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Problem-Based Learning on Students' Attitude Towards Science: An Action Research

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ABSTRACT

Students' attitudes towards science learning based on the results of the questionnaire are still lacking, students' attitudes towards science are lacking because learning is not related to students' everyday problems, learning activities are less fun and students are afraid to express opinions, and students find science learning difficult. This study aims to improve students' attitudes toward science learning on the respiratory system material and wave material using the Problem-Based Learning (PBL) model. The subjects were 32 students (14 males and 18 females). The type of research used in this research is classroom action research (CAR) with 2 cycles. Data collection was carried out by filling out questionnaires and observing attitudes toward science. Attitude toward science indicators consists of 5 indicators, namely: Attitude, Unfavorable outlook, Control beliefs, Behavioral beliefs, and Intention. Based on the results, there was an increase in student attitudes starting from cycles 1 to 2. The student attitudes toward science learning were 69.69 to 71.73%. The average student attitude in one class rose by 2.06%. Attitude toward science in cycles 1 and 2 by applying the PBL model has increased learning outcomes.

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1. INTRODUCTION

Science learning is learning through a series of scientific methods that learn about something empirical and exact which has the concept of scientific study. Science learning includes important learning that can help students overcome the problems they face in everyday life and understand nature. Assessment of science learning consists of 3 aspects, namely attitudes, knowledge, and skills (Kanyesigye *et al.,* 2022). The importance of learning science is not only about knowledge mastered by students but also about students' attitudes toward learning science (Akpinar *et al.,* 2009).

Attitudes towards science learning need to be improved and known by educators to find out how students respond to science learning which can determine the success of the learning process whether it is positive or negative (Kurniawan *et al.,* 2019). One important factor in learning science is the child's attitude. Positive attitudes toward science are generally considered to be behavioral observations, and thus influence scientific attainment and interest in science. On the other hand, a negative attitude can lead to a lack of interest in studying science (Cakici & Turkmen, 2013). Attitudes toward science "satisfy basic psychological needs, such as the need to know and the need to succeed (Feist, 2012).

Through the participation and attitudes shown by students in class, science teachers should be prepared to improve science teaching. The learning process in the classroom should be able to make students like learning science and students' positive attitudes towards learning science increase so that evaluating students' attitudes towards science is an integrated part for students (Hacieminoglu, 2016).

This study measured students' attitudes toward science subjects based on 5 indicators, namely: Attitude, Unfavorable outlook, Control beliefs, Behavioral beliefs, and Intention. Students' attitudes toward science learning can be improved by implementing interesting and fun learning for students in learning (Abd-El-Khalick *et al.,* 2015).

The results of observations in the field and interviews with teachers, that students still have difficulty learning science and there are still many students who cannot do assignments so attitude toward learning science is still lacking. Based on the results of the questionnaire, students' attitudes toward learning science were still lacking, this was because learning did not relate to everyday problems, learning activities were also less enjoyable for students, students were afraid to express opinions and students considered learning science difficult.

Research by Hu *et al.* (2018) also explains that the causes of students' lack of attitudes toward learning science are due to teachers, school, learning environment, and family factors. Another study by Voleta *et al.* (2019) also found that students' attitudes toward learning science were still low as a result of the learning process which did not involve students. The irrelevant relationship between attitudes and learning causes fewer students to choose to continue studying science (Kind *et al.,* 2007). Student attitudes can be improved by implementing fun learning that involves students actively and relates them to the problems around them. One of them is by applying the Problem-Based Learning (PBL) learning model.

The PBL learning model is learning that uses various thinking abilities of students individually and in groups in solving problems in real life. The PBL learning model is a learning model that carries out the learning process by making the problem the central point of learning (Ariyani *et al.,* 2019).

The PBL learning model consists of 5 learning steps, namely: Orientation of students to problems, Organizing students, Guiding individual and group investigations, Developing and presenting work results, and Analyzing and evaluating the results of problem-Solving (Ariyani *et al.,* 2019). The advantages of the PBL model are student-centered learning, students learn

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lessons according to everyday problems, develop student self-control, improve problem-solving skills, develop social skills, integrate concepts with problems, and increase motivation.

Several studies have shown an increase in students' attitudes toward learning science by using the PBL model. Research on PBL and students' attitudes toward learning science was carried out by, among others Akpinar *et al.* (2009) stating that students' attitudes toward science could be improved by investigating gender, grade level, and academic achievement. Amin & Sutrisno (2018) state that PBL learning can improve scientific literacy and student attitudes in elementary schools which see an increase in student attitudes based on 3 indicators of student attitudes. Meanwhile Cakici & Turkmen (2013) stated that students' attitudes toward science could be improved by using a learning model that involved students, namely PjBL. PBL can improve students' attitudes toward learning Physics, this study uses 4 attitude indicators for class XI high school students (Ferreira & Trudel, 2012). By giving full trust to students, it is hoped that the character that is formed will have a positive impact on the personality of these students (Kuvac & Koc, 2019).

Based on the problems and research above, it is necessary to research "Increasing Students' Attitude toward Science using the PBL Model in Grade VIII Middle School". Previous Research by Kind *et al.,* (2007); Amin *et al.* (2020); Barmby *et al.* (2008); Volet *et al. (*2019) increasing the attitude toward science using the r&d method, descriptive analysis and experiments applied to the elementary and high school levels, while in this study the action research method was used and carried out at the junior high school level. Students' attitude toward science which was improved in research by Kind *et al.,* (2007); Akpinar *et al.* (2009); Mou, (2023); Feist, (2012); Sahin & Yilmaz, (2020) consists of 4 indicators of student attitudes, namely Self-concept in science, Practical work in science, Science outside school and Importance of science. However, this study improved students' attitudes toward science learning at the junior high school level based on 5 indicators of student attitudes, namely Attitude, Unfavorable Outlook, Control Beliefs, Behavioral Beliefs, and Intention. The purpose of this research is to improve students' attitudes towards science learning in class VIII students by applying the PBL learning model in the implementation of learning on the material on the respiratory system and waves.

2. METHODS

2.1. Research design

This study uses a class action research design (CAR) with the Kemmis & Mc Taggart model. Classroom action research (PTK) is research with the process of studying learning problems in the classroom through self-reflection to solve these problems by carrying out various planned actions in real situations and analyzing every effect of the treatment (Saiful, *et al.,* 2020). This study applies PBL with Attitude toward science as the dependent variable for cycle I and cycle II. The stages of classroom action research are by the Kemmis & Mc Taggart model which includes 4 stages, namely: 1) Preparation, 2) Implementation, 3) Observation, and 4) Reflection (Ahmad, 2021). The stages of action research can be seen in **Figure 1**.

2.2. Research Subject

This research was conducted in class VIII at one of the public junior high schools in Bandung which implements the independent curriculum in semester II of the 2023/2024 academic year. The research was conducted collaboratively between researchers, teachers, and colleagues from February to May 2023. The subjects of this study totaled 32 students

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consisting of 14 male students and 18 female students with ages ranging from 13-14 years. The distribution of students can be seen in **Table 1**.

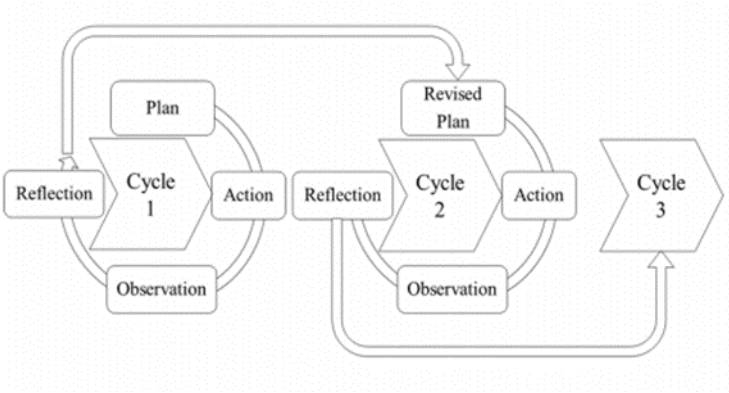

Figure 1. Action research design.
Source: ResearchGate

Table 1. Distribution of research subjects.

Gender	The number of students	Percentage
Man	14 people	43.75 %
Woman	18 people	56.25 %
Total	32 people	100 %

2.3. Research Instruments

The dependent variable of this research is students' attitudes toward learning science. In this study, to see students' attitudes toward science, a questionnaire instrument was used which consisted of 32 valid attitude statement items, which were divided into 23 positive statements and 9 negative statements. This questionnaire was developed by Abd-El-Khalick *et al.,* (2015) and consists of 5 indicators of student attitudes, namely: Attitude, Unfavorable outlook, Control beliefs, Behavioral beliefs, and Intention. Reliability scale scores are evaluated in a similar way to Cronbach's alpha, with a value greater than 0.6 considered acceptable, and a value between 0.7 and 0.9 considered good. The five ASSASS subscales indicate strong reliability, ranging from 0.61–0.87. and equipped with open-ended questions. to find out how students respond to learning science. The formulation of the statement is under the indicators of students' attitudes toward science. Data collection was carried out through the provision of research instruments in the form of questionnaires and observations.

2.4. Research Procedure

This research was conducted in two action cycles. The stages carried out in cycle I include cycle planning, application/implementation, observation, and reflection. After reflecting on cycle 1 the researcher made a plan for cycle 2 based on the results of the reflection as an effort to improve. Each cycle consists of 1 meeting using the PBL learning model, in the first cycle consists of 2 hours of lessons (2 x 40 minutes) on respiratory system material and the second cycle consists of 2 hours of lessons (2 x 40 minutes) on vibration material and wave.

2.5. Data Analysis

Data analysis techniques using quantitative method analysis. Research data The attitude of students towards science subjects in the study was measured using a Likert scale. The Likert

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scale of this study uses an attitude scale: strongly agree (SS), agree (S), neutral (N), disagree (TS), and strongly disagree (STS). Each positive item in the instrument has a value: SA = 5, S = 4, N = 3, TS = 2, and STS = 1. Meanwhile, scores are reversed for negative items/statements (Kind *et al.*, 2007). The attitude scale is used to see students' attitudes towards certain objects, the results of attitude categories include: rejecting (negative), supporting (positive), and neutral (Shah, 2022).

The results of this study are in the form of quantitative data and processed descriptive statistics using the Microsoft Excel application. The data on the results of students' attitudes toward learning science are presented in the form of tables and radar charts.

3. RESULTS AND DISCUSSION

The results of this study were based on the results of data collection in the form of a questionnaire on students' attitudes toward science which consisted of 32 statement items after learning was carried out using the PBL model. The results of the data analysis of students' attitudes toward science learning in cycle 1 were 69.69% while in cycle 2 it was 71.75%. The following is a picture of the results of research on students' attitudes towards science learning, which are displayed as descriptive statistics in cycle 1 and cycle 2. Attitude toward science in cycles 1 and 2 can be seen in **Figure 2**.

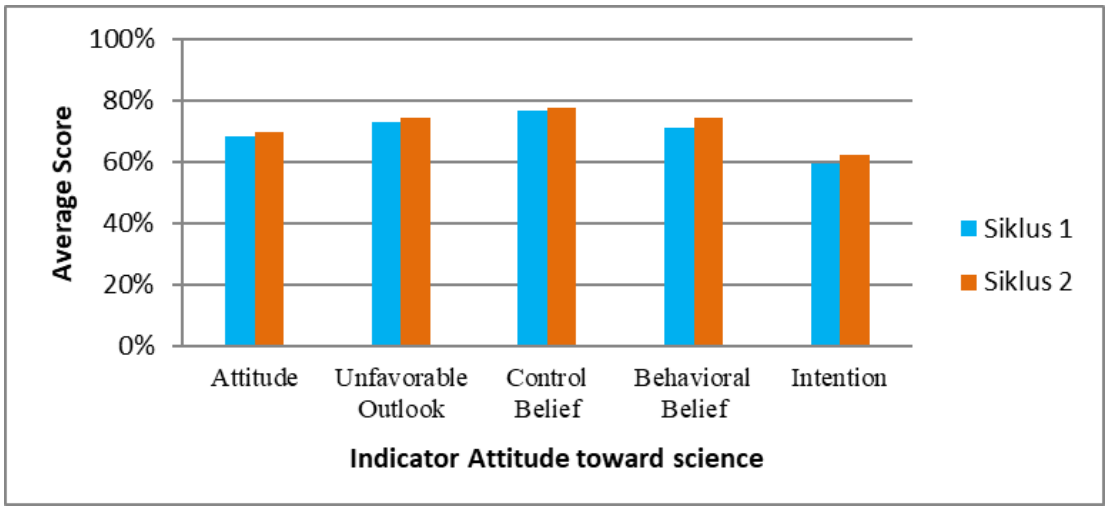

Figure 3. Attitude toward science indicators results.

Figure 3 shows students' attitudes toward learning science increased from cycle I to cycle II in each indicator 1) Attitude has increased, namely how students' attitudes are seen from behavior in cycle I am 68.26% to 69.93% in cycle II, The Attitude indicator consists of 9 statement items and the most significant improvement is in students' attitudes towards teachers who teach and the process they take in learning. 2) Unfavorable Outlook results obtained in cycle I 72.91% and 74.23% in cycle II, Unfavorable Outlook consists of 9 items of negative statements, on this indicator the results of students' attitudes increase significantly, namely disagreeing on aspects of learning science has no benefits and science learning is just a waste of time. 3) Control Belief results obtained in the first cycle 76.87% and 77, 50% in cycle II, the Control Belief Indicator consists of 2 statement items which have increased significantly. 4) Behavioral Belief results obtained in cycle I 71.04% and 74.58% in cycle II, Behavioral belief consists of 6 item statements, students' attitudes increase significantly in aspects of learning science can increase awareness in maintaining health and protecting the

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environment. 5) Intention obtained from cycle I was 59.37% and 63.50% in cycle II. Intention consists of 6 statements related to students' attitudes toward the desire to have a career in science. In the aspect of intention, the attitude of students experienced a significant increase in the desire to become a science scientist.

Learning activities in Cycle I were carried out on March 8 2023 on respiratory system material which consisted of 1 meeting (2x 40 minutes) applying the PBL learning model with the discussion method. The stages of learning in cycle one is as follows: 1) Orientation of students to the problem, showing students a respiratory system problem caused by smoking, and asking students questions related to the learning video shown. 2) Organizing students, students are divided into several groups that have been determined by the teacher, in the distribution of groups students have been grouped based on the results of the diagnostic assessment given to students in the previous week. 3) Guiding individual and group investigations, students analyze respiratory problems based on the video provided by answering and discussing the student worksheet (known as Lembar Kerja Peserta Didik (LKPD)) provided by the teacher. students hold discussions regarding alternative solutions related to the problems formulated, the teacher guided students in solving problems. Each group is given the freedom to discuss finding solutions to respiratory system problems due to smoking, students are also freed to look for reliable literature to support the results of problem-solving that their group is discussing. 4) Develop and present the results of the work. After students complete the student worksheet in each group, they are asked to present the results of problem-solving that have been discussed with their respective group members. Each group took turns presenting the results of their discussions in front of the class, students in other groups asked questions and responded to the results of the presentations that had been delivered by the presenter group. 5) Analyze and evaluate the results of problem-solving, the teacher helps students to analyze problem-solving that has been found by students, and the teacher provides reinforcement and straightens out if there are misconceptions in students when discussing solving respiratory problems.

In the implementation of cycle, I, several obstacles and weaknesses had to be corrected for cycle II, namely the technique of forming groups where many students objected to the division of groups that were formed so that some students did not contribute to discussions such as playing with lights and using headsets. The lowest student attitude in Cycle 1 is the Intention indicator for the aspect of continuing education in the sciences field with an average of 55.65%, while the highest student attitude in Cycle 1 is the Attitude indicator for the student's view of the teacher. The results of the implementation of cycle 1 are still not maximal on the Intention indicator. The following is the documentation of students when presenting the results of the discussion of solving problems from the dangers of smoking. It can be seen in **Figure 4**.

Improvements in cycle I based on the results of reflection will be improved in cycle II. The improvement plan that must be made in cycle II is to improve classroom management which can make students enjoy learning and arrange heterogeneous group divisions to improve students' attitudes toward learning science. The problems presented to students in cycle II must be close to students so that they are attractive to students and learning is easy for them to understand. In the implementation of the cycle I, the learning stages with the PBL model have been carried out well but need to be improved and paid attention to when providing stimulus or showing problems to students because it will affect students' interest in learning.

The implementation of cycle II was carried out on 15 May 2023, in wave material consisting of 1 meeting (2x40 minutes) using the same learning model, namely the PBL model with the discussion method. The implementation of Cycle II was carried out the same as Cycle I by

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making improvements to the constraints and problems in the implementation of Cycle I. The learning stages are carried out as follows: 1) Orientation of students to problems, presenting a problem regarding electromagnetic waves, namely on Smartphone radiation to students and giving trigger questions to students related to the displayed learning video. 2) Organizing students, students are divided into several groups that have been determined by the teacher, in the distribution of groups students have been grouped based on the results of the diagnostic assessment given to students in the previous week. 3) Guiding individual and group investigations, students analyze respiratory problems based on the videos provided by answering and discussing the worksheets given by the teacher. students carry out discussions regarding alternative solutions related to the problems formulated, the teacher guided students in solving problems. Each group is given the freedom to discuss finding solutions to respiratory system problems due to smoking, students are also freed to look for reliable literature to support the results of the problem-solving that their group is discussing. 4) Develop and present the results of the work. After students have completed the student worksheet in each group, they are asked to present the results of problem-solving that have been discussed with members of their respective groups. Each group took turns presenting the results of their discussions in front of the class, students in other groups asked questions and responded to the results of the presentations that had been delivered by the presenter group. 5) Analyze and evaluate the results of problem-solving, the teacher helps students carry out an analysis of solving problems that have been found by students, the teacher provides reinforcement and straightens out if there are misconceptions in students when discussing solving respiratory problems. The teacher and students associate wave material with smartphone radiation so that after carrying out the learning the students experience changes in behavior to limit playing smartphones. Students' attitudes towards learning science in cycle II experienced a very significant increase in negative statements on aspects of learning science that did not have benefits until it reached 84.38%, positive statements on aspects of attitudes towards teachers and learning science which can help students change in maintaining health to achieve 90%.

Figure 4. Example of the results of the PBL stages of developing work.

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The results of the implementation of cycle 1 and cycle II have increased because students' attitudes toward learning have increased, students have followed the learning well by finding alternative solutions related to the problems given because the problems given are attractive to students. Based on the results of the questionnaire on students' attitudes towards science learning, the attitude of students experienced an increase with an average of 69.69% in cycle I to 71.75% in cycle II in the good category.

In this regard, there have been no previous reports that examined the effect of the PBL learning model on improving students' attitudes toward learning science at the junior high school level. However, the application of PBL has been reported to increase students' attitudes toward learning science in elementary and high schools which can increase students' interest in pursuing careers in the field of science, attitudes toward learning science can show a positive attitude, by Ekunola *et al.* (2012); Amin *et al.* (2020); Lumbu-ani *et al.* (2019); Buck, (2014). Learning using the PBL model can also improve students' critical thinking skills (Ekamilasari & Pursitasari, 2021; Sombria *et al.,* 2020). They also showed an increase in students' attitudes after implementing learning with the PBL learning model by obtaining results in good categories.

4. CONCLUSION

Improving learning in one of the Public Middle Schools in the city of Bandung by applying the PBL learning model in the learning process on the material "Breathing System" and "Wave" can improve students' attitudes toward learning natural science as a whole, namely with a score of 69.69% in the cycle 1 increased to 71.75% in cycle II. Improving learning in one of the public junior high schools in the city of Bandung by applying the PBL learning model in the learning process on the material "Breathing System" and on the material "Wave" can significantly improve students' attitudes toward learning science on the Behavioral Belief indicator significantly, namely by a score of 71.04% in cycle 1 increased to 74.58% in cycle II.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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