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The Application of Problem-Based Learning Models Assisted by Instructional Videos to Improve Student Science Learning Outcomes for Elementary School

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Abstract

This study aims to describe the application of a problem-based learning model assisted by learning videos to improve science learning outcomes for fourth-grade students at SDN 12 Palu. The method used is classroom action research which consists of 4 stages; planning, implementation, observation, and reflection, with data collection techniques using evaluation tests and observation sheets. The research subjects totalled 24 students. The results showed an increase in the activity of students and teachers. Student activity shows the percentage score obtained in the first cycle of 67.5% in the sufficient category, and in the second cycle shows a score percentage of 85% in the very good category. Teacher observation activities in cycle I showed a percentage score of 70% in the good category, in cycle II the percentage score was 90% in the very good category. In the results of the analysis of student evaluation tests in cycle I, the percentage of classical learning completeness was 58%, while in cycle II, the percentage of classical learning completeness was 83%. Based on these results it can be concluded that the application of problem-based learning models assisted by learning videos can improve science learning outcomes for fourth grade students at SDN 12 Palu.

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Introduction

The 2013 curriculum is an educational reference currently used which is expected to be able to create students with character who have competency attitudes, knowledge, and skills and have intelligence according to their talents and interests. This curriculum requires students to be ready to face future challenges with various competencies they have. According to Morocco (2008), in the 21st century, there are at least four learning competencies that must be mastered, namely high understanding skills, collaboration skills, communication skills, and critical thinking skills. In the 2013 curriculum, students are considered as subjects so teachers as facilitators and motivators in the learning process must be student-centered.

Science is a subject that is able to develop students' critical thinking skills. Students are guided to explore problems, seek explanations of the phenomena seen, and carry out experiments to solve problems using scientific methods that can form a new perspective about the object being observed. According to Susanto (2013), science is also an effort to understand nature through proper observations using procedures and explanations with reasoning so as to get conclusions. Understanding science is not limited to memorizing but also learning to apply the basic principles to everyday life.

According to Ampuero et al. (2015), science is basically easy to teach, it's just that the teacher's lack of creativity and innovation in designing a lesson that can lead students to be able to integrate the construction of everyday life experiences makes this subject feel very difficult to understand, so students are less motivated and result in learning outcomes decreasing (Saido et al. 2015). Based on the reflection carried out on the Science Lessons in grade IV SDN 12 Palu, there are deficiencies in carrying out learning activities in class, including the use of the lecture method with media that does not arouse the attention and active participation of students and the lack of teacher ability to choose and use learning models right. As a result, learning cannot take place properly, students still look passive and do not understand the material being taught, so the learning objectives are not achieved. This has an impact on low student learning outcomes. The learning outcomes of grade IV SDN 12 Palu for science subjects in the last two years were still low, according to the data in the 2016/2017 school year, among 28 students only 12 students achieved grades above 75. Then in the 2017/2018 school year of the 26 students, only 14 students scored more than 75. It can be concluded that student learning outcomes in science subjects in grade IV SDN 12 Palu have not met the minimum completeness criteria set by the school, namely 75.

Based on this, teachers as educators should be able to improve their professional quality by creating learning that can arouse students' curiosity

so that students can more actively seek answers to their curiosity using all existing learning resources around them. Such learning is an example of student-centered learning. Janah et al. (2018) said that one of the efforts to improve student-centered learning is through a problem-based learning model. This is in line with the opinion of Arends (2013), that problem-based learning is using problems as a basis for students to acquire knowledge.

Trianto (2010) states that problem-based learning is an interaction between stimulus and response that has a two-way relationship between learning and the environment. The environment provides input in the form of help and problems while learning functions to interpret assistance effectively so that problems can be investigated, assessed, and analyzed and solutions sought. Problem-based learning assumes that students are able to learn without having to be assisted by the teacher. They will collect all the information by studying teaching materials, observing the environment, or through discussion so that it can be used to solve problems. The teacher is only a motivator and facilitator who direct students to be actively involved in learning (Sanjaya, 2008).

According to Wasonawati et al. (2014), the problem-based learning model will be maximized if it is combined with learning media that is able to attract student concentration. One of the learning media that can help is the use of instructional videos which will attract more interest, learning motivation and student participation. Teachers also find it easier to deliver learning material. At SDN 12 Palu, the supporting infrastructure for instructional video media is available, so this research was carried out with the aim of describing the application of problem-based learning models assisted by video learning about science in grade IV SDN 12 Palu so that it can be seen that the increase in student learning outcomes about science in a lesson of changes energy.

Method and Materials

The implementation of this classroom action research follows a cyclic action stage. This research model refers to the research model proposed by Muslich (2013) where each cycle is carried out in several stages, namely (1) planning, (2) implementing action, (3) observation, and (4) reflection. The research, which was conducted in grade IV SDN 12 Palu in the odd semester of science subjects from August to October 2019, used research subjects, namely all grade IV students totaling 25 people. The object of this study is the application of problem-based learning models assisted by video learning as independent variables and student learning outcomes in science subjects as the dependent variable.

The research stages include pre-action, cycle I action, cycle II action, and further plans. At each stage of the action cycle, action planning, action, observation, and reflection will be carried out. The type of data used is quantitative data and qualitative data. Quantitative data in the form of students' ability to solve questions consists of the results of student assignments, preliminary test results, and final tests of each cycle. While the qualitative data were obtained from the validity data of expert lecturers, data on teacher and student activity in science learning, data on the implementation of learning activities referring to the problem-based learning model stage, and data from interviews with students referring to the learning process. These data were collected by means of observation and giving tests.

The analysis technique used in this study consists of 3 techniques, namely:

1) Analysis of research instruments, namely by (1) validity analysis by experts (on the observation sheet, Lesson Plan, and Students worksheet), (2) analysis of the validity of the learning outcome test items with the acceptance criteria for each item is to fulfill if $0.21 \leq rpbi \leq 1.00$, (3) analysis of the distinguishing power of test items with the criteria for distinguishing power of test items used $0.21 \leq D \leq 1.00$. (4) analysis of the difficulty level of the test item with the test item difficulty index criteria used was $0.31 \leq P \leq 0.70$, and (5) analysis of the reliability of the test with the test criteria if rl l> 0.70 can be concluded that the test is reliable.
2) Analysis of research data using the formula for individual absorption and classical learning completeness by Purwanto (2013) to determine the percentage of student learning completeness.
3) Qualitative data analysis for the process of student in learning refers to the model of Damopoli, et al. (2018), by summarizing the main and important things in order to provide a clear picture and make it easier for researchers to collect further data, the data is then presented in Narrative form, through data presentation, then draw conclusions from the results of the evaluation which includes searching for the meaning of the data and providing explanations, then verification is carried out, namely testing the truth, robustness, and compatibility of meanings that arise from the data.

4) The quantitative indicator in this study is an increase in student learning outcomes in classroom action research, namely if the individual's absorption capacity gets a minimum score of 75 and a classical completeness score of at least 80% of the total number of students. This provision is in accordance with the minimum completeness criteria imposed at SDN 12 Palu. While qualitative indicators can be seen from three aspects, namely the results of student activity observations, the results of observations of the implementation of learning which refer to the stages of the problem-based learning model, and the results of observations of learning management by the teacher. This research is declared successful if the three aspects are in the minimum good category. To obtain the data, an observation sheet was used which was analyzed in a descriptive qualitative form.

Results and Discussion

1. Instrument test results

The learning outcome test instrument was made based on the learning outcome test grid using objective tests, which had been validated by expert validators to see the suitability of the material, context, and language. The validated objective test was retried to see the validity, reliability, difficulty index, and differentiation of the test. In this study, to measure the validity of the items using the Biseral Point Correlation formula, the criteria for the test items are said to be valid if $0.40 \leq \gamma_{pbi} \leq 1.00$. The validity test that has been done, obtained 10 valid questions which will then be used in this study in the initial test and final test.

The difficulty index test of this test is to find out whether the questions used fall into the difficult, medium / enough, and easy categories. 20 items tested belong to the medium category ($0.31 \leq p \leq 0.70$) because the literacy index test falls into the medium category. The distinguishing power in this study was found in the very good category of 4 questions with a distinguishing power of 0.73 and 0.82, good 6 questions with a distinguishing power of 0.45, 0.55, and 0.64, and poor 10 questions with a distinction of 0.09 and 0.18. After validating the items, the reliability test was then carried out to measure the level of confidence. The reliability test used in this study was the Kuder Richardson test (KR-20). The question is said to be reliable if the test criteria have r11> 0.70 and the test results in this study show a reliability of 0.73 which means reliable.

2. Pre-action

This classroom action research begins with conducting pre-action by giving a pre-test in grade IV SDN 12 Palu. The purpose of giving initial tests to research subjects is to determine the student's initial abilities before the implementation of the action and also as a basic reference in forming groups in learning using problem-based learning models. The results of the analysis of the observational data on the pre-action are presented in Table 1.

Table 1. Results of data analysis of action activities

Acquisition aspect	Student learning outcomes
The number of students	24 students
Lowest Score	30 (5 students)
Highest Score	80 (6 students)
Number of Students who Completed	6 students
Number of Students Who Didn't Complete	18 students
Classical Absorption (CA)	58%
Classical Learning Completeness (CLC)	25%

3. Action observation

This Cycle I action is carried out in accordance with the Lesson Plan that has been made. In presenting the material, the researcher acts as a teacher who is accompanied by fellow teachers or colleagues who act as observers. Observers are in charge of observing teacher and student activities during the learning process. Observations were made using the teacher and student activity observation sheets provided.

1) Results of observation of student activities in cycle I and cycle II

Research activities are carried out by involving peers to be observers of student activities in participating in learning activities. Observations were made using the provided student activity observation sheets. The assessment scale is using a scoring with a range of 1 to 4. Observations of student activities are obtained by observing student activities in implementing energy change material learning through the application of problem-based learning models assisted by video learning Student activity observation data is the second determinant of the quality of the learning carried out. The results of the data analysis of the student activity observation cycle I are presented in Table 2.

Table 2. Results of data analysis on observation of student activities in cycle I and cycle II

Acquisition aspect	Cycle I		Cycle II	
	P1	P2	P1	P2
Acquisition Score	12	15	16	18
Percentage	60%	75%	80%	90%
Category	Enough	good	Good	Very good
The final result				
Average Score	13.5		17	
Average Percentage	67.5%		85%	
Category	Enough		Good	

2) Results of observation of teacher activities in cycle I and cycle II

Research activities are carried out by involving class teachers to be observers of learning activities carried out by the teacher. Observations were made using the teacher activity observation sheet provided. The assessment scale is using a scoring with a range of 1 to 4. The results of the analysis of the observation data on teacher skills in science learning through the application of a problem-based learning model assisted by instructional videos in cycle I are presented in Table 3.

Table 3. Results of data analysis on observation of teacher activities in cycle I and cycle II

Acquisition aspect	Cycle I		Cycle II	
	P1	P2	P1	P2
Acquisition Score	13	15	17	19
Percentage	65%	75%	85%	95%
Category	Enough	good	Good	Very good
The final result				
Average Score	14		18	
Average Percentage	70%		90%	
Category	Good		Very good	

The results of the analysis of the observation data on teacher activity in science learning through the application of problem-based learning models assisted by instructional videos in cycle II have increased.

4. Student learning outcomes data cycle I and II

Student ability tests and final evaluation tests in learning energy sources through problem-based learning models assisted by instructional videos are data sources for variable student learning outcomes. The evaluation test was given using a paper test in the form of a test essay of 5 items per cycle and given individually. The material covered in cycle I and cycle II includes energy changes and their relation to energy which is carried out at the end of the learning process. Data on the results of students' final ability tests in cycle I and cycle II are presented in Table 4.

Table 4. Data analysis of student learning outcomes test in cycle I and cycle II

Acquisition aspect	Student learning outcomes	
	Cycle I	Cycle II
The number of students	24 students	24 students
Lowest Score	30 (5	50 (1
Highest Score	students)	student
Number of Students who	80 (6	100 (1
Completed	students)	student)
Number of Incomplete	6 students	20 people
Students	18 students	4 people
Classical Absorption (CA)	58%	80%
ClassicalLearning Completeness (CLC)	25%	83%

5. Reflection on implementation of actions

The results of the implementation of the learning cycle I, obtained data in the form of data on student abilities from the results of observations of teacher skills and student activities, as well as data on student abilities from the results of students' final evaluation tests in learning energy sources through the application of problem-based learning models assisted by instructional videos. This reflection is carried out by the teacher with collaborators as observers to analyze the implementation of learning that has taken place. Reflection is used as a consideration to improve learning in cycle I. The results of reflection on student abilities are:

1) Reflection of cycle I student activities

Deficiencies in behavior/activities that must be corrected in cycle I include:

a. Student orientation to the problem: Motivation to participate in learning activities is still low, as evidenced by the results of observations where students are not enthusiastic about the problems presented by the teacher and have not been able to express ideas or experiences related to the problem. So that in the orientation phase, students only get a score of 2 with a sufficient predicate.
b. Organizing students to learn: The ability of students to come up with ideas related to the material by linking learning material with facts in the environment is still lacking due to the observation that there have been no attempts by students to find the concept of a

given problem. In the phase of organizing students to learn to get a score of 3 with a good predicate.

c. Guiding investigations: The ability of students to collect information through observation and experimentation is still lacking, students have not linked the material with daily contexts. Evidenced by the results of observations where students have not actively collaborated with group members in the problem-solving process so that in this phase the students obtained a score of 2 with sufficient predicate.
d. Developing and presenting work: Students' skills in planning and preparing appropriate work such as reports on the problem-solving process that have been carried out are still low, as evidenced by the results of observations where students have not been able to communicate the results of group discussions that have been carried out so that in this phase they get a score with good predicate
e. Analyzing and evaluating the problem-solving process: The skills of students in drawing conclusions and providing a reflection on the problem-solving process that has been carried out are still low, as evidenced by the results of observations where the ability of students to draw conclusions by answering questions at the beginning of learning and question and answer activities is still not optimal. So that in this phase the student activity only gets a score of 2 with sufficient predicate
f. Final evaluation test: The first cycle of the learning outcomes test showed that 58% of students completed classical learning while 42% did not complete their learning. These results have not met the category of indicators for the success of students' abilities that have been planned, it was the CLC of 80%.

2) Reflection on student activity cycle II

There are findings of problems in the implementation of learning cycle I, it can be concluded that learning through the application of problem-based learning models assisted by instructional videos still needs improvement to continue to cycle II. The improvements made are:

a. Get direction and guidance from the teacher regarding the division of tasks in groups so that students can carry out group work optimally and evenly. Each group member must have joint responsibility for the results of their group work so that no student plays alone.
b. Students are encouraged to ask or answer questions by providing motivation and developing curiosity in students through questions.
c. Get guidance and encouragement in doing scientific work and must be continuously motivated by giving praise so that students dare to express their opinions.

3) Reflection on teacher activity cycle I

Some deficiencies related to teaching skills in learning that must be fixed in cycle I include:

a. Student orientation to problems: The teacher has not presented a problem that is closely related to the daily life of students and does not motivate students to be involved in the problem-solving activity they choose.
b. Organizing students to learn: the teacher is still lacking in providing direction and asking questions to students related to the material by linking the material with the reality that exists in the student's environment.
c. Organizing, as well as guiding individual and group investigations: Teachers have not fully guided students individually or in study groups in understanding the material. The teacher also has not fully guided students to collect appropriate information through observation and experiments by linking the material with the daily context of students so that from observing students can understand the material.
d. Developing and presenting the work: the teacher has not been maximal in encouraging students to communicate the results of problem-solving during group discussions.
e. Analyze and evaluate the problem-solving process: the teacher has not fully helped students reflect on the process of gaining understanding, and the skills of teachers in measuring and evaluating student investigations and the processes used are still lacking.

4) Reflection on teacher activity cycle II

a. The teacher orientates students towards problems that are closely related to the daily lives of students who are still guided by the learning material

b. The teacher conditions students to be truly ready to learn, and provides motivation in order to foster student interest in learning
c. The teacher should convey the rules for discussion clearly in language that is easy for students to understand, and increase student participation in their groups so that group work is carried out equally by group members.
d. The teacher goes around the class visiting each group and giving guidance with the right supervision.

After making improvements to the shortcomings of implementing cycle I action, implementing cycle II actions is carried out. The data on the results of the implementation of the second cycle of action based on the observation of teacher skills and student activities, as well as the test results at the end of the implementation of the second cycle of action, show that the indicators of the success of the action have been met. The results of the reflection on the implementation of the second cycle of action show that the ability of students has increased both from the skills of the teaching teacher and the activities of students in participating in learning, as shown by:

a. The teacher has been able to condition the students to be truly ready for learning. The teacher can convey the perceptions well.
b. The teacher demonstrates properly and correctly, provides explanations using language that is easy to understand and provides optimal and thorough guidance to students.
c. The intensity of students who asked questions and expressed opinions increased. Students dare to express opinions.
d. Students participate in learning in a fun atmosphere.
e. Students' problem-solving has increased.

The average percentage of student activity in the first cycle of learning was 67.5% with a sufficient predicate, then increased in the second cycle by 85% with a good predicate. Likewise, the average percentage of teacher activity in cycle I was 70% or good and increased in cycle II by 90% or very good. The increase in the percentage of student activity from cycle I to cycle II was 17.5%. This increase occurred because the student activity that was still lacking in cycle I was corrected in cycle II. The activities that are still lacking in cycle I, namely in phase 1, where the motivation of students to take part in learning activities is still low, including the discussion process in solving problems. This is in line with the opinion of Nugraha, et al. (2017) who states that students with low learning motivation and low critical thinking skills do not have an interest in problem-solving, do not like challenges, and do not have demands from parents at home about the learning outcomes they achieve. The ability to ask questions related to the material by linking the material with the reality that exists in the environment is also still lacking. The ability to collect appropriate information through observation and experimentation is still lacking, students have not been able to link the material to daily contexts and the ability of students to reflect on the process of gaining understanding is still lacking, as well as the skills of students in planning and preparing works both individually and in groups on the solving process the problems that have been done are still low.

Student activities in cycle II learning also increased because students got direction and guidance from the teacher regarding the division of tasks in groups so that students could carry out group work optimally. Each member of the group must have joint responsibility for the results of their group work so that no student plays alone. Students are encouraged to ask or answer questions by providing motivation and developing curiosity in students through questions. Get guidance and encouragement in doing scientific work and must be continuously motivated by giving praise so that students dare to express their opinions. In line with the opinion of Suriani et al., (2019) which states that the activities of highly motivated students who are taught with problem-based learning models appear enthusiastic compared to students who are taught using conventional learning models. Students try to find answers to questions that have not been found because of strong curiosity.

Increase in the percentage of teacher activity from cycle I to cycle II by 30%. This percentage increase was due to improvements in aspects that were considered lacking in cycle I, then improvements were made in cycle II. The teacher activity is still lacking in cycle I, especially in phase 1 of problem orientation to students and phase 3 of guiding inquiry into problem-based learning models. Lack of teachers in phase 1, the teacher has not explained well about the equipment needed. The teacher still does not motivate students to be involved in the problem-solving activities they choose, even though in the application of the problem-based learning model, a strategy is needed from the teacher to describe an understanding to students about the purpose of what is being learned so that by itself it can lead to a stronger desire for students to be actively involved in problem-solving. The research of Argaw et al. (2016) which in their research found that problem-based learning when interacting with student motivation would provide learning opportunities and achieve effective learning outcomes. Other than that,

The weak activity of the teacher in the learning process is also seen in phase 3 of guiding the investigation, in this phase the teacher's activity

still gets a sufficient predicate. Teachers have not fully guided students individually or in learning groups in generating ideas or exchanging ideas during the problem solving process. The teacher also has not fully guided students to collect appropriate information through observation and experimentation by linking the material with the daily context of students so that students can understand the material. The teacher also has not fully helped students reflect on the process of gaining understanding, the skills of the teacher are still lacking in measuring and evaluating the problem-solving process used by their students.

Based on the description of the results of the observations, there was an increase in the percentage of teacher and student activity. These results indicate that there is a correspondence between increasing teacher activity and increasing student activity. Increased student activity is supported by increased teacher activity, and vice versa. So that the use of problem-based learning models assisted by instructional videos must really be applied by paying attention to the stages so that the teacher can reflect on which stage their skills or activities are still lacking in learning to fulfill their role as facilitator and motivator. In learning, apart from orienting students towards problems related to learning material, teachers must also be able to condition students to be truly ready to learn by providing motivation to foster student interest in learning and guidance in a proper investigation. As stated by Selcuk (2018), teachers in the problem-based learning model assisted with video learning are recommended to encourage students to engage in problem-oriented projects or assignments and help to investigate intellectual and social problems.

The application of problem-based learning models assisted by instructional videos in this study can increase the activity of the learning process. Students are motivated in solving problems raised by the teacher or classmate. The existence of giving problems at the early stages of this model makes students more enthusiastic about finding solutions which of course indirectly accustom students to hone problem-solving skills. This is in line with the research results of Mulyani et al. (2020) that in achieving problem-solving abilities, the problem-based learning model provides more optimal results when compared to conventional learning. It can be seen that the skills of teachers in managing learning and student activities in participating in learning activities have increased. Teachers can create learning that is more flexible, and fun, and makes students feel less rigid, let alone afraid to do scientific activities. In addition, the teacher's attitude that does not differentiate one student from another makes students dare to express opinions. In line with research by Alhaqwi (2014) which states that the implementation of the PBL model in addition to influencing cognitive learning outcomes also has an impact on self-confidence shown in cognitive abilities and skills in learning. Students are more focused and more focused on learning, as seen when reading the results of the discussion and taking question papers on the Question Box media, students listen to friends' directions and opinions well. In accordance with the results of research by Sinaga & Manurung (2016) who obtained a high percentage of listening activities by applying the PBL model to ecosystem material. The learning atmosphere is created in a dynamic framework and shows high student enthusiasm from the implementation of action cycle I to cycle II. In line with the research of Fauzan et al. (2017) which concludes that the increase in learning outcomes occurs because, in the application of problem-based learning models, students are better trained in solving various problems according to their abilities through authentic investigations.

The percentage of student learning outcomes from cycle I to cycle II has increased. Classical learning completeness (CLC) in cycle I was 52%, increasing in cycle II to 84%. Classical absorption (CA) in cycle I was 62% and increased in cycle II to 80%. The percentage of CLC in cycle I of 58% has not reached the specified performance success indicators, namely for completeness of the CLC (80%), then the learning improvement is carried out in cycle II and has increased to reach 84%. The percentage increase from cycle I to cycle II was 26%. The percentage of CA in the first cycle was 62%, this acquisition has not yet reached the specified performance indicator, namely 65%. After making improvements in cycle II, there were 21 students who completed individually so the percentage of CA in cycle II was 80%. The percentage increase from cycle I to cycle II is 18%. The increase in learning outcomes in this study is in line with Muskanah's (2014) research which also found that students' classical absorption of students increased from cycle I by 77.67% to 80.0% in cycle II, which then concluded that the application of problem-based learning models can improve student learning outcomes.

The number of students who took part in learning activities was 24 students, while only 13 students completed it. The 12 students who have not completed, based on the teacher's notes, still show weaknesses at the stages of the problem-based learning model, especially when presenting problems, students have not been motivated to express ideas or experiences related to the problems presented by the teacher so that students are not fully active in solving the problems presented. At the guiding stage of the investigation, students tend to focus on worksheets and still have difficulty asking questions.

Based on these results, it is necessary to make improvements in the implementation of learning in cycle II, including activities to motivate and condition students to be truly ready to take part in learning by presenting problems that are truly actual and close to students' lives, clearer material delivery and student guidance. in the learning and discussion process is optimized. These improvements were made in an effort to improve student problem-

solving, namely by holding an approach and providing an understanding that learning with direct involvement and mutual discussion and problem-solving cooperation with the ability of each group member makes it easier to understand the lesson. As Mulyani et al. (2020) argue that problem-based learning helps students to develop thinking skills, how students solve problems, and their intellectual skills. So problem-based learning provides opportunities to build life skills, metacognitive thinking (reflection with thoughts and actions), communication, and various related skills. With the application of problem-based learning models assisted by instructional videos, students experience many changes, especially in understanding. These changes are what bring students to get increased learning outcomes. metacognitive thinking (reflection with thoughts and actions), communication, and various related skills. With the application of problem-based learning models assisted by instructional videos, students experience many changes, especially in understanding. These changes are what bring students to get increased learning outcomes. metacognitive thinking (reflection with thoughts and actions), communication, and various related skills. With the application of problem-based learning models assisted by instructional videos, students experience many changes, especially in understanding. These changes are what bring students to get increased learning outcomes.

The percentage of CLC and CA in cycle I and cycle II both experienced an increase. This shows a correspondence between absorption and learning completeness. Therefore, problem-based learning assisted with video learning can improve science learning outcomes for fourth-grade students of SDN 12 Palu. An increase in learning outcomes by applying problem-based learning was also obtained by Zakia et al. (2018) in their research, that learning by applying PBL through school watching showed good learning outcomes on acid-base material. Similar to Suriani et al. (2019) who in their research also found that problem-based learning was superior to conventional learning and interacted effectively with achievement motivation in achieving science learning outcomes for junior high school students. Muskanah (2014) also concluded that the application of the problem-based learning model could improve the science learning outcomes of fifth-grade students of SDN Inpres 2 Tanamodindi in Palu.

Learning that applies a problem-based learning model has advantages over conventional learning methods. This is because the problem-based learning model has 5 main phases that are able to direct students to construct knowledge through learning experiences, especially in phase 1, namely problem orientation to students. In this phase, the teacher should present problems as much as possible to attract student motivation. The chosen problem should not be too complicated and not too easy, it is challenging to attract students 'interest to carry out the problem-solving process and the problems presented are real problems that are closely related to students' daily lives.

The next phase that plays a very important role in the success of the problem-based learning process is phase 3, which is guiding the investigation. In this phase the teacher plays a role in helping students to collect appropriate information through discussion activities, conducting experiments to get explanations, and problem-solving. The teacher's role is to provide guidance so that the experiment is carried out carefully so that no mistakes or mistakes occur. In the discussion and experiment activities in the problem-solving process carried out by students, it is a concrete experience they carry out in the process of constructing knowledge by Sari & Koeswanti (2019). Students try to find their own answers to the problems that have been presented at the beginning of learning, train students to think scientifically (scientific thinking), and in the end, students find evidence of the truth of the theory of something they are studying. In this phase, the teacher must be able to understand the characteristics of each student (Wasonawati et al. 2014). The portion of guidance given will be different for students who have high, medium, and low abilities. The student's initial ability factors, level and speed of thinking, and other heterogeneous aspects make teachers need to continue to train their sensitivity in order to be able to put themselves in the right position so that the inquiry process runs well. As Argaw et al. (2016) stated that a teacher must continue to hone sensitivity to be able to provide appropriate assistance and see students who need help more than other students.

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guidance given will be different for students who have high, medium, and low abilities.

The student's initial ability factors, level and speed of thinking, and other heterogeneous aspects make teachers need to continue to train their sensitivity in order to be able to put themselves in the right position so that the inquiry process runs well. As Argaw et al. (2016) stated that a teacher must continue to hone sensitivity to be able to provide appropriate assistance and see students who need help more than other students. The level and speed of thinking and other heterogeneous aspects make teachers need to continue to train their sensitivity in order to be able to put themselves in the right position so that the inquiry process runs well. As Argaw et al. (2016) stated that a teacher must continue to hone sensitivity to be able to provide appropriate assistance and see students who need help more than other students. The level and speed of thinking and other heterogeneous aspects make teachers need to continue to train their sensitivity in order to be able to put themselves in the right position so that the inquiry process runs well. As Argaw et al. (2016) stated that a teacher must continue to hone sensitivity to be able to provide appropriate assistance and see students who need help more than other students.

Then in phase 5, analyzing and evaluating the process of overcoming the problem. In this phase, the teacher helps students reflect on their investigations and the processes they use. The teacher provides reinforcement for the discussions and experiments that have been carried out. In this phase, the teacher provides reinforcement by showing instructional videos. The instructional video that is displayed by the teacher is able to complement the learning experience for students, in the process of presenting the video, the teacher alternates with question and answer activities so as to maximize the knowledge that has been obtained and assess the weaknesses of the discussion process carried out. In contrast to Mukanah's (2014) research, teachers do not use instructional videos, but the fifth-grade science teacher at SDN Inpres 2 Tanamodindi Palu applying the problem-based learning model provided reinforcement of learning through the science process skills approach. Basically, strengthening and learning approaches can be carried out by the teacher in various ways as long as this can help students to evaluate the investigations and processes used by their students. As mentioned by Arends (2013) that in the problem-based learning model, the last step taken is to analyze and evaluate the problem-solving process where the teacher must be able to help students reflect on the investigations and processes that students use in solving the problems presented by the teacher.

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Conclusions

Based on the research results it can be concluded that: The application of problem-based learning models assisted by instructional videos increases the learning activities of energy sources in grade IV SDN 12 Palu, which is indicated by an increase in the percentage of student and teacher activity. The average student activity in the first cycle was 67.5% or sufficient and increased in the second cycle to 85% or very well. Teacher activity in cycle I was 70% or enough and increased in cycle II to 90% or very good.

The application of problem-based learning models assisted by instructional videos can improve student learning outcomes in learning energy resources in class IV SDN 12 Palu, with classical absorption (CA) cycle I of 69% and an increase in cycle II to 80%. Classical learning completeness (CLC) cycle I was 58% increased in cycle II to 83%.

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