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The Effectiveness of the Problem-Based Learning Model Assisted by Augmented Reality on Learning Outcomes in the Material of the Forms of the Five Senses and Their Functions

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Abstrak: The low learning outcomes of students are caused by the inconsistency of the learning model and media with Permendikbudristek Number 16 of 2022 concerning Process Standards. This study aims to test the effectiveness of the Problem-Based Learning (PBL) model assisted by Augmented Reality (AR) compared to the PBL (teacher version) model assisted by image media on the learning outcomes of grade IV science students of SD Gugus Lokantara, Temanggung District, Temanggung Regency. This type of research is an experiment with a quasi-experimental research design in the form of a Non-Equivalent Control Group Design. Data collection techniques were in the form of test techniques (pretest and posttest); non-test techniques in the form of observation, interviews, questionnaires, and documentation. Data analysis techniques include initial data analysis with normality test and homogeneity test and final data analysis with t-test and N-Gain test. From the t-test results obtained sig. value of 0.002 (<0.05) so that H_0 is rejected and H_a is accepted. The output of the N-Gain test of the experimental class is 0.68 and the control class is 0.50. In conclusion, the PBL model assisted by AR is effective and has a higher average increase in learning outcomes compared to the PBL model (teacher version) assisted by image media in science learning for grade IV SD Gugus Lokantara, Temanggung District, Temanggung Regency.

Keywords: Augmented reality; Effectiveness; Learning outcomes; Problem-Based Learning model.

Introduction

Learning and teaching are core activities in an educational process. Education in Indonesia is expected to run effectively and efficiently, so the government makes regulations through the Regulation of the Minister of Education, Culture, Research, and Technology *(Permendikbudristek)* Number 16 of 2022 concerning Process Standards which is explained in article 2 that process standards are used as a reference to be able to organize an effective and efficient learning process to develop potential, initiative, skills, and independent attitudes in students optimally. To realize effective and efficient education, it should be carried out with an atmosphere and process of teaching and learning activities that can involve students to be able to develop their potential (Faizah & Kamal, 2024). This statement is in line with that stated in Permendikbudristek Number 16 of 2022 concerning Process Standards, precisely in article 9 which states that the implementation of effective learning is carried out in an interactive and fun learning atmosphere, inspiring, challenging and motivating student activity, and providing opportunities for students to develop their best potential.

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The learning process should be adjusted to technological developments and implemented by providing real problems that can encourage active involvement of students in learning so that they can develop their process skills and learning outcomes (Jery Dariansyah et al., 2023; Juwairiah et al., 2024). As stated in the Process Standard article 7 which states that the learning strategy designed is intended to provide meaningful learning experiences implemented by applying learning materials to real problems that can involve student activity, optimizing resources in educational entities and the community environment, and integrating learning with technology. However, in reality, the learning process at several elementary school levels in Indonesia has not yet implemented the directions of the Process Standard. Natural and Social Sciences (IPAS) is one of the subjects that still faces various problems in its teaching at the elementary school level, such as less than optimal student learning outcomes caused by the lack of variety in teacher learning models (Ngatman et al., 2025; Nur Rifai et al., 2024).

The low learning outcomes of students in science subjects are caused by learning that is still centered on the teacher (Astiti et al., 2021; Suparman et al., 2020). Another problem found is that teachers have not maximized the use and integration of technology-based learning media. Teachers have not optimally developed technology-based learning media to improve student learning outcomes (Inayati & Setyasto, 2024). Teachers' innovation and creativity in developing digital-based learning media are still lacking and only rely on visualized materials in the form of simple images (Miftahul Jannah et al., 2023). In addition, it is not uncommon for several elementary school teachers to have difficulty operating the smartphones they have for classroom learning. The majority of teachers can indeed operate computers or smartphones, but have not been able to process and utilize various learning support applications in more depth (Asmuni, 2020). Some teachers still have a low level of literacy related to the features and use of applications on smartphones, so there are no materials that can be used for teaching (Novitasari & Nurfiqih, 2022).

Problems related to science learning also occurred in class IV of SD Gugus Lokantara, Temanggung District, Temanggung Regency, including SD Negeri Joho, SD Negeri Tlogorejo, and SD Negeri Manding. Based on the results of interviews, questionnaires, observations, and grade IV grade data, researchers found various problems, including the learning model applied by teachers during learning was not in accordance with the learning model that was directed at process standards and still tended to be teacher-centered. In the learning tools prepared by teachers, a problem-based learning model has been written, but the syntax of the model has not been seen in the learning steps section. In practice, teachers still seem to dominate with the lecture method, so that students tend to be quiet and just pay attention. In most of the learning processes carried out, teachers tend to use learning media in the form of pictures in textbooks. Occasionally teachers use technology in learning, but it has not been used optimally, for example in science learning on the material of the five senses and their functions, the teacher displays simple images related to human sense organs via LCD, then the teacher explains using the lecture method related to the parts and their functions which makes learning tend to be fixated on the teacher's explanation without any active involvement of students. In fact, the material has complex and abstract problems so that it requires more detailed visualization. Therefore, students become easily bored and unfocused, so they tend to be passive during learning. During learning activities, most students just pay attention to the teacher's explanation, some even pay no attention at all and are distracted by other things.

This finding is supported by data from the results of filling out the student questionnaire which shows that students who actively ask questions and respond to questions are only 45% of the total number of students in grade IV of Joho State Elementary School, Tlogorejo State Elementary School, and Manding State Elementary School. The rest, students tend to be passive and do not show activeness during the learning process. The availability of adequate facilities such as LCD, speakers, and internet network (Wi-Fi) has not been maximized in learning. Teachers rarely use LCD because they think that the material is delivered faster if using a whiteboard or just verbally. This certainly makes learning not in accordance with what is expected by the Process Standards, which state that the learning process should be integrated with technology. Based on the results of filling out the questionnaire by students, as many as 56 out of 76 students (74%) have smartphones that can access the internet which can be used to support learning activities.

From the results of filling out the questionnaire, as many as 84% of the total number of students like to use smartphones to support their learning activities, but have not been optimally used for learning, only 17 (13%) of 76 students use their smartphones for learning, the rest are often used to play games, watch YouTube, and play social media. From the results of filling out the questionnaire of parents of grade IV students of Joho State Elementary School and Tlogorejo State Elementary School as representatives of the Lokantara Cluster, as many as 78% of the total parents who responded,

allowed their children to bring smartphones to school as a learning tool with teacher supervision. Based on the description above, it can be concluded that there is a very large potential in the use of technological devices to support learning activities, only it has not been fully optimized by teachers. Thus, this results in problems in the learning process, namely becoming less effective and efficient which has an impact on the learning outcomes of grade IV students in several elementary schools that are members of the Lokantara Cluster, Temanggung District, Temanggung Regency.

Based on observations of the recapitulation data of the results of learning science for grade IV of the 2023/2024 academic year at SD Gugus Lokantara, Temanggung District, Temanggung Regency, namely SD Negeri Joho, SD Negeri Tlogorejo, and SD Negeri Manding, in general the learning results shown are not optimal. This means that some students have not reached the specified KKTP, which is 70. At SD Negeri Joho with 22 students, 10 students (46%) scored below the KKTP. At SD Negeri Tlogorejo with 26 students, 13 students (50%) scored below the KKTP. At SD Negeri Manding with 28 students, 15 students (54%) scored below the KKTP. From the results of interviews with teachers, it was conveyed that these results were caused by the lack and difficulty of students in understanding complex and abstract science material.

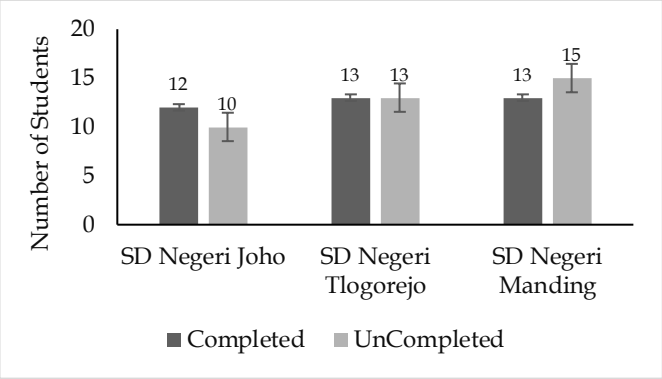

Figure 1. Diagram of Students' Science Learning Completion

Science is a subject that links its material to students' real lives, so as a trigger, learning begins by using everyday problems in the students' environment (Milasari & Setyasto, 2023). Permendikbudristek Number 16 of 2022 concerning Process Standards, specifically in Article 7 paragraph (2) point a, states that learning should be centered on real problems or contexts. Therefore, in teaching science material, a learning model is needed that can apply learning that is centered on real problems. The Problem-Based Learning (PBL) Model is one of the appropriate models, namely a learning model related to students' contextual problems so that it can make students actively involved in the learning process (Ariyani & Kristin, 2021; Lisnawati et al., 2022). This is in line with previous research that shows the influence of the Problem-Based Learning model on science learning outcomes that can be a reference for teachers to create student involvement to be more active in the learning process (Dwiyanti et al., 2023; Fazryn et al., 2023).

In addition to involving students to be more active in learning, the implementation of the Problem-Based Learning model is able to develop problem-solving skills and critical thinking skills of students, because students will be introduced to real everyday problems that can integrate new knowledge through problem solving (Rohmah & Setiani, 2022) . Thus, the Problem-Based Learning model is effective in improving problem-solving and solution skills. Based on the above, student learning outcomes can be improved through the application of the Problem-Based Learning model (Barradas et al., 2024). Referring to the reality in the field, teachers at SD Gugus Lokantara have also not fully implemented technology-based learning. Teachers have not optimally utilized adequate technological facilities in order to achieve learning objectives. Therefore, it is necessary to combine problem-based learning models with the TPACK (Technological Pedagogical Content Knowledge) approach which can help teachers come up with learning methods that can help and improve students' critical thinking skills by utilizing technology. To implement technology-based learning, researchers will use Augmented Reality as a learning medium.

Augmented Reality (AR) media is the use of technology that integrates virtual objects (2D or 3D) so that users can see in the real world. AR-assisted media can be one of the interactive media that teachers can use to teach science materials that can create a fun learning atmosphere and stimulate children's imagination, so that it can motivate students to learn (Amdani et al., 2022). This is in line with previous research which states that the application of Augmented Reality media can minimize student misconceptions caused by their inability to visualize a complex science concept (Safira et al., 2022). Other findings show that the use of Augmented Reality media in the learning process can improve student learning outcomes, especially in the cognitive domain. In this study, the Problem-Based Learning model assisted by Augmented Reality will be implemented in accordance with the PBL model that is in accordance with the syntax, namely orienting students to problems, organizing student work groups, assisting in the investigation process, developing and presenting results, and evaluating the problem-solving process.

The use of Augmented Reality media is intended to teach the material on the form of the five senses and their

functions in grade IV of elementary school. In practice, AR media is applied to the syntax of the two PBL models, namely when researchers organize students into several groups. This AR media is in the form of a QR code that can be scanned by students via smartphone, which will then display a visualization of objects related to the material being taught. For example, in the material on the sense of sight and hearing, AR will visualize the senses of the eyes and ears in 3 dimensions (3D) which can give students the freedom to explore and understand the parts and functions of these senses in more detail and concretely, because in this media a detailed description has been presented on each part of the senses and their functions. Students can enlarge (zoom in), reduce (zoom out), and rotate the 3D objects displayed to be able to know and understand more deeply about the senses being studied. Thus, through the Problem-Based Learning model that is in accordance with its syntax with the help of Augmented Reality learning media, it can create an interesting, enjoyable learning process, and provide a more meaningful learning experience and can minimize misconceptions in abstract and complex science materials.

Based on this description, the researcher aims to test the effectiveness of the Problem-Based Learning model assisted by Augmented Reality on the learning outcomes of fourth grade elementary school science students. The researcher hopes that the application of the AR-assisted PBL model can have a more positive impact than the PBL (teacher version) model assisted by image media on the learning outcomes of fourth grade students of Gugus Lokantara Elementary School, Temanggung District, Temanggung Regency.

Method

The type of research used is experimental research with a quasi-experimental research design in the form of Non-Equivalent Control Group Design. At the beginning of learning, the experimental class and the control class were given a pretest first to determine the initial abilities of students. Furthermore, the two classes were given different treatments. The treatment given to the experimental class used the Problem-Based Learning model assisted by Augmented Reality, while the control class used the Problem-Based Learning model (teacher version) assisted by image media. At the end of learning, both classes were given a posttest to determine the effect of the different treatments that had been given to each class. The following is a form of quasi-experimental research design presented in Table 1.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experiment	0_1	X_1	0_2
Control	0_3	X_2	0_4

Information:
O1: pretest experimental class
O2: posttest experimental class
O3: pretest control class
O4: posttest control class
X1: treatment in the experimental class using the Problem-Based Learning model assisted by Augmented Reality
X2: treatment in the control class using the Problem Based Learning model (teacher version) assisted by image media.

In this study, the treatment was carried out during the science learning of the material on the form of the five senses and their functions Phase B with the following learning outcomes (CP): students analyze the relationship between the form and function of body parts in humans (five senses).

The population in this study were all grade IV students of SD Gugus Lokantara, namely SD Negeri Joho and SD Negeri Tlogorejo, totaling 73 students. This study used a purposive sampling technique. Therefore, the sample used in this study was grade IV students of SD Negeri Joho in the 2023/2024 academic year as small-scale test subjects totaling 15 students, grade IV students of SD Negeri Joho as the experimental class totaling 27 students and grade IV students of SD Negeri Tlogorejo as the control class totaling 31 students. There are two variables used in this study, namely the independent variable (X) and the dependent variable (Y). The independent variable (X) is the Problem-Based Learning model assisted by Augmented Reality, while the dependent variable (Y) is the results of learning science in grade IV of SD Gugus Lokantara.

The hypothesis in this study is that there is no effect of using the Problem-Based Learning model assisted by Augmented Reality on the results of learning science in grade IV of SD Gugus Lokantara (H_0); there is an effect of using the Problem-Based Learning model assisted by Augmented Reality on the results of learning science in grade IV of SD Gugus Lokantara (H_a). This study uses data collection techniques in the form of tests and non-tests. The test technique is carried out by providing a pretest and posttest of 25 questions. Before giving the pretest and posttest questions to the experimental and control classes, the researcher first conducted a validity, reliability, difficulty level, and distinguishing power test of the questions which was carried out with a small-scale test. The test results are presented in Table 2.

Meanwhile, non-test techniques are carried out by observation, interviews, questionnaires, and documentation. This study uses initial data analysis and final data analysis. Initial data analysis uses prerequisite tests, including normality tests and homogeneity tests. While the final data analysis uses t-tests and N-Gain tests.

Table 2. Validity, Reliability, Difficulty Level, Distinguishing Power Test

Test Type	Status	r Count	Number of Questions
Validity	Valid		25
	Invalid		0
Reliability	KR-20	0.952	
	KR-21	0.946	
	CA	0.946	
Difficulty Level	Difficult		1
	Medium		23
	Easy		1
Distinguishing Power	Very Good		12
	Good		13
	Quite		0
	Bad		0

Result and Discussion

From the results of research that has been conducted at Joho State Elementary School as an experimental class and Tlogorejo State Elementary School as a control class in the Lokantara Cluster, Temanggung District, Temanggung Regency, then there are several things that will be studied in the results and discussions, including: pretest and posttest learning outcomes of students in the science subjects; normality test of pretest and posttest data for the experimental and control classes; homogeneity test of pretest and posttest data for the experimental and control classes; hypothesis test using independent sample t-test for the experimental and control classes; N-Gain test for the experimental and control classes. In this study, student learning outcomes were obtained through the scores of the pretest and posttest results for the experimental and control classes. The following are the student learning outcomes from the pretest and posttest in the experimental and control classes presented in Table 3.

Table 3. Learning Outcomes of Experimental and Control Classes

Parameters	Pretest		Posttest	
	Experiment	Control	Experiment	Control
Number of Students	27	31	27	31
Average	41.04	48.13	82.37	75.61
Maximum Score	60	80	96	96
Minimum Score	24	32	68	60
Students Who Completed	0	1	23	24
Learning Success	0%	3.22%	85.18%	77.41%

Based on Table 3, it can be concluded that the average learning outcomes of students from the pretest and posttest of the experimental class that was given treatment using the Problem-Based Learning model assisted by Augmented Reality was higher than the control class that was given treatment using the Problem-Based Learning model (teacher version) assisted by image media. This study used the help of the SPSS version 25 application to conduct a normality test. Before being given treatment, the experimental class and control class were first given a pretest. After being given treatment, the experimental class and control class were directed to work on the posttest. To find out whether the final data on the learning outcomes of grade IV students of Gugus Lokantara Elementary School, Temanggung District, Temanggung Regency were normally distributed or not, a normality test was needed. The following are the results of the normality test on the pretest and posttest presented in Table 4.

Table 4. Output of Pretest and Posttest Data Normality Test Results

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistics	df	Sig.	Statistics	df	Sig.
Learning outcomes	Experiment Pretest	0.123	27	0.200	0.963	27	0.426
	Pretest Control	0.124	31	0.200	0.943	31	0.097
	Posttest Experiment	0.164	27	0.061	0.933	27	0.082
	Posttest Control	0.126	31	0.200	0.961	31	0.316

Based on the results of the normality test in Table 4, the pretest significance value of the experimental class using the Kolmogorov-Smirnov method was 0.200 and the control class was 0.200. Meanwhile, the significance value tested using the Shapiro-Wilk method in the experimental class was 0.426 and the control class was 0.097. Meanwhile, for the significance value in the posttest using the Kolmogorov-Smirnov method in the experimental class, the results were 0.061 and the control class was 0.200. Meanwhile, for the posttest significance value tested using the Shapiro-Wilk method in the experimental class, the results were 0.082 and the control class was 0.316. From the data above, it can be concluded that the pretest and posttest significance values of the experimental class and the control class have values greater than 0.05, both in the Kolmogorov-Smirnov and Shapiro-Wilk methods. Thus, H_0 can be accepted or the pretest and posttest data are normally distributed. Furthermore, in this study, a homogeneity test was conducted using the SPSS version 25 application. The homogeneity test was conducted using the pretest and posttest scores of students to determine whether the data variance was homogeneous or not. The following are the results of the homogeneity test presented in Table 5.

Table 5. Output of Pretest and Posttest Data Homogeneity Test Results

Learning outcomes		Levene Statistic	df1	df2	Sig.
Based on Mean	Pretest	0.967	1	56	0.330
	Posttest	0.184	1	56	0.670

Based on Table 5, the significance value of the pretest data from both classes is 0.330 and the significance value of the posttest data from both classes is 0.670. So, it can be concluded that the significance value of the pretest and posttest data of both classes is greater than 0.05, so H_0 is accepted, which means that the data is homogeneous or there is no difference in data variance from the two classes. Based on the results of the prerequisite test, it can be concluded that the data in this study are normally distributed and homogeneous, so that hypothesis testing can be done using the independent sample t-test. In this study, hypothesis testing was carried out using students' posttest scores to determine the effectiveness of the Problem-Based Learning model assisted by Augmented Reality in the experimental class and the Problem-Based Learning model (teacher version) assisted by image media in the control class. Hypothesis testing was carried out using the independent sample t-test and the N-Gain test. The following are the results of the independent sample t-test with the help of the SPSS version 25 application presented in Table 6.

Table 6. Output Results of Independent Sample T-Test

Parameters		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Results	Equal variances assumed	0.184	0.670	3.214	56	0.002	6.757	2.102	2.546	10.969
	Equal variances not assumed			3.204	54.160	0.002	6.757	2.109	2.530	10.985

Based on Table 6, the results of the independent sample t-test show the sig. (2-tailed) value is 0.002 or less than 0.05 (0.002 <0.05). Thus, H_0 is rejected and H_a is accepted. This means that there is a significant difference in the average learning outcomes of students between the experimental class and the control class. So, it can be concluded that there is a difference in the learning outcomes of grade IV students of SD Gugus Lokantara, Temanggung District, Temanggung Regency who were given the Problem-Based Learning model assisted by Augmented Reality and the Problem-Based Learning model (teacher version) assisted by image media. The N-Gain test was conducted to determine whether there was an increase in student learning outcomes before and after being given treatment, both in the experimental class and the control class. The N-Gain test was conducted with the help of the SPSS version 25 application. The difference in the learning outcomes of pretest and posttest students of grade IV SD Gugus Lokantara, Temanggung District, Temanggung Regency can be seen in Table 7.

Table 7. Average Gain Test Results (N-Gain)

Parameters	Average		N-Gain	Category
Class	Pretest	Posttest		
Experiment	41.04	82.37	0.68	Medium
Control	48.13	75.61	0.50	Medium

Based on Table 7, it can be seen that there is an average increase in learning outcomes between pretest and posttest in the experimental class of 0.68 which is included in the moderate category. In the control class there is also an increase of 0.50 which is included in the moderate category. The following is a diagram of the increase in learning outcomes in the pretest and posttest in Figure 2.

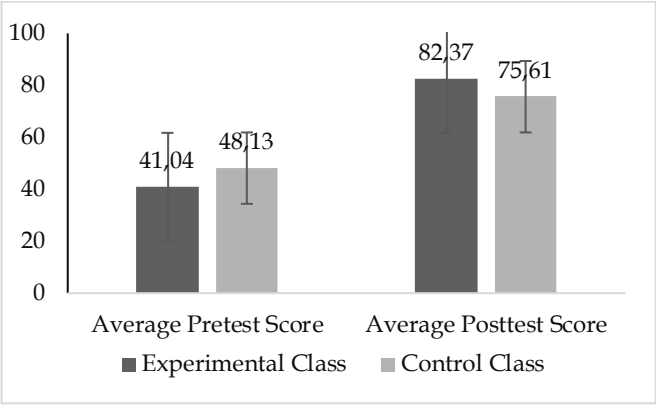

Figure 2. Diagram of Improvement of Pretest and Posttest Learning Outcomes

Based on Figure 2, both classes have almost the same learning ability, however, after the experimental class was given treatment using the Problem-Based Learning model assisted by Augmented Reality, there was a higher average increase in learning outcomes compared to the control class which was given treatment using the Problem-Based Learning model (teacher version) assisted by image media. This is in line with research conducted by Hikmawati et al. (2022), which states that the application of the Problem-Based Learning model can improve student learning outcomes (Vachry Dhani et al., 2023). Other findings also show that the use of Augmented Reality media in the learning process can improve student learning outcomes, especially in the cognitive domain (Alawyah et al., 2024). So based on the research results supported by previous research, it can be said that the Problem-Based Learning model assisted by Augmented Reality is a learning model and media needed by students to be able to concretize complex and abstract science and science material, so that it can have a positive impact on student learning outcomes.

Table 8. Results of Teacher and Student Response Questionnaires

Respondent	Percentage	Criteria
Teacher	92.50%	Very Positive
Students	90%	Very Positive

Based on Table 8, the application of the Problem-Based Learning model assisted by Augmented Reality also received a positive response from teachers and students. Through the response questionnaire given to teachers, overall learning that applies the PBL model that is in accordance with the syntax assisted by AR media has a significant impact on student activity in the learning process, so that in each aspect of the assessment it gets an average score of 4 which states the statement "very good". This is also supported by the teacher's comments on the response questionnaire stating that the use of AR media with the PBL model in science learning provides a more interactive and interesting learning atmosphere that makes students more enthusiastic, focused, and happy to explore the material visually. Based on the student response questionnaire related to the use of AR media, as many as 27 students stated "strongly agree" with the statement that AR learning media is easy and interesting to use for learning.

In the statement related to the material in AR media, as many as 22 students stated "strongly agree" and as many as 5 students stated "agree" that AR media helps in understanding the learning material. And also, in the statement related to the learning process, as many as 27 students stated "strongly agree" that the use of AR media provides a more enjoyable learning experience. Thus, the application of the Problem-Based Learning model can increase student activity in the learning process (Cahyani et al., 2023) and the use of Augmented Reality media can create a pleasant learning atmosphere and help in understanding complex and abstract science learning materials (Amirahma & Setyasto, 2024; Firdanu et al., 2020). Based on the results of data analysis, it shows that the Problem-Based Learning model assisted by Augmented Reality is effective to be applied in the learning process which can increase the average learning outcomes of students higher than the Problem-Based Learning model (teacher version) assisted by image media applied by grade IV teachers in several elementary schools in the Lokantara Cluster, Temanggung District, Temanggung Regency.

This effectiveness is reinforced by several factors. First, the Problem-Based Learning model emphasizes the active involvement of students in classroom learning activities (Indriani, 2022), where teachers relate everyday problems experienced by students in learning that makes students enthusiastic to learn (Leite et al., 2022; Yhonara et al., 2022). Thus, the Problem-Based Learning model can contribute as a reference for teachers in the learning process to be able to increase student activity (Jumhur et al., 2024). Second, the Problem-Based Learning model is able to develop problem-solving skills and critical thinking skills of students (Bonafide et al., 2021; Yana et al., 2022). Students are accustomed to facing problems and then finding solutions (Elvira et al., 2015; Whitelock-

Wainwright et al., 2020). Thus, the Problem-Based Learning model is effective in improving problem-solving and solution skills, which will have a positive impact on learning outcomes. Third, interactive media assisted by Augmented Reality can create a fun learning atmosphere and stimulate children's imagination, so that it can motivate students to learn (Câmara Olim et al., 2024; Wang et al., 2024). Finally, Augmented Reality media can help students understand and visualize complex and abstract learning materials. One of the advantages of AR media in teaching a material is providing a virtual experience that is easy for students to remember rather than just reading text (Alhamad et al., 2024; Tuli et al., 2022). So it can minimize student misconceptions due to their inability to understand complex materials (Mandinach & Schildkamp, 2021; Ningrum et al., 2022).

Conclusion

Based on the results and discussions in this study, it shows that the Problem-Based Learning model assisted by Augmented Reality provides a fairly good increase in learning success, namely with a percentage of 85.18%. The results of the teacher and student response questionnaires on the learning model and media also show a positive category. Data analysis also shows that there is a significant difference in the increase in pretest and posttest scores with an average difference of 41.33 and an N-Gain value output of 0.68 which is included in the moderate category. With these results, the Problem-Based Learning model assisted by Augmented Reality has been proven to be more effective than the Problem-Based Learning model (teacher version) assisted by image media in improving the science learning outcomes of grade IV students of SD Gugus Lokantara, Temanggung District, Temanggung Regency.

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