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Application of Problem-Based Learning-Audio Visual Approach to Improve Science Problem-Solving Ability of Elementary School Students

Penerapan Model *Problem Based Learning – Audio Visual* untuk Meningkatkan Kemampuan Pemecahan Masalah IPA Siswa Sekolah Dasar

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Abstract
This study aims to determine the application of the Problem Based Learning-Audio Visual approach in improving science skills. The research method used is quantitative. The type of research used is a quasi-experimental design with a nonequivalent control group design. The sample in this study was fourth-grade students in one of the elementary schools in Maros Regency, amounting to 44 people. Data collection techniques used tests to determine students' science problem-solving abilities. The data collected were analyzed quantitatively using descriptive statistics and inferential statistics. The results of descriptive statistical data analysis showed that the average value of the scientific problem-solving ability of the experimental class was 88.26, and the control class was 72.38. At the same time, the results of inferential statistical data analysis showed the value of sig. On the problem-solving ability of 0.000 < 0.05 with a value of t count > t table that is 10.228 > 1.681. This means that there is an increase in the ability to solve science problems through applying the Problem Based Learning-Audio Visual approach.
Keywords: *problem solving ability; problem based learning approach; audio visual*

Abstrak
Penelitian ini bertujuan untuk mengetahui penerapan model Problem Based Learning-Audio Visual dalam meningkatkan kemampuan kemampuan pemecahan masalah IPA. Metode penelitian yang digunakan adalah kuantitatif. Jenis penelitian yang digunakan adalah quasi eksperimental dengan desain nonequivalent control group design. Sampel dalam penelitian ini adalah siswa kelas IV di salah satu sekolah dasar di kabupaten maros yang berjumlah 44 orang. Teknik pengumpulan data menggunakan tes untuk mengetahui kemampuan pemecahan masalah IPA siswa. Data yang terkumpul dianalisis secara kuantitatif dengan

menggunakan statistik deskriptif dan statistik inferensial. Hasil analisis data statistik deskripstif menunjukkan bahwa skor rata-rata kemampuan pemecahan masalah IPA kelas eksperimen adalah 88.26 dan kelas kontrol adalah 72.38. Sedangkan hasil analisis data statistik inferensial menunjukkan bahwa nilai sig. pada kemampuan pemecahan masalah adalah $0.000 < 0.05$ *dengan nilai t-hitung > t-tabel yaitu 10.228 > 1.681. Artinya bahwa terdapat peningkatan kemampuan pemecahan masalah IPA melalui penerapan model Problem Based Learning-Audio Visual.*

Kata Kunci: *kemampuan pemecahan masalah; problem based learning; audio visual*

Introduction

Education is a vital thing that everyone should have. With education, a person can develop the abilities and potentials that exist in him in an optimal and directed manner. Education today is experiencing rapid development, marked by various innovations in the world of science and technology. With the development of science and technology, humans are required to achieve the highest education.

In the world of education, teachers have a vital role in the development of human resources. The teacher profession has the task of being a facilitator in educating, teaching, and training students. Educators must carry out the role of the teacher as a facilitator by providing services to students to facilitate the process of learning activities. Therefore, the teacher is one of the education staff who has a role as a determining factor for the success of the goals and quality of education (Nurmala et al., 2017).

The teacher is the spearhead in improving the quality of education, where the teacher will interact directly with students in classroom learning. It is through this process of learning and teaching that the quality of education begins. This means that, overall, the quality of education begins with the quality of classroom teachers' learning (Nurmala et al., 2017). Therefore, the teacher, in this case, is faced with the selection of learning models and media that can cover all the characteristics of their students. Starting from this thought, teachers should improve their quality as educators, including being willing and able to apply learning models and media in every learning process. Sagala suggests that the learning model is a conceptual framework that describes a systematic procedure for organizing student learning experiences to achieve specific learning goals and serves as a guide in planning and implementing teaching and learning activities (Sagala, 2011). Trianto suggests that the learning model is a plan or pattern used as a guide in planning learning in class or in tutorials (Trianto, 2013). At the same time, Sundayana suggests that learning media is a vehicle for distributing learning information or messages (Sundayana, 2015). Arsyad suggests that learning media are forms of communication, both printed and audiovisual, and the equipment that can be manipulated, seen, heard, and read (Arsyad, 2010). The learning process will be more exciting and fun using learning models and media.

Science is a science that studies events that occur in nature by observing, experimenting, inferring, and compiling theories so that students have organized knowledge, ideas, and concepts about the natural environment that are obtained from experience through a series of scientific processes, including investigation, preparation, and presentation of ideas (Oktari, Koeswati, & Giarti, 2018). Meanwhile, Darmodjo and Kaligis argue that science is rational and objective knowledge about the universe and all its contents (Darmodjo & Kaligis, 1992). Science mastery of students in Indonesia is still low. This is based on the results of the Trends in International Mathematics and Science Studies (TIMSS) survey in 2015 for science which showed that Indonesia was in the bottom 4th place, namely at 45th out of 48 participating countries, with an average score of 397 from the international average score. A score of 500 has been determined (Hadi and Novaliyosi, 2019). Of course, this is an evaluation material for the education sector in Indonesia.

Good mastery of science requires a learning model that can cover all the diverse characteristics of students. One of the basic skills that students in science must achieve is problem-solving ability. Problem-solving ability is one of the essential abilities that students must have because, in everyday life, everyone is constantly faced with various problems that must be solved and require creativity to find solutions to the problems they face (Permatasari, 2014). Gok and Silay stated that problem-solving ability is fundamental in science learning (Gok & Silay, 2010). At the same time, Polya stated that problem-solving ability is an attempt to find a way out of a difficulty and achieve goals that cannot be achieved immediately (Polya, 1985). The results of field observations indicate that students still have difficulty determining and solving problems related to science learning materials. This is because there are still many students who only memorize concepts and are less able to use the concept if they encounter problems in their daily lives. Even students are less able to formulate and find solutions to their problems.

Other observations also found that when students were given a test in which the questions were changed in the form of story questions, students were less able to identify the problems contained in the questions, so they looked confused and had difficulty answering the questions given. Some of them seem indifferent, so they only answer

questions as they are. This proves that students' problem-solving ability in answering questions is very lacking in science learning. The teacher's role that can affect students' problem-solving abilities is the teacher's inaccuracy in choosing the learning model and media used during the science learning process. Suppose the teacher only applies the conventional learning process. In that case, it negatively impacts students' learning motivation, which is marked by the lack of enthusiasm of students in learning science. They only listen to the material delivered by the teacher, but there are no activities that show students' enthusiasm to take part in learning.

One solution to follow up on these problems is to apply learning models and media that can actively involve students and contribute to the learning process in the classroom to improve problem-solving abilities. One of the innovative learning models that can improve problem-solving skills is a problem-based learning approach. The problem-based learning approach is a learning model whose main starting point is solving the problem (Istanti, 2015). So, to solve the problems given to students, the problem-based learning approach needs to be equipped with observation activities on the subjects studied through practical activities so that they can present real situations and deep impressions on students in the learning process (Billik, 2015). Meanwhile, Sutirman stated that the problem-based learning approach is a learning process that uses a systematic approach to solve problems or face challenges that will be needed in real life (Sutirman, 2013). Meanwhile, Shoimin suggested that the problem-based learning approach is a teaching model characterized by real problems as a context for students to learn to think critically in solving existing problems (Shoimin, 2014).

Audio-visual media can support the application of the problem-based learning approach. Audio-visual media are media that can attract students' attention. It raises curiosity about the information that will be conveyed because it contains sound elements and images (Sanjaya, 2008). Meanwhile, Asyhar defines audio-visual media as the type of media used in learning activities involving hearing and sight simultaneously in one process or activity (Asyhar, 2011). The application of a problem-based learning approach assisted by audio-visual media can attract students' attention, increase student activity in the learning process, develop student independence through meaningful problem-

solving, form higher-order thinking skills, and improve students' critical thinking skills (Dewi et al., 2017).

This research is in line with research conducted by Rivaldi et al.. They concluded that there was an effect of the Audio-visual-assisted Problem Based Learning learning model on the mastery of science knowledge competencies (Rivaldi et al., 2018). However, the research conducted by Rivaldi et al. and researchers both wanted to see the effect of problem-based learning models assisted by audio-visual media. Still, the difference lies in the research of Rivaldi et al. on students' science problem-solving abilities. Another study was conducted by Purbarani et al.. They concluded that Problem Based Learning assisted by audio-visual media affected elementary school students critical thinking skills and science learning outcomes (Purbarani et al., 2018). Research conducted by Purbarani et al. with research conducted by researchers both wants to see the effect of problem-based learning models assisted by audio-visual media. Still, the difference is that Purbarani et al.'s research relates to critical thinking skills and student science learning outcomes, while researchers researched students' science problem-solving abilities.

Each research must have characteristics that make it different or unique from other research. The differences include the integration of problem-based learning approaches with audio-visual media in the science learning process on substances, and their changes, the existence of practical activities carried out by students to solve problems contained in student activity sheets, and the insertion of questions in each media display. Audio-visual can trigger students to think about solving existing problems to create a more meaningful learning process and produce better problem-solving abilities. This is undoubtedly a novelty or novelty that makes it different from previous research. Thus, this study will provide an overview of the application of the problem-based learning-audio-visual approach to improve science problem-solving abilities, with the aim of the study being to determine the application of the problem-based learning-audio-visual approach in improving students' science problem-solving abilities.

Method

The research method used in this study is quantitative, with a quasi-experimental research type and a nonequivalent control group design. There are two variables: the

problem-based learning approach as the independent variable and the scientific problem-solving ability as the dependent variable. The population in this study were all fourth-grade elementary school students in the region I, Maros Baru sub-district, which consisted of 3 elementary schools. At the same time, the sample was fourth-grade students in one of the elementary schools in the Maros district, totaling 44 students who were grouped into an experimental class totaling 23 students. The control class with a total of 21 students. The sampling technique used was simple random sampling with two draws. The first draw was conducted to find out the schools that were the sample of this study. At the same time, the second draw was conducted to determine the experimental and control classes in this study.

The data collection technique used observation and tests in the form of description questions consisting of five questions. The collected data will be analyzed quantitatively using descriptive statistics and inferential statistics. For descriptive statistical data analysis, the data obtained from the pretest and posttest results were analyzed to determine student scores before and after being given treatment. The data were processed using the SPSS for windows program. Categorization is carried out to get a clear picture of the results of the student's problem-solving ability test. The first categorization is divided into seven categories: the number of samples, the highest score, the lowest score, the ideal score, the range of scores, the average score, and the standard deviation. Then the data is interpreted into the category of students' problem-solving abilities, which consist of very high (scores 81-100), high (scores 61-80), moderate (scores 41-60), low (scores 21-40), and very low (value 0-20). Furthermore, 75 is set as the complete category for the completeness category, and the value <75 is the incomplete category. As for the analysis of inferential statistical data, a hypothesis test was carried out. Before that, a prerequisite test was carried out first, namely the normality test and homogeneity test. The normality test was based on the Kolmogorov-Smirnov One-Sample test with a significance level of 5% or 0.05. If P_value≥0.05, the distribution is normal, while if P_value<0.05, the distribution is not normal. The homogeneity test was carried out with the help of the SPSS for windows program using the Barlett test with a significance level of 5% or 0.05. If P_value ≥0.05, the distribution is homogeneous, while if P_value<0.05, the distribution is not homogeneous. Meanwhile, the hypothesis test

used is the Independent t-test, a different test for two unpaired or unequal samples that do not receive the same treatment. The decision-making criteria are If Sig. 0.05 and the value of t-count < t-table, then H0 is accepted, and H1 is rejected, while if Sig. <0.05 and the t-count value > t-table, then H0 is rejected and H1 is accepted.

The following is a description for H0 and H1 on hypothesis testing:

H_0 : There is no increase in science problem-solving skills through an audio-visual problem-based learning approach.

H_1 : There is an increase in science problem-solving skills through an audio-visual problem-based learning approach.

Result

Student's Science Problem-Solving Ability Test on Pretest

The statistical results of students' problem-solving abilities in the implementation of the pretest both in the experimental class and the control class can be seen in table 1 below:

Table 1 *Descriptive Statistics of Students' Science Problem-Solving Ability on Pretest*

Descriptive statistics	Statistical Value	
	Experiment Class	Control Class
N	23	21
Maximum Score	60	60
Minimum Score	20	20
Ideal Score	100	100
Range	40	40
Mean	40,00	39,52
Std. Deviation	12,060	11,170

Based on the results of Table 1, it can be said that the student's initial science problem-solving abilities for the experimental class and control class are almost equivalent when viewed from the average scores obtained by the two class groups so that the two classes can be able to compare their abilities in this study.

Suppose the scores of students' science problem-solving ability results in the pretest for the experimental and control classes are grouped into five categories. In that case, the distribution of frequency and percentage scores is shown in table 2.

Table 2 *Distribution and Percentage of Students' Science Problem-Solving Ability in Pretest*

No	Student scores	Category	Experiment Class		Control Class	
			Frequency	%	Frequency	%
1	81-100	Very high	0	0,00	0	0,00
2	61-80	High	0	0,00	0	0,00
3	41-60	Medium	6	26,00	3	14,30
4	21-40	Low	13	56,50	15	71,40
5	0-20	Very low	4	17,50	3	14,30
	Total		23	100,00	21	100,00

Based on table 2, the average score of students' science problem-solving abilities on the pretest for the experimental class is in a low category, which is 40.00. Likewise, the average score of students' science problem-solving abilities on the pretest for the control class is also in the low category, which is 39.52.

The percentage of students who completed science problem-solving ability in the pretest for the experimental and control class can be seen in table 3.

Table 3 *Description of Students' Science Problem-Solving Ability Completeness on Pretest*

Score	Category	Experiment Class		Control Class	
		Frequency	%	Frequency	%
≥ 75	Complete	0	0,00	0	0,00
< 75	Not Complete	23	100,00	21	100,00
	Total	23	100,00	21	100,00

Table 3 shows that the completeness of the students' initial science problem-solving abilities for the experimental and control classes is equivalent or the same so that the two classes can compare their abilities in this study.

Student's Science Problem Solving Ability Test on Posttest

The statistical results of students' problem-solving abilities in the posttest, both in the experimental and control classes, can be seen in table 4.

Table 4 *Descriptive Statistics of Students' Science Problem-Solving Ability on Posttest*

Descriptive statistics	Statistical Value	
	Experiment Class	Control Class
N	23	21
Maximum Score	100	80
Minimum Score	80	70
Ideal Score	100	100
Range	20	10
Mean	88,26	72,38
Std. Deviation	5,762	4,364

Table 4 shows that the experimental class's science problem-solving ability is higher than the students' science problem-solving abilities for the control class. This means that the application of a learning approach based on audio-visual aided learning is better than the application of a learning approach based on learning without the aid of learning media as a supporter.

Suppose the scores of students' science problem-solving ability results in the posttest implementation for the experimental and control classes are grouped into five categories. In that case, the frequency and percentage scores distribution is obtained, as shown in Table 5.

Table 5 *Distribution and Percentage of Students' Science Problem-Solving Ability on Posttest*

No	Student scores	Category	Experiment Class		Control Class	
			Frequency	%	Frekuensi	%
1	81-100	Very high	17	73,90	0	0,00
2	61-80	High	6	26,10	21	100,00
3	41-60	Medium	0	0,00	0	0,00
4	21-40	Low	0	0,00	0	0,00
5	0-20	Very low	0	0,00	0	0,00
Total			23	100,00	21	100,00

Based on Table 5, after the scores or scores of students are grouped into five categories, the average score of students' science problem-solving abilities in the posttest for the experimental class is included in the very high category, namely 88.26. At the same time, the average score of students' science problem-solving abilities in the posttest implementation for the control class was included in the high category, namely 72.38.

Then to see the percentage of students who completed science problem-solving ability in the posttest for the experimental and control class can be seen in table 6.

Table 6 *Description of Students' Science Problem-Solving Ability Completeness on Posttest*

Score	Category	Experiment Class		Control Class	
		Frequency	%	Frequency	%
≥ 75	Complete	23	100,00	5	23,80
< 75	Not Complete	0	0,00	16	76,20
	Total	23	100,00	21	100,00

Table 6 shows that the mastery of students' science problem-solving abilities for the experimental and control classes after a treatment is applied is better than before the treatment is applied. However, experimental class, students' mastery of science problem-solving abilities was much better than in the control class. This is because all of the experimental class students got the complete score category, while for the control class, there were only five students who got the complete score category. The rest got the incomplete score category.

Normality test

Table 7 *Normality Test*

Item	Sig.
Experiment Class Problem Solving Ability Pretest	0,283
Control Class Problem Solving Ability Pretest	0,340
Experiment Class Problem Solving Ability Posttest	0,358
Control Class Troubleshooting Ability Posttest	0,469

Table 7 shows that the results of the normality test on the pretest of the problem-solving ability of the experimental class are known to be 0.283 > 0.05, the results of the normality test of the pretest of the problem-solving ability of the control class are known to be 0.340 > 0.05, the results of the normality test on the posttest of the problem-solving ability of the experimental class. It is known that 0.358 > 0.05, the results of the normality test in the posttest of the problem-solving ability of the control class are 0.469 > 0.05. Based on this, it can be said that the data is normally distributed.

Homogeneity Test

Table 8 *Homogeneity Test*

Item	Sig.
Problem-Solving Ability Pretest	0,624
Problem-Solving Ability Posttest	0,472

Table 8 shows that the results of the homogeneity test on the problem-solving ability pretest are known to be 0.624 > 0.05. In the problem-solving ability posttest, it is known that 0.472 > 0.05. Based on this, it can be said that the data is homogeneously distributed.

Hypothesis testing

Tabel 9 *Hypothesis testing*

Independent Samples t-test					
		Levene's Test for Equality of Variances			
		F	Sig.	T	Df
Problem solving skill	Equal variances assumed	.526	.000	10.228	42
	Equal variances not assumed			10.358	40.670

Table 9 shows that the value of sig. The problem-solving ability is 0.000, and the t-count is 10.228. From the results of hypothesis testing on problem-solving ability, it can be seen that 0.000 <0.05, and if referring to the t-table with df = 42, it can be seen that 10.228 > 1.681, it can be concluded that H0 is rejected and H1 is accepted. This means that there is an increase in the ability to solve science problems by applying an audio-visual problem-based learning approach.

Discussion

Problem-solving ability is one of the essential abilities that students must have because, in everyday life, everyone is constantly faced with various problems that must be solved and require creativity to find solutions to the problems they face (Permatasari, 2014). Problem-solving ability is an essential part of science learning because problem-solving activities require students to find their concepts in learning.

The application of the Problem Based Learning learning approach assisted by audio-visual media can attract students' attention, increase student activity in the learning process, develop student independence through meaningful problem-solving,

form higher-order thinking skills, and can improve thinking skills. Critical students (Dewi, 2017).

The researcher applied the Problem Based Learning approach with the aid of audio-visual media for three meetings in the experimental class. In comparison, the application of the Problem Based Learning approach without the aid of learning media as support was applied by the researcher for three meetings in the control class. Of course, applying a learning model combined with learning media will have better results than only applying a learning model. This is proven by the results of data analysis in this study.

The learning activities are adjusted to the syntax of the Problem Based Learning approach, which is, of course, combined with audio-visual media. The audio-visual media in question is video. The syntax of the Problem Based Learning approach has five steps, namely the problem orientation stage, the organizing stage, the investigation stage, the result display stage, and the analysis and evaluation stage. In the problem orientation stage, the researcher presented audio-visual media to students that revealed a problem related to learning materials in everyday life. The students analyzed the problem and solved it by thinking and asking questions. In the organizing stage, the researcher divided students into several groups of 4-5 people each (before the learning was carried out, the teacher had informed them about the division of student groups and instructed them to be together in one place while still paying attention to health protocols, namely wearing masks, maintaining distance, and always wash their hands. In the investigation stage, the researcher distributes student activity sheets to each group. The questions in the student activity sheets are a matter of analyzing problems in everyday life related to learning materials. Then, students solve these problems through practical activities and group discussions. In the stage of displaying the results, students report their observations and present them in front of their friends. In the stage of analysis and evaluation, students provide feedback on presentations from other groups and conclude the material from learning

Conclusion

The results of descriptive statistical data analysis showed that the average score of students' science problem-solving abilities in the pretest for the experimental class was

40.00, while the average score of students' science problem-solving abilities in the control class was 39.52. Then the average score of students' science problem-solving abilities in the posttest for the experimental class was 88.26, while the average score of students' science problem-solving abilities in the control class was 72.38.

The results of inferential statistical data analysis showed that the value of sig. The problem-solving ability is 0.000, and the t-count is 10.228. From the results of hypothesis testing on problem-solving ability, it can be seen that 0.000 <0.05, and if it refers to the t-table with df = 42, it can be seen that 10.228 > 1.681, it can be concluded that H0 is rejected, and H1 is accepted. This means that there is an increase in the ability to solve science problems by applying an audio-visual problem-based learning approach.

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