated learning materials that keep pace with current developments. This includes the use of student worksheets (LKPD) supplemented with animated videos. Animated videos can illustrate difficult-to-understand concepts through concise presentation. For example, animated videos can include images of how viruses enter the body, how inflammation or tissue repair occurs when bacteria enter damaged skin tissue, and how the body reacts when exposed to allergens. Animated videos help break down complex information

such as B cell and T cell activation so that students do not expericence information overload compared to reading long narrative texts. Apart from that, watching animated videos can help students develop their thinking skills and provide space for them to experience, feel, and discover for themselves what they are learning. This finding aligns with research by Bhutto et al. (2018), which states that in today's modern world, animation has become an essential tool for presenting multimedia materials to improve student understanding. The use of animated media can facilitate students' visualization of biological concepts, thereby improving learning outcomes (Jasmanto et al., 2022).

Innovation in teaching materials integrated with interactive and modern media can increase student engagement and cognitive abilities. Animated videos are a learning medium that displays images, text, and audio, thereby attracting students' attention and effectively understanding the material. This is in line with research conducted by Xue et al. (2024) that found that animated learning systems significantly reduce students' cognitive load because animated videos allow them to concentrate better, relieve psychological stress, and reduce frustration compared to learning material through text or reading. Animated media presents information through a combination of visuals, audio, and dynamic movements that can cognitively engage and construct students' understanding Saleh et al. (2023). The material presented by teacher will look more concrete and clear because with the help of video media students can see and hear what is the main topic of discussion at that time. If these conditions have been created then the material presented by the teacher will be easily absorbed and accepted by students (Caella & Yulianto, 2024).

The use of technology through mobile phones can improve the quality of student learning outcomes and assist teachers in delivering material more efficiently. This finding aligns with research conducted by Margaretha et al. (2024), which states that in today's modern era, the use of technology is essential to enhance the learning process and make it more applicable. As technology advances, technology-based learning innovations also need to be developed to adapt to current student needs (Crawford et al., 2020). Animated videos are a medium with the advantages of flexibility and accessibility. This opinion is supported by research by Faridah (2025), who stated that animated videos allow students to watch at their own pace. They can replay parts of the video they don't understand and pause the video if they wish to note important points from the material being shown. This finding is further supported by research by Wahyuni (2022), which states that students can access animated videos to view the material they wish to learn anytime and anywhere through their digital devices. Animated videos have been proven to significantly increase students' knowledge of biology material (Putri et al., 2024).

Conclusion

The use of appropriate teaching materials can effectively address learning challenges experienced by students. The results of the research show that student worksheets (LKPD) assisted by animated video significantly improve students performance in all measured variabels compared to conventional methods. This was proven through hypothesis testing with significant values for problem-solving ability ($p = 0.03$), learning motivation ($p < 0.01$), and cognitive learning outcomes ($p < 0.01$). Animated video-assisted student worksheets (LKPDs) are an innovative teaching material that can address student learning challenges. The integration of LKPDs with animated videos allows students not only to read and write but also to observe more concrete conceptual visualizations of the material being taught. The use of animated video-assisted LKPDs can increase learning motivation because they provide an engaging and interactive learning experience. Apart from that, the use of technology via cell phones can improve the quality of student learning outcomes and help teachers deliver material more efficiently. The author's suggestion from this research is that educators can provide appropriate teaching methods and strategies to address the various learning challenges experienced by students. Furthermore, this paper is expected to serve as a reference for developing new research.

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Conceptualization, methodology, formal analysis, investigation, resources, data curation, writing-original draft preparation, visualization, project administration, D.D.L.; validation, writing-review and editing, D.D.L., Y.H., I., F.D., and S.; supervision, Y.H. and I. All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

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