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Impact of Problem-Based Learning Models with a Contextual Approach on the Learning Competence of Students in Junior High School

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Abstract: The education of the natural sciences is closely linked to environmental issues. One of the most accurate models used is the problem-learning model. This study aims to look at the impact of a problem-based learning model. With a contextual approach to the competence of high school students, this research is an experimental study using a non-equivalent group design. Based on statistical analysis of the cognitive, psychomotor, and affective aspects of the students, it is known that the data is distributed normally but homogeneously. Then the hypothesis was tested using an independent t test, with the result of the H0 hypotheses rejected. It is understandable that a problem-based learning model with a contextual approach has a significant influence on the competence of high school students. Based on the results of the research, it can be concluded that to enhance student competence, the teacher plays an important role in implementing problem-based learning as it can improve learning outcomes in various aspects, including cognitive, psychomotor, and affective. Then one of the recommended models is problem-based learning (PBL) with a context-based approach.

Keywords: Contextual approach; Problem-based learning model; Student competence

Introduction

Learning is an effort carried out intentionally and directed by a particular individual or group, such as a teacher or textbook writer, with the aim of helping others, including pupils, gain meaningful and important experience in the learning process (Arif, 2020). The learning process involves changes in individual behavior or appearance through various activities such as reading, observing, listening, imitating, and so on. It is better if the subject of learning experiences or does it directly rather than simply being verbalistic (Purwanto et al., 2020). In the 21st century, learning today can be seen as the result of the evolution of society throughout history. Societies have evolved from the primitive era to the agrarian era, then to the industrial era, and are now shifting to an informative society. This is what led to the emergence of 21st-century learning (Syahputra, 2018).

Learning in the 21st century is a form of learning that unites cognitive, affective, and psychomotor abilities, as well as integrating information and communication technologies. This learning is based on a scientific approach that emphasizes 4C learning and innovation skills (Meilani et al., 2020). Moreover, the ability demanded is no longer 4C but 6C (Fauzan, 2023). One thing to pay attention to in the 21st century is science education. In the 21st century, the quality of science education will affect the progress of a country. The implementation of different science learning methods in each country is the key to improving the quality of science education. By involving students in science learning, they can understand the impact of science in everyday life and their role in society (Pratiwi et al., 2019). Science education provides students with an opportunity to understand how science affects their daily lives and their roles in society. By leveraging the concept of science in learning, students in Indonesia are expected to be able to solve real problems in the 21st century (Pratiwi et al., 2019; Septianita et al., 2023).

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Science learning aims to enhance students' understanding of the importance of protecting the environment and addressing environmental problems (Banawi, 2023). In addition, students will be trained to be skilled in managing the environment so that such activities can become a habit in their lives. As a field of study that touches on the affective aspect, science lessons allow students to learn about nature in greater depth (Hafza et al., 2023). Because of this, science learning has a close connection with the problems that exist in the environment (Laksmi et al., 2021; Permata et al., 2022). This will enhance their ability to apply their knowledge to real-life situations (Treepob et al., 2023).

Learning today has begun to implement an approach that focuses on the student studying one aspect of motivation in depth by using an approach focused on the pupil in various aspects of motivation. This is in line with recent findings, especially from psychology, which show that individual aspects of motivation interact (Kubsch et al., 2023). Therefore, in the implementation of science learning, an approach that is consistent with the results of the renewed research is required. Science learning should be applied to learning that focuses on the students, where learning that is close to the problems around them can directly increase the motivation of the students in science learning (Mardhani et al., 2022).

However, the interest of students in simply seeing and listening to the environmental problems in the introductory part of learning alone is not enough to make them interested during the learning process. This is still often happening in every school, including one of the first high schools that are in the area of Solok district. Many teachers use the phenomenon of nature for the introduction of learning only after the use is continued with conventional learning, so interest in the topic of learning today is only at the beginning of learning. The main role of the teacher is as the primary driver who is directly responsible for translating the curriculum into a learning activity, but it is not the only important source of knowledge (Urwati et al., 2019).

In science education, the teaching and learning methodology appeared to be crucial for academic success (Bara et al., 2020). To maintain the interest of students in learning, a suitable learning model is needed. Since students are not only asked to know but also to understand and interpret what they know, the application of learning models will affect students' learning motivation (Safitri et al., 2023).

Learning models play a very important role in determining learning outcomes. Applying learning models can help students develop thinking skills for solving problems (Arif et al., 2021). The learning model that can hone 21st Century competencies is Problem Based Learning (Sholihah et al., 2020). Educators say that when educators use the PBL learning model, learners can often use a variety of skills to solve problems (Laksmi et al., 2021; Wahyuni et al., 2023). One of the right models for dealing with student problems and being active and interested in teaching related to surrounding problems is the problem-based learning model. The PBL learning model can help improve the quality of education through its emphasis on problem-solving and thinking (Magaji, 2021; Tan, 2021).

According to a Dutch national survey that compares the quality of higher education, students who follow a problem-based learning model are more satisfied with their educational process than students who follow a conventional learning model. The problem-based curriculum always ranks first or second in the education category. Graduates from problem-based schools also said that they felt better prepared for interpersonal competencies such as teamwork, consulting with clients, and leadership. Besides, they feel more independent, more creative, and more efficient at work (Moust et al., 2021). One of the learning methods that can help students develop thinking skills is the problem-based learning model. The model is a learning approach that emphasizes structured learning experiences involving research and problem solving, especially issues relevant to everyday life (A. H. Putri et al., 2020).

Based on previous research, the problem-based learning model has a great influence on IPA learning. There are various advantages to using this model. Model problem-based learning can improve cognitive ability and science processing skills (Stevani et al., 2023). The advantages gained through PBL are that students are actively engaged in exploring their learning experiences, instilling flexible thinking skills, becoming successful problem solvers, and involving collaboration (Susanti et al., 2023). In addition, the application of problem-based learning in science learning in junior high school has a major impact on the improvement of student's critical thinking skills (Anwar et al., 2023; Thorndahl et al., 2020). Then, by applying the PBL model to creative thinking skills, students can also increase them (Fauzan, 2023). Scientific attitudes and cognitive learning outcomes can also be enhanced through the use of this learning model (Dalila et al., 2022; Purwanto et al., 2020). Therefore, the problem-based learning model can be one of the solutions to improving student learning competencies.

Method

This study belongs to the category of semu experiments. Quasi-experimental designs were chosen because, with the use of human samples, the researchers could not fully control external factors. The group research plans used were non-equivalent; the same treatment was not given to both classes. The study applied pretest and posttest to two different classes with different treatments, aiming to know the impact of treatment on the subject of the study (Sugiyono, 2017).

The study focused on first-secondary school students in the Solok district as a research population. The sample consists of two groups: the experimental group and the control group. The sample-taking technique used is purposive sampling, selected because this research requires samples with a specific purpose. The sample selection is carried out taking into account the average student values that are almost equal or close.

In this study, the instruments used to collect data are validated psychomotor and lifting tests. Tests used include posttests and pretests that are tested using the test. In addition, secondary data is also used as a benchmark in sample selection. The type of data used is the primary data obtained by researchers through direct testing. Secondary data is adapted based on the data available in the school for purposes of reference material in sample selection.

This research began by selecting samples to form 2 sample classes, namely experimental and control. During the research, the experimental class was given treatment using a problem-based learning model with a contextual approach, while the control class used a conventional learning model. During the learning process, affective students observe and fill in the psychomotor rubric at each meeting. After the training is complete, a posttest is carried out. After obtaining test data, data analysis was carried out to draw conclusions from the research.

In this research, data analysis was carried out using descriptive and inferential statistical tests. Descriptive statistical tests include calculating the maximum, minimum, mean and gain scores for the two sample classes. To test inferential statistics, test hypotheses after carrying out normality tests, and test homogeneity as a prerequisite in making decisions to proceed to hypothesis testing (Sundayana, 2016). For statistical analysis, this research uses the SPSS application as a data analysis tool.

Result and Discussion

The implementation of the experimental research quota on cognitive and psychomotor outcomes in high school students has been implemented optimally and has already implemented the learning model of problem-based learning. Before the performance of the study participants is first known with this learning model for training, eight meetings are conducted for the research application of the model. Based on the procedures that have been developed, one class gets the treatment of the application of the problem-based learning model, followed by the control class with the use of conventional learning.

At the beginning of the study, a test was performed in the form of a pretext to measure the initial cognitive abilities of students. After the study took place for 8 meetings with obtaining treatment according to the research procedure, a post was carried out to assess the final ability of the students. Then continue with the posttest implementation at the end of the research. It aims to see the final outcome of students' cognitive abilities. In addition, during the implementation process, we also see the psychomotor and affective results of students posted on the heading sheet.

Analysis of the Cognitive Results of Students

The results of the cognitive data analysis of students at the first high school district of Solok are seen from the test results of pretest and posts. The results of this test are carried out in a descriptive analysis test to see the highest score value, lowest score, average, median, mode, standard deviation, and gain score. The maximum and minimum values of the sample classes can be seen in Table 1.

Table 1. Dispersion of the Data Score Pretest Control Class and Experiment Class

Acquisition of data	Control Class	Experiment Class
The lowest score	20	15
The highest score	75	80
Mean	50.18	50.17
Median	50	50
Modus	55	50
Standard deviation	9.85	14.62
Quartered up	50	40
Quarterly below	55	60
The intersectional range	5	20

Table 1 shows the concentration and distribution of data based on the correct scores obtained by the students of the control class and the experimental class on the outcome of the pretest. The pre-test results showed that the control class and the experimental class did not have any significant differences. Table 1 shows the lowest value of the control class greater than the experimental class, which is 20 and 15. At the highest grade, the experiment class is superior to the control class, which is 80 and 75. Average and median values are not very different. The average value for the control class was 50.18, and the experiment was 50.17. For the median results at the pre-test of the control class and the experiment, it was 50. The modes and standard deviations in both classes have slightly different values. For the mode in the control class 55 and the experimental class 50, the standard deviations of the control class are 9.85 and 14.62. For the quarters of both research classes, the experimental class has a larger interquartile range than the control classes (20 and 5).

Posttest results obtained from control classes and experiments after receiving treatment Based on statistical calculations, some data spread values are obtained from the posttest values shown in Table 2, which can be seen in the table below.

Table 2. Dispersion of the Data Score Pretest Control Class and Experiment Class

Acquisition of data	Control class	Experiment class
The lowest score	40	30
The highest score	90	95
Mean	62.59	74.64
Median	60	75
Modus	55	75
Standard deviation	11.63	16.66
Quartered up	55	58.75
Quarterly below	70	88.75
The intersectional range	15	30

Table 2 shows that the posttest results show that the control class and the experiment class have significant differences. The lowest values for control and experiment classes are 40 and 30. For the highest scores for the two classes, there are slight differences: the control class is 90 and the experimental class is 95. Similarly, the average mode, median, and standard deviation values in the experimental class have higher values than those in the control class. The average for the experimental class was 74.64, while the average for the control class was 62.59. This showed that the students in the experimental class had greater values than the control class. The same goes for the control class median of 60 and the experiment median of 75. This median indicates that students in the experimental class have a fairly high average score compared to the control class. The value of students is already very high. The values that often appear in the experimental class have reached the limit of KKM, which is 75. But for the control class, the maximum value is 55. Also with the standard deviation of the experimental class of 16.66 and the control of 11.63. Based on the upper and lower quarter values of both research classes, the experimental class has a larger interquarter range compared to the control classes of 30 and 15.

This shows that there is a difference in the average end result between the experimental and control classes after being treated. To be more clear in testing inferential statistical analysis, use the gain score result so that each person sample can be measured from the range of increased value results from pre-test to post-test. In other words, the improvement of initial knowledge before learning and then after learning N-Gain Tables and Cognitive Results.

Table 3. N-Gain and Cognitive Results

Name of student	Study in control class		Control N-gain	Study in experiment class		Experiment N-gain
	Pretest	Posttest		Pretest	Posttest	
Students 1	50	55	10	65	75	29
Students 2	55	70	33	50	70	40
Students 3	40	40	0	60	75	38
Students 4	45	75	55	50	90	80
Students 5	50	55	10	50	55	10
Students 6	20	65	56	50	70	40
Students 7	50	70	40	70	85	50
Students 8	55	55	0	40	85	75
Students 9	55	55	0	55	85	67
Students 10	30	55	36	55	70	33
Students 11	55	75	44	60	90	75
Students 12	55	60	11	70	75	17
Students 13	55	55	00	30	85	79
Students 14	75	85	40	50	95	90
Students 15	50	50	0	45	95	91
Students 16	55	60	11	40	30	17
Students 17	55	65	22	40	55	25
Students 18	50	70	40	50	75	50
Students 19	50	50	0	50	75	50
Students 20	60	90	75	30	75	64
Students 21	50	55	10	80	90	50
Students 22	50	55	10	15	50	41
Students 23	50	80	60	70	95	83
Students 24	40	55	25	35	55	31
Students 25	45	70	45	45	55	18
Students 26	55	65	22	40	85	75
Students 27	55	55	0	40	55	25
Students 28	-	-	-	70	95	83

Can be seen in Table 3. A considerable amount of improvement in student cognitive outcomes in both classes can be seen from the N-gain results. However, there are still some students who do not experience improvement; some even experience decreased cognitive outcomes. This may be due to a failure to understand concepts or misconceptions, even for students who respond blatantly. However, there is still a significant increase in student cognitive performance. To see more clearly the impact of the learning model applied, an inferential statistical test is carried out. Before entering the hypothesis test, a prerequisite test is carried out. This test consists of a test of normality and homogeneity. The results of the normality test on student cognitive outcomes can be seen in the following table:

Table 4. Testing for Cognitive Normality

Class	Sig	α	Cutly
Control	0.05	0.05	Normally
Experiment	0.15		Normally

Based on the table above, it shows that the control class has a significance value of 0.05 and the experiment has a significance value of 0.15. Based on the decision-making conditions, when the significance value is greater than 0.05, the data is distributed normally. From the results of these significance values, it can be inferred that both classes have normally distributed data (Sundayana, 2016). After a normality test, a homogeneity test is carried out.

Table 5. Test of Cognitive Homogenity

Class	Sig	α	Cutly
Control Experiment	0.33	0.05	Homogen

In Table 5, we can see that the cognitive outcome data of students has a significance value of 0.33. A large significance value of 0.05 shows that both sample classes data are homogeneous. Homogeneous data means that the variations between the two classes of samples are almost identical or homogenous. After the normality and homogeneity of the data are tested, an inferential statistical test is performed. Normal and homogeneously distributed data can continue the parametric test. In testing with such data, an independent t test is used. As you can see in the table below:

Table 6. Independent Cognitive Test Results

Class	Sig	α	Cutly
Control Experiment	0.00	0.05	H_0 not accepted

Based on Table 6, the significance value of the independent t test is 0.00. Significance values less than 0.05 indicate that H_0 is rejected. It can be concluded that there are differences between the two classes of samples after different treatments. In the sense that the problem-based learning model has a significant influence on the cognitive outcomes of the student. This is based on previous research.

Using a problem-based learning model (PBL) can improve student learning outcomes because this model encourages students to be active and think critically during the learning process (Kasuga et al., 2022; Salfina et al., 2021). Critical thinking involves the ability to think logically, analyze problems objectively, and carefully evaluate information. Students are also actively involved with this information. By developing critical thinking skills, we can achieve accurate and logical outcomes. This can contribute to the improvement of student learning outcomes (Syamsinar et al., 2023).

Providing appropriate problem-based learning models, such as problem-based learning (PBL), in the learning process can improve student activity and learning outcomes. This model can increase the motivation of students to learn (Djonomiarjo, 2020; Munawaroh et al., 2022). The higher the learning motivation students have, the greater their chances of success in learning, so it can have a positive impact on the improvement of student learning outcomes (W. A. Putri et al., 2021). Therefore, to improve students' cognitive outcomes, appropriate learning models are needed that can motivate students to learn. The application of the PBL learning model is beneficial because students feel the learning material is easier to understand, there is significant development after the learning process, and they have an increased understanding of how to address a variety of problems, which ultimately expands their insights (Fitri, 2023).

The implementation of a problem-based learning model in schools has been supported by previous research that demonstrates its effectiveness in improving IPA learning outcomes. In this model, problems are used as a starting point for learning that helps students develop scientific attitudes such as curiosity, the ability to ask, cooperation, and sensitivity to living beings and the environment (Utami et al., 2020). A scientific attitude becomes an important point for improving student cognitive outcomes. Therefore, the problem-based learning model is the right solution for improving student learning outcomes (Munawaroh et al., 2022).

Psychomotor Data Analysis of Students

The results of the psychomotor data analysis of students are obtained through the psychomotor section during the learning process. Descriptive analysis tests to see the maximum value, minimum average, mean value, mode, and standard deviation. The results can be seen in the following table.

Table 7. Disclosure of Psychomotor Score Data

Acquisition of data	Experiment Class
The lowest score	75
The highest score	97.73
Mean	90.01
Median	90.91
Modus	93.18
Standard deviation	5.68

Based on the above table, it can be seen that the minimum score of the learners is only 75 in the experimental class. This shows that the student's ratings are good enough. Even with the maximum value of the experimental class of 97.73 and the average value of 90.01, the ratio is already quite good. For median results, modes and standard deviations have been raised, with an excellent median value of 90.91. The mode has a value of 93.18 and a standard deviation of 5.68.

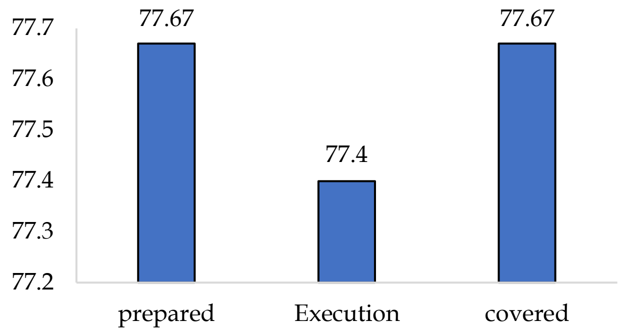

Figure 1. Psychomotor result

The evaluation process using this psychomotor section consists of three general indicators: preparation, implementation, and closure. In preparatory activities, it is seen as providing tools and materials used in making work, equipment, and materials, then reading and understanding the procedures in the production of work results. For the implementation assessed of how to use all the tools and materials in the manufacture of a simple respiratory system in humans correctly, making a respiratory tool properly, the creativity of the students (color, completeness of the respiratory organs in humans), the participation of all members in each step of the activities carried out, and the responsibility of all the members within the group in the creation of a protective tool At the closing stage, what is observed is the accuracy of the time, how to make the result of the work according to the instructions of the activity, and how to explain it to other friends in front of the class. Based on the results of the graph we can see above, psychomotor competence is already sufficiently satisfactory and exceeds the minimum limit of assessment. This means that there is sufficient influence to enhance the psychomotor skills of the student.

This is supported by previous research. It turns out that the results showed that the use of the PBL model in learning has improved the psychomotor abilities of the students. The PBL model allows learners to submit their ideas and thus improve their skills. Research processes, experiment design, experiment execution, data collection and analysis, as well as conclusion-making, are some of the factors that can improve the psychomotor abilities of learners at each learning session (Oktaviani et al., 2019).

In addition, scholars who used the PBL model experienced increased psychomotor values as they were given the opportunity to thoroughly try the actions involved. By engaging and exploring their experiences, learners can demonstrate their understanding and develop skills. This can happen because the PBL model provides space for students to actively participate in the learning process (Yuliani et al., 2017). Thus, it can be concluded that the problem-based learning model can enhance the psychomotor skills of students.

Analysis of Affective Data of Students

The results of the affective data analysis of students are obtained through the psychomotor section during the learning process. Descriptive analysis tests to see the maximum value, minimum average, mean value, mode, and standard deviation. The results can be seen in the following table.

Table 8. Diffusion of Experimental Class Affective Score Data

Acquisition of data	Experiment Class
The lowest score	75
The highest score	95.83
Mean	84.37
Median	83.33
Modus	79.17
Standard deviation	6.27

Based on the descriptive processing results of the students' emotional values in the experimental class, it can be seen in the table above that the minimum student values are only 75 in the experimental class. This shows that the student's ratings are good enough. Similarly, it has a maximum value of 95.83 and an average value of 84.37. The median results, modes, and standard deviations have been picked up with excellent median values of 83 and 33. The mode has a value of 79.17 and a standard deviation of 6.27.

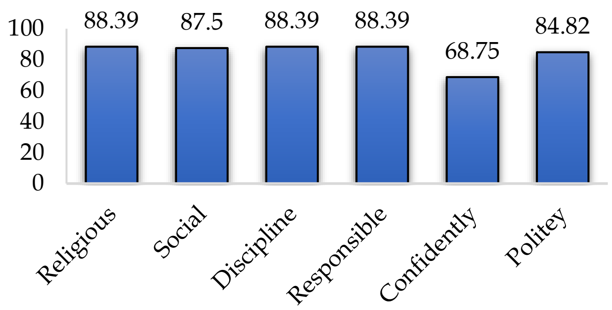

Figure 2. Affective results

Based on the graph above, it can be seen that the average emotional results of students are very good. Good of religion, social attitude, disposition, responsibility, and span of salvation. The average is over 80. But the affective result on the part of self-confidence is still satisfactory enough. Teachers still use conventional approaches such as discussions, questions and answers, and drilling questions when teaching. They do not use innovative learning models, so lessons become unvariable and students tend to be uninterested, which affects poor scientific learning outcomes (Samsudin et al., 2023). This may happen because students are not so accustomed to the new model they are trying. However, this can be said to be satisfactory because students begin to show their activity in learning.

The use of the problem-based learning model is excellent for increasing the student's affective sphere (Damayanti et al., 2022; Susilawati et al., 2023). Teachers play an important role in applying problem-based learning, which can improve learning outcomes in a variety of aspects, including cognitive, psychomotor, and affective (Halimah et al., 2023; Nurtanto et al., 2015). The application of the PBL learning model has a positive impact on improving the learning outcomes of the student's affective area because PBL can facilitate the achievement of various categories of learning results in the affective aspects of students during the learning process.

Conclusion

Through this study, it was concluded that a problem-based learning model with a context-based approach in the implementation of IPA has an impact on the learning outcomes and psychomotor skills of students. It can be inferred that there is a significant influence of the application of a problem-based learning model on student learning competence.

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The authors declare that there is no conflict of interest in the publication of this article.

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