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Application of The Icare Model to Improve Problem Solving Ability in Momentum and Impulse Materials in Class X SMA

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Abstrak

Problem-solving ability is the ability of individuals to use their thinking processes to solve problems through the stages of understanding the problem, planning problem solving, implementing the problem solving, and re-examining solutions. The purpose of this study is to determine the problem-solving ability of students using the ICARE model and to determine the differences in problem-solving abilities. The type of research used is experimental research with a quasi-experimental design "Nonequivalent control group design" with the "Posttest only control group design" model. The population of this study is all students of class X IPA SMA Negeri 1 Tambang for the academic year 2021/2022 with a sample of 59 students consisting of class X IPA 1 as the control class, which consists of 31 students and class X IPA 2 as the experimental class. 28 students. The data collection instrument was in the form of a test of momentum and impulse problem-solving skills for class X SMA which consisted of 5 essay questions. The data analysis used is descriptive analysis through the results of students' problem-solving abilities and inferential analysis through normality test, homogeneity test, and independent-sample t-test with the help of SPSS version 23. The results show that the results of students' problem-solving abilities in the experimental class are better than in the experimental class. control and there are differences in the results of problem-solving abilities between the experimental class that applies the ICARE model and the control class that applies the conventional learning model.
Keywords: Problem Solving Ability, ICARE Model, Momentum and Impulse

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Introduction

Education is like an experiment that will never end, as long as there is human life in this world. This is in line with the nature of humans who have creative and innovative potential in all their lives. According to Hasbullah (2013), education is a conscious and planned effort to help the growth and development of students directed towards achieving an education. According to Law Number 20 of 2003 concerning the National Education system, it states that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, self-personality, personality, intelligence, noble character, as well as the skills needed by himself, society, nation, and state. One of the factors that determine educational progress is what teachers do in classroom learning. According to Kawuri and Fiyanto (2020), learning will be optimal and meaningful, one of which can be achieved if teachers are creative and innovative and always try to continuously improve the quality of education.

Physics is a science that has an important role in the world of education because physics is a tool that can be used to shape students to think critically, logically, analytically, and systematically. Azizah (2015) states that in studying physics, student activity is very necessary. Activeness in learning physics lies in two aspects, namely active in action (hands activity) and active thinking (minds activity). In addition, students will be active if students can relate new knowledge to their initial understanding. But connecting the two in physics learning is not easy. Learning physics is a process of interaction that occurs between students and their environment to achieve the objectives of learning physics. The quality of the achievement of learning objectives is strongly influenced by several factors such as teaching and learning strategies, methods, use of media, and others. Physics subjects are seen as important to be taught as subjects because Physics is a vehicle for growing thinking skills that are useful for solving problems in everyday life and equipping students with the knowledge, understanding, and several abilities which are a requirement to enter higher education levels. In addition, physics is physical knowledge, so to study physics and form knowledge about physics, requires direct contact with the things you want to know,

Slamet (2010) states that an effective learning process requires effective guidance, paying attention to good learning conditions and strategies, and applying appropriate learning models and methods. In line with this, to achieve the objectives of learning physics, teachers must be able to use appropriate strategies, models, and learning methods. Physics learning is done by providing the right learning method or model for each material. This is because each material in physics has its characteristics. Learning physics means practicing to understand the concepts of physics, solving and discovering why and how an event occurs so that students will more easily apply physics problems in everyday life. In the learning process, students often think that physics is difficult and scary, so students are less interested in taking physics lessons. This is quoted from Herdianata, which turns out to be known that physics is considered the most difficult subject in school so students do not like it (Herdianata, 2008; Azhar, 2008)

In addition, the current 2013 curriculum emphasizes the skills of reasoning, processing, and presenting effectively, creatively, critically, productively, independently, collaboratively, communicatively, and absolutely (Kemendikbud, 2015). In designing learning so that success in learning is more optimal, the authors feel the need to apply the ICARE model (Introduction, Connect, Apply, Reflect, Extend). ICARE model learning can train students' problem-solving skills which is one of the higher-order thinking skills (Yumiati and Wahyuningrum, 2016).

The ICARE learning model is a learning model that provides opportunities for teachers to able to change students' learning experiences through emphasis at each stage (Byrum, 2013). So that physics learning becomes a preferred subject and students are actively involved in learning activities and can achieve results that are by the planned goals, an educator needs to grow and change the learning experience in students at each stage of learning.

Momentum and impulse material was one of the materials in physics in the form of complex materials, concepts, and formulas. One of the reasons that physics is difficult and boring for most students is because physics contains a lot of mathematical formulas. Students assume that learning physics only contains memorized theories and formulas, but physics has many concepts that must be understood and can be applied in everyday life (Hanna et al, 2016).

In this regard, it is necessary to apply learning tools based on the ICARE learning model that can be useful for teachers in learning activities and can make students more active and creative in solving a physics problem that is relevant to everyday life. The ICARE learning model was introduced by Decentralized Basic Education (DBE3) which was built to be able to grow the character of students and be able to change the learning paradigm (Wulandari et al, 2017). Therefore, based on the introduction that has been explained, the researchers planned research on "Implementation of the ICARE Model to Improve Students' Problem-Solving Ability in Momentum and Impulse Materials for Class X SMA".

Methodology

This study uses a quasi-experimental design, namely "Nonequivalent Control Group Design", which uses the "Posttest Only Control Groups Design" model, and has a control group and an experimental group as shown in Tabel 1.

Tabel.1 Posttest-only control group design

Class	Variabel	Postest
Experiment	X	O_2
Control		O_4

In this design, both the experimental group and the control group will be compared. The experimental class will receive treatment, namely carrying out learning using the ICARE model, while the control class will not receive treatment, which means carrying out learning continues using conventional learning models as usual.

This research was carried out at SMA Negeri 1 Tambang in the academic year 2021/2022, namely from April to June 2022. The population of this study was all students of class X science at SMA Negeri 1 Tambang in the academic year 2021/2022 with a sample of 59 people consisting of 2 science classes. Before selecting the sample, a normality test and homogeneity test were conducted based on the student's daily test scores on the work and energy material, and it was found that class X IPA 1, which consisted of 31 students, was the control class and class X IPA 2 was 28 students as the experimental class.

The method of data collection in this study is by giving tests to the experimental class and control class after being given treatment in the form of learning using the ICARE model on Momentum and Impulse material. The instrument used is the problem-solving ability of class X

SMA on Momentum and Impulse material. The student's problem-solving ability test consists of 5 essay questions consisting of 4 indicators. After the test, the student’s test results will be analyzed using descriptive and inferential analysis.

A descriptive analysis of research is used to see an overview of the results of students' problem-solving abilities. The result of problem-solving ability (HKPM) is calculated from the comparison between the scores obtained by students and the maximum score determined by the equation:

$$HKPM = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100$$

The criteria for the category of student absorption can be seen in Table 2.

Table 2. Categories of student absorption

Mastery Level	Criteria
$85 \leq x\ 100$	Very Good
$70 \leq x < 85$	Well
$50 \leq x < 70$	Enough
$0 \leq x < 50$	Not Good

(Purwanti, 2019)

Inferential analysis in this study was used to see the magnitude of the difference in the results of students' problem-solving abilities using the ICARE model with learning using conventional models. In this analysis using the help of SPSS version 23, with 3 tests, namely, the normality test using the Kolmogorov Smirnov technique, the homogeneity test with a test of homogeneity of variance, and hypothesis testing using an independent samples-test.

Result

Data on the results of students' problem-solving abilities were obtained from the results of the posttest of students who were conducted after the implementation of the ICARE learning model in class X IPA 2 as an experimental class and the application of conventional learning models in class X IPA 1 on Momentum and Impulse material at SMA Negeri 1 Tambang. The results of descriptive analysis seen through the results of students' problem-solving abilities can be seen in Table 3.

Table 3. Results of Students' Problem-solving Ability

TinMastery level (%)	Criteria	Control Class		Experiment Class	
		Total Students	Score Percentage	Total Students	Score Percentage
$85 \leq x\ 100$	Very good	-	-	5	17.85%
$70 \leq x < 85$	Well	9	29.03%	15	53.57%
$50 \leq x < 70$	Enough	22	70.96%	8	28.57%
$0 \leq x < 50$	Not good	-	-	-	-

It was found that some students in the experimental class entered the very good criteria while some students in the control class entered the good criteria. Data on the results of the problem-solving ability test in the control class in terms of each indicator can be seen in Table 4.

Table 4. Problem Solving Ability Test Results on Each Indicator Control Class Troubleshooting Ability

No	Problem Solving Ability Indicator	Average score	Problem Solving Ability Level
1	Understanding the Problem	83.87	Well
2	Planning Problem Solving	83.87	Well
3	Implementing Problem Solving	77.41	Well
4	Rechecking Solution	50.53	Enough
	Average Score of Students' Problem Solving Ability	73.92	Well

It can be seen in the table above that the results of the control class problem-solving ability test are good criteria. Meanwhile, the data from the problem-solving ability test in the experimental class in terms of each indicator can be seen in Table 5.

Table 5 Problem Solving Ability Test Results on Each Experiment Class Problem-Solving Ability Indicator

No	Problem Solving Ability Indicator	Average score	Problem Solving Ability Level
1	Understanding the Problem	96.42	Very good
2	Planning Problem Solving	91.96	Very good
3	Implementing Problem Solving	84.82	Well
4	Rechecking Solution	76.19	Well
	Average Score of Students' Problem Solving Ability	87.34	Very good

It can be seen in the table above that the results of the problem-solving ability test of the experimental class are very good criteria compared to the control class. The data on the student's problem-solving ability test results obtained for each indicator between the experimental class and the control class varied which can be seen in Figure 1.

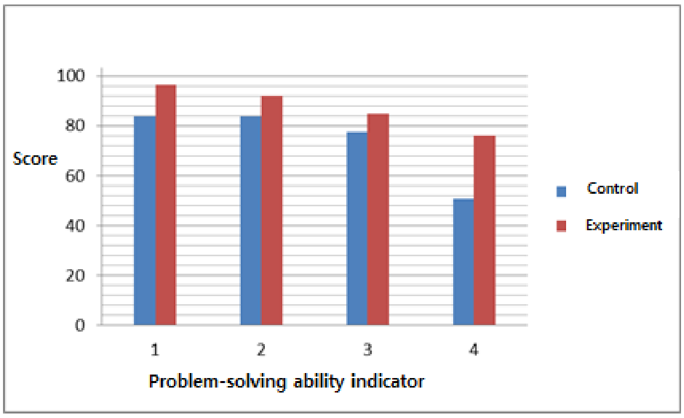

Figure 1. Graph Comparison of Problem-solving Ability on Each Indicator of Problem-solving Ability

Discuss

Based on the results of the research that has been obtained, show that:

1. Ability to Understand Problems

At the stage of understanding the problem, students are expected to be able to identify and analyze the problems faced so that the actual problems can be understood by students. at this stage, the average score of the control class obtained a score of 83.87 categorized as a good level, while the average score in the experimental class was 96.42. Categorized at a very good level, it means that students have been able to understand the problem, seen from the ability of students to identify the quantities that are known and the quantities that are asked in the questions correctly. When going to work on the questions, the teacher invites students to read and identify the quantities that are known and which are asked slowly, if they do not understand they can ask the teacher.

2. Ability to Plan Problem Solving

In the planning stage of problem-solving, students are expected to be able to plan solutions to solve problems, namely by determining the right steps and equations to solve problems. The average score of students' ability at this stage in the control class is 83.87 on the criteria of good ability, while the average score of students' ability in the experimental class is 91.96 on the criteria of very good ability as well. Categorized at a very good level, it means that students have been able to determine the steps for solving problems and determining the right equation for problem-solving. At this stage, the teacher invites students to choose and match the formula according to the amount and the questions asked are on the concepts that have been taught previously, if they do not understand,

In planning the solution of a problem, students must be able to connect between the quantities that are known and the quantities to be sought and one concept with another concept. At this stage, students need to understand the concept of self. As in Mauke et al (2013), it is said that to solve problems it is necessary to understand the concept as a prerequisite and the ability to make relationships between concepts.

3. Ability to Implement Problem Solving

This is an activity to carry out the procedures that have been made in the previous step to be able to solve problem-solving with accurate calculations, from the results of the problem-solving ability test an average score of 77.41 in the control class which includes sufficient criteria and an average score of 84.82 in the experimental class which includes very good criteria. This is because students have been able to carry out the completion plan by the steps that have been designed. At this stage, the teacher invites students to systematically complete the formulas they have obtained. Sihana (2019) says that a person will easily solve problems with the help of mathematics because mathematics itself provides truth based on logical and systematic reasons.

4. Solution Checking Ability

At this stage, students are expected to be able to re-check the correctness of the results and the unit concludes the answers and evaluates the answers based on the concept. From the assessment of problem-solving abilities, the average score was 50.53 in the control class with sufficient criteria and an average score of 76.19 in the experimental class with good criteria. In the experimental class, students are quite able to check the correctness of the results or answers as well as units and draw conclusions from the results obtained. At this stage, the teacher invites students to re-check the answers they have received and adjust them to what was asked in the form of sentences.

Research conducted by Rahman (2013); Sujarwanto et al (2014) with the application of modeling instruction also shows that there are still students who have difficulty evaluating solutions based on concepts. The cause of student difficulties at the evaluation stage is because most students do not understand how to connect the results obtained with concepts, to be able to evaluate answers based on concepts, students must be able to explain the relationship between concepts, given a short meeting time, and the habits of students who never Making conclusions in previous lessons makes students less trained at this stage.

Overall, the level of problem-solving ability of students in the control class is 73.92 and the level of problem-solving ability of students in the experimental class is 87.34. It is included in the very high category compared to the control class. The difficulties experienced by students because problem-solving skills require the ability to process information to respond to problems and phenomena that occur. According to Nasution (in Deni Fauziah, 2013), this is the highest type in the level of learning so some students still have difficulty solving these problems for that it takes time and teacher guidance to be able to practice problem-solving skills to the fullest.

Inferential analysis was performed using SPSS version 23 with a 95% confidence level. Inferential analysis conducted in this study consisted of normality test, homogeneity test, and hypothesis testing. Before testing the hypothesis, a pre-requisite test is carried out, namely the normality test and homogeneity test

The normality test in this study used the Kolmogorov Smirnov test and the results were obtained significantly in the experimental class of 0.200 and the control class of 0.062. So based on these results, the test data in the experimental class are normally distributed and the test data in the control class are also normally distributed. Then do the homogeneity test using the test of homogeneity of variance. Based on the test results, there were significant results between the experimental class and the control class of 0.891. It can be concluded that the two classes are homogeneous, that is, they have the same variance.

After the normality test and homogeneity test were carried out, the next step was to test the hypothesis using the parametric t-test method, namely the independent sample t-test. Based on the results of the t-test output, a significant result was obtained at 0.0001. Based on the decision-making criteria, if 0.05 then Ho is rejected, which means Ha is accepted. Thus, the result obtained is 0.0001, which means it is smaller than 0.05 so Ho is rejected and Ha is accepted. It can be said that there is a significant difference in students' problem-solving between the experimental class using the ICARE model and the control class using the conventional learning model on Momentum and Impulse material for class X SMAN 1 Tambang.

Conclusion

Based on research the problem-solving ability of class X SMA Negeri 1 Tambang students with the application of the ICARE model on momentum and impulse materials is at a very good ability level.

1. The problem-solving ability of students at the stage of understanding the problem is at a very good level. The problem-solving ability of students at the stage of planning problem solving is very good. The problem-solving ability of students at the stage of carrying out problem-solving is at a good level. Then the student's problem-solving at the stage of re-examining the solution was at a good level.
2. There is a difference in the problem-solving ability scores of class X IPA SMA Negeri 1 Tambang students between classes that apply to learn using the ICARE model and classes that apply conventional learning models on momentum and impulse materials.

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