JPPIPA 10(10) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Influence of the Problem Based Learning Model on the Scientific Attitudes and Science Learning Outcomes of Fifth Grade Elementary School Students

Vania Desiyanti[1*], Ikhlasul Ardi Nugroho[1]

[1] Faculty of Education and Psychology, Yogyakarta State University, Yogyakarta, Indonesia.

Received: March 02, 2024
Revised: July 23, 2024
Accepted: October 25, 2024
Published: October 31, 2024

Corresponding Author:
Vania Desiyanti
vaniadesiyanti.2022@student.uny.ac.id

DOI: 10.29303/jppipa.v10i10.8623

Abstract: This research aims to determine the significant influence of the PBL model on the scientific attitudes and science learning outcomes of fifth grade elementary school students. The method used is quasi experimental design with pretest non-equivalent control group design. The research population was SDN Hugus II Kapanewon Sewon, Bantul Regency, with a sample of several class V students from SD Negeri 2 Blunyahan, SD Negeri 3 Jarakan, SD Negeri Jarakan, and SD Negeri Sawit. The experimental group used the PBL model in science learning. The normality test was carried out using Kolmogrov Smirnov, the homogeneity test was carried out using Levene's test, and the hypothesis test was carried out using the independent sample t-test and MANOVA. The research results show that PBL has a positive and significant effect on scientific attitudes with a value of (0.000 < 0.005) and on learning outcomes with a value of (0.000 < 0.005). Data analysis shows that there is a significant influence of the PBL model on students' scientific attitudes and science learning outcomes with a value of (0.000 < 0.005).

Keywords: Learning results; Problem based learning (PBL); Scientific attitude

Introduction

According to Wartoyo (2022) in Article 3 of Law Number 20 of 2003, elementary schools (SD) have an important role in laying a solid foundation for academic growth to meet the country's educational needs. The main activity in education is learning, with the aim of improving students' abilities. The development of students to become human beings who have faith and devotion to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens.

A scientific attitude is a type of attitude that encourages people to seek and develop knowledge. This is achieved through various educational activities that involve students, such as debates, group projects, role playing, and simulations (Widani et al., 2019). A scientific attitude is produced through an educational process that allows students to make observations of other people and their environment. A scientific attitude is related to a way of respecting others and oneself, because it has a basis like this.

Scientific attitudes that influence students in respecting others and themselves include several aspects, such as curiosity, respect for data, openness, cooperation, perseverance and responsibility (Listiani & Purwanto, 2018). Students can become more objective, rational and critical thinkers when learning new material by developing their critical thinking skills in class. Student learning outcomes show how big the influence of a scientific mindset is in teaching.

Learning outcomes are understanding and awareness of the subject matter taught to students. Learning outcomes reflect students' expectations during the learning process, which supports stated changes (Amaliyah, 2023). This practice can include self-

How to Cite:
Desiyanti, V., & Nugroho, I. A. (2024). The Influence of the Problem Based Learning Model on the Scientific Attitudes and Science Learning Outcomes of Fifth Grade Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, *10*(10), 8088–8097. https://doi.org/10.29303/jppipa.v10i10.8623

improvement, changing one's perspective, and gaining new insights. The three main learning outcomes are cognitive, behavioral, and psychomotor.

The three main domains of cognitive, affective, and psychological learning outcomes are based on Bloom's Taxonomy theory. Application, knowledge, understanding, analysis, synthesis, and judgment are useful for intellectual achievement at six levels. The lower limit of talent in the domains of emotional acceptance, reaction judgment, organizational, and characteristics related to attitudes and values. The psychomotor domain includes connection and observation as well as motor skills, object manipulation and neuromuscular coordination (Andryannisa et al., 2023). The learning outcomes achieved by students on the surface indicate whether or not educational goals have been achieved. Whatever way students show pretension in class and the grades or numbers they score can be used to lower their learning outcomes. Positive learning outcomes indicate the success of science learning (Fidyaningrum & Prasetiyo, 2023).

One of the core subjects taught in elementary schools is science. Increasing the younger generation's awareness of the surrounding environment is one of the main goals. Apart from coming from experience, this information is also obtained through a series of scientific processes that involve designing and testing ideas, investigating, and guiding students towards discovery (Sulistriani et al., 2021; Sukarini & Manuaba, 2021). Furthermore, science learning is basically to enforce and train skills, knowledge, and form scientific attitudes in students, including love for God Almighty (Shofiyah & Wulandari, 2018).

Science learning directs students to understand the learning process that will influence their development. This learning has objectives that become a reference in its implementation. The aim of teaching science in elementary schools is to provide practical knowledge and understanding of scientific principles to students (Jannah, 2020). Science learning is considered successful if it is able to improve students' abilities, which can be seen when the assessment is carried out.

The aim of evaluating learning outcomes is to reveal the cognitive, affective and psychomotor domains (Nasution, 2022). Studying science seeks to advance scientific communication as well as the capacity to think, act, and behave scientifically. In addition to learning facts, science students also learn how to think critically, analytically, and creatively. Apart from that, the aim of science is also to encourage students to have a scientific attitude, such as curiosity based on evidence. Scientific communication is also improved, so that students are able to explain the findings they obtain.

One of the main goals of science education is to increase students' understanding and ability to apply science concepts in real-world activities. Students who study science will have a strong intellectual foundation and transferable skills that will allow them to face life with more self-awareness and develop a broader perspective on the world.

One model that can be used in education is called problem-based learning. In 2022, Indonesia will start using a new curriculum known as the Merdeka Curriculum. To enable each student to reach their maximum potential, the curriculum is designed to support and enhance their learning abilities while providing a more flexible and enjoyable learning environment. This method produces learning that focuses on actual issues (Setiyaningsih & Subrata, 2023).

In the independent curriculum, especially in science learning, there is an emphasis on using two learning models, namely the PjBL and PBL models. These two models help students develop scientific concepts, encourage them to think critically, and connect learning with real-world contexts. The PjBL, PBL, and DL models have the potential to become important components in the science learning process because the independent curriculum provides teachers with the opportunity to develop teaching strategies that suit students' learning needs and goals. This is in accordance with the findings of Meliniasari et al. (2023) that the elementary school curriculum emphasizes science learning through project-based learning and problem solving in real-world contexts. Furthermore, the findings of Kusuma et al. (2015) explain that the DL Model is very relevant to use with Pancasila values which are integrated in the Merdeka curriculum.

According to Hasanah et al. (2021), the aim of PBL is for students to be able to actively participate in the learning process. The PBL paradigm has the ability to improve student learning outcomes by educating students to become independent learners and developing critical thinking skills. The PBL model helps students learn by enabling them increase the level of previous knowledge they have. According to Masrinah et al. (2019) PBL has the potential to improve students' critical thinking and literacy skills and align classroom teaching with real-world experiences by encouraging students to examine problems from various perspectives during the learning process, model it also teaches them how to think critically, analytically, creatively, and holistically.

According to research of Lestari et al. (2016) conducted on junior high school students using the "My Water is Clear and My Environment is Healthy" curriculum, PBL can increase students' knowledge and abilities in recognizing analytics in science classes. PBL improves student learning outcomes in basic school subjects. Research by Rosdiana (2019) further shows that PBL increases the knowledge and learning outcomes of

high school science program students, especially in the Psychotropics sub-material. The results of this study indicate that PBL has a significant negative impact on students' academic achievement and learning goals.

Based on the results of interviews and observations, research found that at SD Sawit, the learning models used include PBL, DL (Discovery Learning), PjBL, and other models that are adapted to the subject matter. Based on research, some young people find it difficult to apply the lessons taught by their teachers, either through learning lessons or not applying them consistently. Based on the teacher's interview, this behavior was possibly caused by community bias during the pandemic, where people were not cooperative in carrying out their duties. Most students tend to accept assignments without much curiosity, and only a small portion of them actively ask questions about the learning material. Additionally, the lack of thorough skills in completing tasks is also a concern.

Similar interview results were recorded at Jarakan Elementary School and Blunyahan 2 Elementary School, where students tended to be less active in learning. Teachers adopt a learning approach using discussion and question and answer models in delivering material. At Jarakan Elementary School, a small number of students show interest in exploring the material and are less active in participating by giving their opinions during the learning process. The material is taught using a lecture approach, using PBL and DL models adapted to the learning material.

Based on observation data, teachers at Blunyahan 2 State Elementary School, Sawit State Elementary School, Jarakan 3 State Elementary School, and Jarakan School State Elementary School trained students to adjust their learning outcomes during the science learning process. However, there are still few students who actively ask questions about the assignments and material being taught. There are also notes that when doing assignments, there are still many students who are dishonest, such as copying friends' work. Students are also less careful in completing assignments, such as many mistakes in writing letters, especially for class V elementary school. Apart from that, there is a tendency for students to be dishonest with teachers, such as pretending to be sick or giving various reasons when they do not complete the assignment given. Based on observations in the four elementary schools, there are indications of problems in developing students' scientific attitudes.

The issues raised are also consistent with research of Oktarian (2019), which shows that students are less interested, have lower self-esteem, and voice their ideas less frequently, all of which contribute to unfavorable attitudes toward science. This conclusion is further elaborated by research of Razak et al. (2018) which says that when students have difficulty understanding, expressing critical thinking, and working together during the learning process, their academic performance declines negatively and gradually.

Based on the background above, research was conducted on the effect of PBL on academic achievement and science learning outcomes in class V. Therefore, this research was conducted at SDN Blunyahan 2, SDN Sawit, SDN 3 Jarakan, and SDN Jarakan, where there was no research. previously conducted on this subject. The aim of this research is to test that the PBL model can influence scientific attitudes and science learning outcomes in class V of Blunyahan 2 Elementary School, Sawit State Elementary School, State Elementary School Jarakan, Elementary School Jarakan 3.

Method

The methodology used is quantitative research with a quasi-experimental design. Quantitative research based on positivist philosophy assesses research hypotheses by analyzing data and using statistical methods to study populations or samples (Sugiyono, 2019). Therefore, research data is numerical and has gone through statistical processing. The control group design in this study is not equivalent. This research includes an experimental class that uses PBL and a control class that uses Discovery Learning (DL). The research design used in this study was an unequal control group design. Details of the design can be seen in the following table.

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

Description:
X_1 : Experimental class treatment (PBL Model)
X_2 : Control class treatment (DL Model)
O_1 : Experimental class pretest
O_2 : Experimental class posttest
O_3 : Control class pretest
O_4 : Control class posttest

This research was conducted on class V students of Cluster II Kapanewon Sewon, Sewon District, Bantul Regency. The sample was selected using cluster random sampling. The sample for this research consisted of SD Negeri 3 Jarakan and SDN 2 Blunyahan in the experimental class, while SDN Jarakan and SDN Sawit were in the control class consisting of 100 students.

Research procedures include preparation, implementation and post-experiment stages. In the preparation stage, researchers prepared learning tools such as teaching modules, teaching materials, student

worksheets, and research instruments. The implementation phase involves giving a pretest to measure students' initial understanding, followed by implementing the PBL model in the experimental class and the DL model in the control class. In the final stage, a posttest is given to measure students' learning outcomes and scientific attitudes after treatment.

The research variables consist of independent variables (PBL) and dependent variables (scientific attitudes and learning outcomes). Research instruments include objective tests, descriptions and scientific attitude questionnaires which have been validated and tested for reliability using statistical methods. Data collection techniques include a Likert scale for scientific attitudes, observation to observe student behavior, and tests to measure learning outcomes. The collected data was analyzed statistically to test the research hypothesis. The validity of the instrument was tested using content and construct validity, while reliability was tested using the Cronbach Alpha method, with the results showing that the instrument used was valid and reliable.

Results and Discussion

The data obtained in this research used descriptive analysis of learning outcomes and scientific attitudes. Used to describe the characteristics of data that has been collected clearly and in detail.

From the data in Table 2, a conclusion was obtained that students in the experimental class with the PBL model had more influence on learning outcomes in science subjects. From the data in Table 3, a conclusion was obtained that students in the experimental class with the PBL model had more influence on scientific attitudes in science subjects.

Table 2. Descriptive Learning Outcomes

Description	Pretest		Posttest	
	KE	KK	KE	KK
Mean	51.27	55.60	81.65	71.04
Maximum score	74	79	100	90
Minimum score	33	34	58	43
Standard deviation	10.169	8.497	11.894	12.384
The number of students	52	48	52	48

Table 3. Descriptive of Scientific Attitude

Description	Pretest		Posttest	
	KE	KK	KE	KK
Mean	67.19	71.06	82.71	78.15
Maximum score	85	91	96	92
Minimum score	51	51	69	69
Standard deviation	9.255	9.733	6.396	5.694
The number of students	52	48	52	48

The necessary data analysis is a prerequisite for evaluating research hypotheses. Data from both groups should have a normal distribution, and the experimental and control groups should have similar standardized variances. Consequently, normality and homogeneity are assessed by testing the normality and homogeneity of the data. In this study, it was found that the data was normally distributed and homogeneous because the data significance was > 0.05. Because the data testing was normal and homogeneous, researchers tested MANOVA. The following is the basis for decision making in the MANOVA test.

Table 4. MANOVA Test

Effect		Value	F	Hypothesis df	Error df	Sig
Intercept	Pillai's Trace	0.995	10088.206[b]	2.000	97.000	0.000
	Wilks'Lambda	0.005	10088.206[b]	2.000	97.000	0.000
	Hotelling's Trace	208.004	10088.206[b]	2.000	97.000	0.000
	Roy's Largest Root	208.004	10088.206[b]	2.000	97.000	0.000
Model	Pillai's Trace	0.261	17.122[b]	2.000	97.000	0.000
	Wilks'Lambda	0.739	17.122[b]	2.000	97.000	0.000
	Hotelling's Trace	0.353	17.122[b]	2.000	97.000	0.000
	Roy's Largest Root	0.353	17.122[b]	2.000	97.000	0.000

This result shows a significance of 0.000 (0.000 < 0.005). Therefore, we can conclude that there is a relationship between the PBL paradigm and its simultaneous impact on learning outcomes and attitudes.

First Hypothesis Testing (The Influence of the PBL Model on Scientific Attitudes)

Based on the research results, it was concluded that students who used the PBL learning style approach had better and more substantial grades compared to students who used the DL approach. In particular, "Chapter 4 Let's Get to Know Our Earth" shows how the use of the PBL model further optimizes the scientific attitude.

Learning that uses the PBL model in each learning process provides students with contextual problems as an initial step in learning, and to build science learning concepts. Students are given the freedom to express their thoughts, solve problems, communicate and learn from

the views of their friends. Under the teacher's direction, students participate actively in the learning process. The PBL learning model answers problems that are relevant to students' daily lives; in other words, science education can be seen as beneficial for learning in order to maximize students' scientific attitudes and spark their interest in the subject.

Scientific attitude is an important thing in science learning, and can influence student skills, student learning environment, and learning motivation. A scientific attitude forms a generation that is careful, critical, and focused on knowledge based on evidence. A scientific attitude is carried out from an early age so that it becomes a foundation and investment for students and society as a whole (Widani et al., 2019). Cultivating a scientific attitude that is less than optimal results in an imperfect self-foundation, resulting in imperfect learning.

When used in an experimental environment, the PBL model can help students adopt a scientific mindset. Students can learn to think critically and solve problems using the PBL model. Starting from problem observation, identification, inquiry, collaboration, and drawing conclusions, PBL with its syntax can maximize a scientific attitude. Because curiosity, respect for information and facts, open-mindedness, tenacity, and sensitivity to the environment are characteristics of a scientific attitude.

Achievement of the scientific attitude dimension can be seen in the scientific attitude indicators found in the experimental class using the PBL model, namely enthusiasm for seeking answers with the statement I am enthusiastic about finding answers to questions given by the teacher. This can be seen in the third syntax, namely guiding students in individual and group investigations where students can be seen carrying out investigations to collect various sources needed as group discussion material and can be seen in the syntax four of developing and presenting the results of the work. Students can be seen collaborating and discussing to find solutions in solving problems. In this statement, the experimental class had a pretest score of 122 and a posttest of 163, while the control class had a pretest score of 117 and posttest 119.

With a difference of 41 points, it can be concluded from the total data that the indicator of curiosity in seeking answers to the experimental class PBL model in the experimental class has a stronger influence on scientific attitudes. According to research of Suhirman et al. (2020), students who have a scientific mindset, curiosity will give rise to positive attitudes in students. These findings are consistent with those studies.

The PBL syntax that guides students in individual and group investigations as well as the syntax for developing and presenting the results of their work because students are in this syntax can be used to see how to achieve a scientific attitude in terms of the dimension of respect for data. facts with indicators do not manipulate data with statements that I record the results of observations according to reality. The group is directly responsible for gathering information and reporting solutions that have been discussed among group members. Based on this statement, the experimental class scored 121 on the pretest and 170 on the posttest, compared to 78 on the pretest and 93 on the posttest for the control class. Based on the cumulative findings, it can be concluded that with a difference of 49 points, the indication of not using the PBL model to manipulate data in the experimental class has a greater impact on scientific attitudes. This can be seen in research conducted by Listiani & Purwanto (2018), there must be respect for data. a mindset that values information, facts, and evidence.

The final PBL syntax consists of analysis and evaluation of the problem solving process and indicators of cooperative thinking with the statement I am enthusiastic about showing how to achieve a scientific attitude in an open-minded and cooperative attitude with indicators of open thinking and cooperation with the statement I respect different opinions. This is demonstrated in PBL syntax during the group work phase when students collaborate to identify sources of information needed to manage problem solving and other tasks. And continued with other PBL syntaxes to the syntax of developing and presenting work results where students work together to find the right solution in solving problems.

The experimental class scored 113 on the pretest and 173 on the posttest on the open thinking indicator, compared to 98 on the pretest and 105 on the posttest in the control group. Based on the cumulative findings, it is known that with a difference of sixty points, the open thinking indicator in the PBL-based experimental class has a greater influence on scientific views. This can also be seen in the collaborative thinking indicator where the experimental class scored 129 on the pretest and 131 on the posttest, compared to 110 on the pretest and 110 on the posttest in the control class. The combined data shows the superiority of collaborative thinking indicators in PBL-based experimental classes. impact on views of science by a difference of two points. This is in line with the explanation of the scientific attitude presented by research of Astawan & Agustiana (2020) which explains that open thinking means having the courage to accept new ideas and beliefs even if they are not supported by evidence or data.

Furthermore, the achievement of a scientific attitude in terms of the dimension of perseverance with the indicator of searching for data enthusiastically with the statement I can be seen from the PBL syntax. I

postpone playing with friends if the teacher's assignment has not been completed. This can be seen in all PBL learning syntaxes, one of which is developing and presenting work results where students play an active role in discussing and completing group findings so that before students finish the discussion, they cannot play with group friends or friends outside the group.

The experimental class has a pretest score of 118 and a posttest score of 119, which indicates enthusiasm for searching for data, while the control class has a pretest score of 140 and a posttest score of 103. Based on the cumulative findings, it can be concluded that attitudes towards science are more influenced by indications of open thinking in PBL experimental class with a 1 point disparity.

Finally, PBL syntax as a whole analyzes and assesses the problem solving process where students provide conclusions on each learning outcome, showing the achievement of a scientific attitude in terms of the dimension of a sensitive attitude towards the surrounding environment with indicators of care. The school environment is clean with the statement that I throw rubbish in its place. They later learned that the students understood the need to keep their environment clean before and after the conversation.

The open thinking indicator for the experimental class had a pretest score of 134 and a posttest score of 182, but the control class scored 152 and 153 respectively. Based on the cumulative findings, it can be concluded that the PBL model environmental cleanliness indicator in the experimental class had a greater impact on scientific views. with a difference of 48 points. According to research by Magdalena et al. (2020), maintaining cleanliness and participating in all cleaning activities, both the environment around students and the cleanliness of the school as a whole, are both important aspects in developing a scientific attitude.

Second Hypothesis the Influence of the PBL Model on Learning Outcomes

The independent sample t test used to test the first hypothesis shows that the level of significance is between 0.0005 and 0.0005. All of this shows that the PBL experiential learning model and the DL control learning model have different influences on learning outcomes. Thus, it can be said that PBL has a significant and positive influence on the science learning outcomes of class V students in Sewon Bantul.

The research findings showed that although the learning outcomes of the control group and the experience group increased, the learning outcomes of the experience group increased more than the control group because the control group used PBL. Research shows that the PBL approach has a big impact on students' science learning outcomes (Mazidah & Bektiarso, 2013).

PBL describes how the learning process can solve problems in science learning. This fact is reinforced by Hidayah et al. (2016) stated that students learning that is linked to real problem solving so that students can develop science skills and help student learning outcomes. Because students learn science topics through discovery, the PBL approach incorporates some syntax to help students understand the material.

Learning outcomes are skills that arise from the learning process. According to Febriani (2017), learning outcomes are conclusions drawn by students after completing the learning process. In the results of the experimental class pretest, the learning outcome indicator (C1) students got a score of 21.5 and the posttest was 31.5. Meanwhile, the pretest control class was 14 and the posttest was 15. This accumulation resulted in the conclusion that the memory learning outcome indicators were significantly influenced by the application of the PBL paradigm. PBL learning syntax is directly involved in achieving memory learning outcome indicators, which can be seen from the first syntax of problem orientation to the syntax of analyzing and evaluating. If we look more closely, analyzing and evaluating work performance and analyzing and evaluating problem solving skills are two PBL components that have a significant impact on students' ability to meet learning outcome indicators. Remembering indicators are the results that students will obtain from implementing the PBL syntax itself. Because in these two syntaxes students communicate the findings again and make a finding report which requires a deep understanding in presenting the findings.

In the next learning outcome indicator, understanding (C2), the experimental class results obtained a pretest score of 16 while the posttest score was 23. On the other hand, the control group's pretest score was 14.5 and the posttest score was 16.37. This accumulation results in the conclusion that the understanding indicators are influenced by both the experimental class and the control class. However, the effect of using the PBL model in the experimental class. Success indicators: These learning outcome indicators are seen in the overall structure of problem-based learning (PBL), but are especially seen in the structure of creating and presenting work products by increasing students' capacity to develop their understanding through PBL. PBL is then applied in the creation and demonstration of meaningful work products, because these products are based on real-world issues. CORRECT. This is in accordance with Djonomiarjo (2020) who states that PBL problems are real world problems that arise from the environment around students.

The Applying learning outcome indicator (C3) in the experimental class obtained a pretest score of 21 while the posttest score was 27.5. Meanwhile, in the control class the pretest score was 14.5 while the posttest score was 19.5. This accumulation results in the conclusion that the indicators applied are influenced by the experimental class and the control class. However, the effect of using the PBL model in the experimental class. The application of this learning outcome indicator can be seen in the syntax of developing and presenting work results. Because after previous syntax students collect data from various references, whether from books, interviews and so on, students apply it in the form of work or reports that are communicated in front of the class. This of course cannot be separated from the opportunities that exist in the PBL syntax by providing problems so that students are able to apply the knowledge they have. This is in line with Handayani et al. (2021). By solving problems, students can apply and improve their own knowledge.

The Analyzing learning outcome indicator (C4) in the experimental class obtained a pretest score of 24 while the posttest score was 34.5. In contrast, the control group had a pretest score of 42 and a posttest score of 43. This accumulation resulted in the conclusion that the indicators applied were influenced by the experimental and control classes. However, the effect of using the PBL model in the experimental class. The application of this learning outcome indicator can be seen in its application to all PBL syntax. Because this is the result of implementing the PBL model which has been passed. Students also get practice using their talents when analyzing previous research findings. The process of solving problems impacts how well students can solve problems, encourage critical thinking, and acquire new information (Nurlaily et al., 2019).

The Evaluating learning outcomes indicator (C5) in the experimental class obtained a pretest score of 26.5 while the posttest score was 56. Meanwhile in the control class the pretest score was 46 while the posttest score was 57. This accumulation resulted in the conclusion that the indicators applied were influenced by the experimental class and the control class. However, the effect of using the PBL model in the experimental class. The application of these learning outcome indicators can be seen in the syntax used in the analysis and assessment of the problem solving process. Due to the fact that students research and discuss in groups various possible solutions to the difficulties they face. The assessment stage is completed collaboratively. Research conducted by Elita et al. (2019) supports this. At this stage, the instructor guides students in assessing and analyzing what they have learned.

Indicators of learning outcomes for Making (C6) in the experimental class obtained a pretest score of 50 while the posttest score was 117. Meanwhile in the control class the pretest score was 71.5 while the posttest score was 95. This accumulation resulted in the conclusion that the indicators applied were influenced by the experimental class and the control class. However, the effect of using the PBL model in the experimental class. The development and presentation of work results shows the syntactic application of these learning outcome indicators. Because at this stage, apart from analyzing, students also evaluate the conclusions and results they have achieved when overcoming previous difficulties. Additionally, students have the opportunity to draw conclusions that align with the results of their group projects. According to Mayasari et al. (2022), PBL provides students with the opportunity to design their own education by utilizing the PBL learning syntax they have experienced.

Based on the research above, it can be concluded that although learning outcomes increased in both the control group and the experimental group, it was more significant in the experimental group when the PBL model was used. Research according to Novi et al. (2021) regarding the impact of PBL on learning outcomes for science material in fifth grade elementary school supports this statement. Research findings show that PBL can improve learning outcomes. Mazidah et al. (2013) shows how the use of PBL can influence student learning outcomes. We can conclude that PBL has a statistically significant impact on learning objectives.

Testing the Third Hypothesis. The Influence of the PBL Model on Scientific Attitudes and Learning Outcomes

To find out whether the PBL model influences learning outcomes and scientific attitudes simultaneously, a multivariate analysis must be carried out using MANOVA with a significance threshold of 0.005. The results showed that there were differences between the experimental and control groups. This shows that the PBL model can have a significant impact on the learning outcomes and scientific attitudes of fifth grade elementary school students.

The PBL model has a significant influence on scientific attitudes and learning outcomes as measured by overall test results. This is the result of the PBL learning approach which produces questions as a means to improve student learning, improve critical thinking skills, and help students in searching for information. By posing problems, students engage in group projects and learn under the guidance of an instructor.

PBL style learning begins the learning process with challenges that are relevant to students' daily lives. Therefore, science education will become more relevant and interesting for students, and will be seen as beneficial for maximizing students' attitudes towards science learning. An attitude of inquiry, respect for

information and facts, open-mindedness, perseverance, and sensitivity to the environment are some of the aspects that form a scientific mindset. People who have a scientific attitude are people who have an innate curiosity, respect for information, critical thinking skills, a creative and inventive spirit, cooperation and open-mindedness, perseverance, and sensitivity to the environment. Someone with this attitude has usually studied science (Hs & Kistian, 2020).

Apart from optimizing a scientific attitude, PBL can also provide space to optimize science learning outcomes. PBL also places great emphasis on the process, not just learning outcomes, if the learning process is carried out optimally then the results obtained will be optimal. In line with Septiana et al. (2018), PBL can expand knowledge about the material and have an impact on the results of the learning process. Learning stages can be seen in the PBL learning syntax.

PBL syntax is carried out one by one and has a good impact on students understanding the lesson. The first stage of learning is oriented towards problems related to the material; the second step in organizing student learning is related to determining the resources and equipment needed, the third step; guiding students in individual and group investigations related to data collection, step four; develop and present results related to presenting the results of the investigation, step five; analyzing and evaluating the problem solving process is related to making conclusions. Judging from the syntax of PBL learning, students are really given the opportunity to develop their abilities, which of course will have an impact on learning outcomes. PBL can provide meaningful experiences and develop students' potential, starting with presenting a problem and asking questions, so that students are able to increase their own knowledge (Handayani & Muhammadi, 2021).

Based on the analysis and justification provided above, there are significant differences between the PBL model and the DL model regarding students' learning outcomes and scientific attitudes. The stricter PBL model used in the classroom will maximize student learning outcomes and scientific attitudes in science learning for fifth grade elementary school students.

Conclusion

Based on the results of the research and discussion, it can be concluded that the application of the PBL learning model influences scientific attitudes and learning outcomes in science subjects in elementary school.

Acknowledgments
All authors would like to thank to all parties who have helped in this research.

Author Contributions
Conceptualization, writing—original draft preparation, methodology, formal analysis, investigation, and data curation, V.D.; validation, writing—review and editing, visualization, and supervision, I.A.N. All authors have read and agreed to the published version of the manuscript.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

References

Amaliyah, S. (2023). Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw untuk Meningkatkan Hasil Belajar Siswa Materi Protista pada Siswa Kelas X IPA MAN 1 Kota Tangerang Selatan Tahun Pelajaran 2022/2023. *Metakognisi*, *5*(1), 41–51. https://doi.org/10.57121/meta.v5i1.55

Andryannisa, M. A., Wahyudi, A. P., & Sayekti, S. P. (2023). Upaya Meningkatkan Hasil Belajar Siswa dengan Menggunakan Metode Resitasi pada Mata Pelajaran Akidah Akhlak di SD Islam Riyadhul Jannah Depok. *Jurnal Pendidikan Sosial dan Humaniora*, *2*(3), 11716-11730. Retrieved from https://publisherqu.com/index.php/pediaqu/article/view/393

Astawan, I. G., & Agustiana, I. G. A. T. (2020). *Pendidikan IPA Sekolah Dasar di Era Revolusi Industri 4.0*. Badung: Nilacakra.

Djonomiarjo, T. (2020). Pengaruh Model Problem Based Learning Terhadap Hasil Belajar. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *5*(1), 39–46. http://dx.doi.org/10.37905/aksara.5.1.39-46.2019

Elita, G. S., Habibi, M., Putra, A., & Ulandari, N. (2019). Pengaruh Pembelajaran Problem Based Learning dengan Pendekatan Metakognisi Terhadap Kemampuan Pemecahan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(3), 447–458. https://doi.org/10.31980/mosharafa.v8i3.580

Febriani, C. (2017). Pengaruh Media Video Terhadap Motivasi Belajar dan Hasil Belajar Kognitif Pembelajaran IPA Kelas V Sekolah Dasar. *Jurnal Prima Edukasia*, *5*(1), 11–21. https://doi.org/10.21831/jpe.v5i1.8461

Fidyaningrum, R. A., & Prasetiyo, W. H. (2023). Pengaruh Perhatian Orang Tua Terhadap Hasil Belajar Pendidikan Pancasila dan Kewarganegaraan pada Kurikulum Merdeka. *JPK (Jurnal Pancasila dan Kewarganegaraan)*, *8*(2), 87–96. Retrieved from https://journal.umpo.ac.id/index.php/JPK/article/view/6948

Handayani, R., & Muhammadi, M. (2021). Pengaruh Model Pembelajaran Problem Based Learning

Terhadap Hasil Belajar Siswa dalam Pembelajaran Tematik Terpadu di Kelas V SD. *e-Jurnal Inovasi Pembelajaran Sekolah Dasar (e-JIPSD)*, *9*(2). http://dx.doi.org/10.24036/e-jipsd.v9i2.9780

Hasanah, U., Sarjono, S., & Hariyadi, A. (2021). Pengaruh Model Problem Based Learning Terhadap Prestasi Belajar IPS SMP Taruna Kedung Adem. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *7*(1), 43–52. http://dx.doi.org/10.37905/aksara.7.1.43-52.2021

Hidayah, R., & Pujiastuti, P. (2016). Pengaruh PBL Terhadap Keterampilan Proses Sains dan Hasil Belajar Kognitif IPA pada Siswa SD. *Jurnal Prima Edukasia*, *4*(2), 186–197. https://doi.org/10.21831/jpe.v4i2.7789

Hs, D. W. S., & Kistian, A. (2020). Perbedaan Sikap Ilmiah Siswa Menggunakan Model Pembelajaran Inquiry Training dengan Model Pembelajaran Direct Instruction. *Jurnal Tunas Bangsa*, *7*(2), 174–188. https://doi.org/10.46244/tunasbangsa.v7i2.1160

Jannah, I. N. (2020). Efektivitas Penggunaan Multimedia dalam Pembelajaran IPA di SD. *Jurnal Ilmiah Sekolah Dasar*, *4*(1), 54–59. https://doi.org/10.23887/jisd.v4i1.24135

Kusuma, T. A., & Harijanto, A. (2015). Model Discovery Learning Disertai Teknik Probing Prompting dalam Pembelajaran Fisika di MA. *Jurnal Pembelajaran Fisika*, *3*(4). Retrieved from https://jurnal.unej.ac.id/index.php/JPF/article/view/1428

Lestari, D. I., & Projosantoso, A. K. (2016). Pengembangan Media Komik IPA Model PBL untuk Meningkatkan Kemampuan Berfikir Analitis dan Sikap Ilmiah. *Jurnal Inovasi Pendidikan IPA*, *2*(2), 145–155. https://doi.org/10.21831/jipi.v2i2.7280

Listiani, S. H., & Purwanto, A. (2018). Penerapan Model Pembelajaran Project Based Learning dengan Pemanfaatan Barang Bekas untuk Meningkatkan Sikap Ilmiah Siswa. *Prosiding Seminar dan Diskusi Pendidikan Dasar*, 24-29. Retrieved from http://journal.unj.ac.id/unj/index.php/psdpd/article/view/9939

Magdalena, I., Sari, D. M., Hurrahmah, M., & Sari, N. R. (2020). Pengembangan Instrumen Penilaian Sikap Ilmiah pada Pembelajaran dengan Model Latihan Penelitian di SDN Rawakidang. *Edisi: Jurnal Edukasi dan Sains*, *2*(3), 350–359. Retrieved from https://ejournal.stitpn.ac.id/index.php/edisi/article/download/924/636

Masrinah, E. N., Aripin, I., & Gaffar, A. A. (2019). Problem Based Learning (PBL) untuk Meningkatkan Keterampilan Berpikir Kritis. *Prosiding Seminar Nasional Pendidikan*, *1*, 924–932. Retrieved from https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/129

Mayasari, A., Arifudin, O., & Juliawati, E. (2022). Implementasi Model Problem Based Learning (PBL) dalam Meningkatkan Keaktifan Pembelajaran. *Jurnal Tahsinia*, *3*(2), 167–175. https://doi.org/10.57171/jt.v3i2.335

Mazidah, N., & Bektiarso, A. S. (2013). *Pengaruh Penerapan Model Problem Based Learning (PBL) Terhadap Hasil Belajar IPA Siswa Kelas IV SDN Sidokerto, Sidoarjo*. Retrieved from https://repository.unej.ac.id/handle/123456789/62700

Meliniasari, F., Sudjarwo, S., & Jalmo, T. (2023). Filsafat Aliran Progresivisme dan Perspektifnya Terhadap Pembelajaran IPA pada Kurikulum Merdeka. *Jurnal Ilmiah Profesi Pendidikan*, *8*(1), 204–209. https://doi.org/10.29303/jipp.v8i1.1048

Nasution, S. W. (2022). Asesment Kurikulum Merdeka Belajar di Sekolah Dasar. *Prosiding Pendidikan Dasar*, *1*(1), 135–142. https://doi.org/10.34007/ppd.v1i1.181

Novi, N. P., Suarjana, I. M., & Sudarmawan, G. A. (2021). Model Pembelajaran Problem Based Learning untuk Meningkatkan Hasil Belajar Muatan Pelajaran IPA Siswa Kelas IV SD. *Jurnal Penelitian dan Pengembangan Pendidikan*, *5*(2), 278–286. https://doi.org/10.23887/jppp.v5i2.37427

Nurlaily, V. A., Soegiyanto, H., & Usodo, B. (2019). Elementary School Teachers' Obstacles in the Implementation of Problem-Based Learning Model in Mathematics Learning. *Journal on Mathematics Education*, *10*(2), 229–238. https://doi.org/10.22342/jme.10.2.5386.229-238

Oktarian, N. (2019). Meningkatkan Sikap Ilmiah Siswa dengan Model Project Based Learning (PBL) pada Kelas IX SMP Ar-Raudlah Jember. *Jurnal Pembelajaran Sains*, *3*(1), 7-13. http://dx.doi.org/10.17977/um033v3i1p7-%2013

Razak, F., & Kamaruddin, R. (2018). Pengaruh Sikap Ilmiah Siswa Terhadap Hasil Belajar Materi Bangun Ruang Siswa Kelas VIII SMP Negeri 3 Minasatene. *Mosharafa: Jurnal Pendidikan Matematika*, *7*(1), 133–142. https://doi.org/10.31980/mosharafa.v7i1.483

Rosdiana, Y. (2019). Pengaruh Model Pembelajaran Problem Based Learning (PBL) terhadap Sikap Ilmiah dan Hasil Belajar Peserta Didik pada Sub Materi Psikotropika. *Biosfer: Jurnal Biologi dan Pendidikan Biologi*, *4*(1), 25–32. https://doi.org/10.23969/biosfer.v4i1.1741

Septiana, T. S., & Kurniawan, M. R. (2018). Penerapan Model Problem Based Learning untuk Meningkatkan Berpikir Kritis Siswa Kelas 5 pada Mata Pelajaran PKN di SD Muhammadiyah Kauman Tahun 2016/2017. *Jurnal Fundadikdas*

(Fundamental Pendidikan Dasar), *1*(1), 94–105. https://doi.org/10.12928/fundadikdas.v1i1.74

Setiyaningsih, S., & Subrata, H. (2023). Penerapan Problem Based Learning Terpadu Paradigma Konstruktivisme Vygotsky pada Kurikulum Merdeka Belajar. *Jurnal Ilmiah Mandala Education*, *9*(2). http://dx.doi.org/10.58258/jime.v9i2.5051

Shofiyah, N., & Wulandari, F. E. (2018). Model Problem Based Learning (PBL) dalam Melatih Scientific Reasoning Siswa. *JPPIPA (Jurnal Penelitian Pendidikan IPA)*, *3*(1), 33–38. https://doi.org/10.26740/jppipa.v3n1.p33-38

Sugiyono, S. (2019). *Metode Penelitian Pendidikan*. Bandung: Alfabeta.

Suhirman, S., Yusuf, Y., Muliadi, A., & Prayogi, S. (2020). The Effect of Problem-Based Learning with Character Emphasis Toward Students' Higher-Order Thinking Skills and Characters. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(6), 183–191. https://doi.org/10.3991/ijet.v15i06.12061

Sukarini, K., & Manuaba, I. B. S. (2021). Video Animasi Pembelajaran Daring pada Mata Pelajaran IPA Kelas VI Sekolah Dasar. *Jurnal Edutech Undiksha*, *9*(1), 48–56. https://doi.org/10.23887/jeu.v9i1.32347

Sulistriani, S., Santoso, J., & Oktaviani, S. (2021). Peran Guru sebagai Fasilitator dalam Pembelajaran IPA di Sekolah Dasar. *Journal of Elementary School Education (JOuESE)*, *1*(2), 57–68. https://doi.org/10.52657/jouese.v1i2.1517

Wartoyo, F. X. (2022). Menakar Korelatifitas Merdeka Belajar dengan Sistem Pendidikan Nasional Undang-Undang Nomor 20 Tahun 2003 dan Pancasila. *Widya Pranata Hukum: Jurnal Kajian dan Penelitian Hukum*, *4*(2), 140–153. https://doi.org/10.37631/widyapranata.v4i2.682

Widani, N. K. T., Sudana, D. N., & Agustiana, I. G. A. T. (2019). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar IPA dan Sikap Ilmiah pada Siswa Kelas V SD Gugus I Kecamatan Nusa Penida. *Journal of Education Technology*, *3*(1), 15–21. https://doi.org/10.37631/widyapranata.v4i2.682