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The Application of the Relationship between the Ability to Study Kinematics Concepts and Problem Solving with Learning Achievement in Physics Learning

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ABSTRACT

The importance of teachers have skills in conveying material and choosing the right learning model so that learning activities are effective and efficient. This study aims to improve the application of the relationship ability to study concepts and to problem-solve to improve student achievement. The population and sample are 40 students of class VII SMP in the Pidie district for the 2021/2022 Academic Year. The instrument in this study was carried out with test questions. Data has been analyzed using SPSS version 17.0 with a correlation test. Results The correlation between understanding the concept and problem-solving shows a value of r = 0.679 and a significance value of 0.000, meaning that H0 is rejected. There is a positive correlation between the two variables, 46.1%. The results of the correlation between understanding the concept and learning achievement show a value of r = 0.939 and a significance value of 0.000, meaning that H0 is rejected that there is a correlation between the two variables of 88.2%. The correlation between problem-solving and student achievement results shows a value of r = 0.887 with a significance value of 0.000; this shows that H0 is rejected, meaning that there is a positive relationship between the two variables of 78.7%. Based on the results of this analysis, there is an increase in physics learning outcomes in kinematics material with a problem-solving approach. Suggestions that can be given by physics subject teachers as alternative learning methods that can solve problems in learning physics always tend to be associated with formulas because they are proven to be able to produce better learning outcomes so that learning using the problem-solving method can be applied in learning physics.

INTRODUCTION

The learning process that occurs all the time, indeed the estuary, is the achievement of increased learning achievement. The quality of education in Indonesia today is generally still low; with such conditions (low physical facilities, teacher quality, and teacher welfare),

student achievement is also unsatisfactory. According to Trends in Mathematics and Science Study (Martin et al., 2004). Indonesian students are only ranked 35th out of 44 countries in mathematics achievement and 37th out of 44 countries in Indonesia. The underdeveloped learning process partly causes this. Education is said to be of quality if the learning process takes place effectively (Amanah, 2017). Therefore, in the learning process, the teacher as an educator is expected to have skills in carrying out the learning process, including skills in conveying material and choosing the right learning model so that learning activities are effective and efficient.

Teachers must have skills in conveying material and choosing the right learning model. The selection of this learning model is based on the fact that each student has different abilities and levels of thinking, so choosing the right learning model will help students master the subject matter according to the targets set in the curriculum, that physics is one of the most important subjects for all in Indonesia. Physics is related to how to systematically find out about nature, so learning physics is not only for mastering a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery, so students are required to be able to think critically and creatively (Rohmah, 2018). Physics lessons are not rote lessons but understanding and applying these concepts. Mastery of physics concepts is needed to solve all physics problems in everyday life and in the form of questions (Mason & Singh, 2011).

Physics subjects are generally considered difficult by most students at school (Tekeng, 2015). This assumption significantly influences physics learning outcomes at the school level. Only students who are truly interested in studying physics show satisfactory learning achievements. Based on the practical experience of students in one of the junior high schools in Pidie Regency practising physics, several conditions support the erroneous assumption of the subject of physics: 1) Physics material contains many formulas and abstract sequences of events. The concept of physics material in every basic competency has almost a formula, even though the formula comes from an ordinary statement. For example, the Distance formula (s = v x t-). This formula is derived from the statement; The motion of an object is the product of the object's velocity (v) and time (t). 2) The learning model could be more conducive; it is known that the lack of students' interest in learning physics is caused by learning factors. The teacher carries out learning strategies and methods that do not attract students' attention. 3) The attitude of the physics teacher could be more enthusiastic and friendly. Physics does require seriousness to pursue it, but it requires a relaxed, humorous, and friendly attitude. More than strictly carrying out learning is needed to get students to enjoy the subject (Young & Freedman, 2012). The most important thing is to make students interested in the teacher first. If so, interest in the subject will grow naturally. 4) Limitations of learning tools and media. This problem is familiar in the world of education. However, the government still makes half-hearted efforts to complete these learning facilities. It is especially felt in schools in the suburbs and rural areas. Physics needs tools for practicum; it needs media to concretize abstract material.

Solving problems and principles of physics in the early grades of junior high school is a prerequisite for successfully learning physics and increasing students' interest in physics in later classes. In other words, if the problem-solving process and physics principles in early grades are very low, accompanied by a negative attitude towards physics lessons, it is not easy to expect that students will do well in learning in the classes. Furthermore, physics lessons in junior high school contain motion material. The material is often taught theoretically only. It causes students to become bored and lazy to think and accept the material. Therefore, appropriate learning strategies are needed to make the learning process fun. Class discussion activities involving all students in small groups with a problem-solving

approach are suitable for use in learning Kinematics (Docktor & Mestre, 2014). Students are expected to avoid boredom in the learning process, so the quality of learning will increase.

Based on the narrative from the physics teacher at Pidie District Middle School, it is known that the learning outcomes of students in the learning process tend to be low; this is because the learning that takes place is still conventional with the lecture method, where students tend only to record what the teacher teaches. Students still need to solve problems in particular physics materials. The low learning outcomes are suspected to be due to several factors, namely: 1) teacher-centred learning; 2) less varied learning approaches and learning resources; 3) learning that is oriented towards the pursuit of material without solving problems; 4) lack of interest in student learning towards physics subjects. Therefore, the researcher took the initiative to conduct research at the school.

One of the expected goals of this research activity is to see the relationship between students' ability to apply concepts and solve physics problems. According to Surahman&Surjono, (2017), effective problem-solving is carried out with the following steps: 1) with a conceptual analysis of the problem, 2) planning problem solutions, 3) implementing and evaluating problem solution plans, and 4) reflecting on the problem-solving process. The physics principles in the early grades are a prerequisite for success in learning physics and increasing students' interest in physics in later classes. In other words, if the problem-solving process is based on research results, according to Masduki (2016), problem-solving learning has five important steps. 1) What is the type of question? This research aims to connect questions with known approaches; 2) What is the purpose of the question? Or what to look for in the question? 3) What is already known? 4) what is the plan to solve the problem? Moreover, 5) how do you know you have solved the problem?

Several researchers regarding problem-solving have conducted several studies as a mental and intellectual process of finding problems and solving them based on accurate data and information to draw appropriate and careful conclusions (Amanah, 2017). The results of other studies, as stated by Hamalik (2001), to manipulate information, new information must be combined with existing cognitive structures. So the problem-solving process consists of (1) awareness of the problem, (2) formulation of the problem, (3) formulation of hypotheses, (4) collection of data or information, (5) testing of hypotheses, (6) drawing of conclusions and (7) application of the results of problem-solving in new situations. Gok (2010) also reported the results of research on problem-solving that has been recognized as a complex cognitive paradigm that is part of our everyday experience. Gaigher & Brau (2006) in his research stated that in learning physics, teachers usually only emphasize calculations in students' final answers which are only numbers regardless of students' understanding which tends not to be able to solve physics problems outside the classroom because it is physics that well understood by students will be able to solve physics problems in everyday life. Santyasa (2003) also reports the results of research on problem-solving-based learning to be very important because, in learning, students quickly forget if they are only explained orally, they remember if given examples, and understand if allowed to try (Djamarah, 2006).

METHODS

Method

This study examines the relationship between the ability to examine concepts and solve physics problems to increase student achievement, so this study used a quantitative approach and correlation techniques. It is what was stated by Sugiyono (2017). Correlational research is sometimes needed as descriptive research, especially because correlational research describes an existing condition. Correlational studies describe in quantitative terms the degree to which variables are related.

Research Procedure

Before the implementation of the research, an initial analysis was carried out, which aimed to determine the initial state of the population. The initial stage of analysis was carried out on the motion material by attaching indicators to see whether or not the motion questions were suitable for the instrument test, which would be validated by the supporting lecturer according to the directions of the first supervisor and the second supervisor, from the questions that the researcher made, after being validated by the instrument by the powerful lecturer, the valid questions according to the indicators totalled 34 questions about understanding concepts, 33 questions about problem-solving, and 30 questions about achievement.

Population and Sample

The population and sample of this study were in class VIII, which consisted of 60 students; this was because class VIII had already received motion material. Tryouts were carried out to find appropriate and appropriate research questions.

Research Instruments

The research instrument used in this study is the form of questions. From the validity test results, the researcher took 20 valid questions from questions of conceptual understanding, problem-solving and achievement.

Data analysis technique

Data were analyzed with three kinds of statistics, namely normality test, correlation test, and correction test. Data analysis used a correlation test using SPSS.

RESULTS AND DISCUSSION

Results

Before the implementation of the research, an initial analysis was carried out to determine the population's initial state. Early-stage analysis was carried out on motion material by attaching indicators to see whether or not the motion questions were suitable for the instrument test, which the supporting lecturer would validate by the directions of supervisors one and two. Of the 74 questions the researcher made, after the powerful lecturer validated the instrument, the valid questions by the indicators totalled 40. A trial of 40 research questions was carried out with descriptions in class VIII of the 40 questions that were feasible to be tested on students to make how many questions because class VIII has already received motion material that will be carried out research in class VII. The try-out was conducted to find questions that were considered appropriate and appropriate for research questions and obtained 25 valid questions out of 40 questions given to class VIII who had received motion material. Of the 40 questions answered by class VIII students, the questions were validated by researchers to get valid questions.

Before implementing the learning process with a problem-solving approach, several research instruments were compiled, including the lesson plan (LP), which contained a research program plan that led to the problem-solving process. In later learning, students in learning will use SDS (student discussion sheets), which contain student discussions where students will be able to solve and solve physics problems by using logical thinking and using a little formula. The learning process with the problem-solving approach referred to in this study is to train students to solve problems in learning science, especially physics. Physics

lessons are usually closely related to many formulas that must be memorized and learned so that students feel bored, lazy, and afraid of physics lessons which can be helped in this research. This research directs students to apply concepts and solve problems, especially with existing questions with no or little use of formulas or in a top way (easy, fun, and fun) which is usually liked by junior high school students.

Learning the problem-solving approach at SMPN 4 Sakti in class VII was carried out in 5 face-to-face meetings, the details of which four face-to-face meetings were used as learning and one face-to-face meeting was used as a post-test. Several obstacles arise in the implementation of the learning. For example, several students (5 to 10 people) make noise in class or are not very happy with physics lessons. It challenges researchers; how can students enjoy the physics lesson? In the early learning process of unhappy students, the researcher invited these students to move forward by giving examples of questions and following the existing examples. It turned out that the students were happy and motivated to learn. The learning process for the next meeting by forming study groups in the early stages of the obstacle was in the form of a lack of concentration of students in learning; students were not active in asking questions or discussing, in dividing groups, students were not adept at sitting with their groups, so they wasted much time. It is because students need to get used to group learning. The learning atmosphere is a factor that hinders the maximum capture of the material.

In the next learning, the obstacles began to decrease because, with the study groups, students were happier and able to solve a physics problem, especially in motion material. The noise and grouping of students and the inefficiency of time can be handled by easy group placement without having to move randomly from their original place. In this case, pay attention to individual competence in each group so that group discussions run smoothly. Meanwhile, the need for more activity of students during the discussion can be reduced by the active role of researchers in monitoring and directing students during the discussion so that the discussion takes place. The group discussion process is better, making each student dare to present their group discussion answers without being reluctant with doubts. With this group, study students who need help understanding the material about motion. With problem-solving learning, it encourages students to cooperate with other students in working on a problem. They were more active in asking questions and expressing their opinions in connecting existing material, so they were able to complete student discussion sheets that had been given by the researcher properly.

The existence of group learning encourages students to cooperate with other students in working on a problem. They were more active in asking questions and expressing their opinions in connecting existing material, so they were able to complete student discussion sheets that had been given by the researcher properly. It is what causes better learning outcomes with the problem-solving approach; the results of the post-test questions given can be seen from the normality test and the correlation between the three variables, namely, the value of applying the concept (X) and the value of problem-solving (Y) with the student achievement value (Z).

Normality Test on Concept Understanding

From the results of the post-test, the value of understanding the concept that student learning outcomes at SMPN 4 Sakti in class VII can be shown through the results of the normality test on the application of the concept (Tx) = 0.94 at the degree of freedom level (df) = 40 with a significant level of 0.70. it means that for understanding the concept 0.070 > 0.05, normally distributed, meaning that if p is greater than 0.05, it can be concluded that our data is not significantly different from normal data. It means that the data we have is normally

distributed.

Troubleshooting Normality Test

From the results of the post-test problem-solving scores that the learning outcomes of students at SMPN 4 Sakti in class VII on the normality test show that the data is normally distributed at (Ty) = 0.958 at the degree of freedom level (df) = 40 with a significant level of 0.146. It means that problem-solving shows a significance value of 0.146 > 0.05, normally distributed, meaning that if p is greater than 0.05, it can be concluded that our data is not significantly different from normal data. It means that the data we have is normally distributed.

Performance Normality Test

From the post-test results, student achievement scores at SMPN 4 Sakti in class VII have a statistical value of (TZ) = 0.97 at the degree of freedom (df) = 40 with a significant level of 0.551. It means that achievement shows a significance value of 0.551 > 0.05, normally distributed, meaning that if p is greater than 0.05, it can be concluded that our data is also normally distributed. It can be concluded that the three variables are normally distributed, where the significant value for understanding the concept is 0.07 > 0.05, and for problem-solving, a significant value is 0.146 > 0.05. The achievement also shows a significant value of 0.551 > 0.05. The significant value of the three variables is greater than 0.05. It means that if p is greater than 0.05, it can be concluded that our data is also normally distributed.

Correlation Test Results for Understanding Concepts and Problem Solving

The value of understanding the concept and the value of solving problems in the correlation test shows that the relationship between examining concepts and problem-solving is obtained by a relationship of r = 0.679; this means that there is a relationship between the two variables that are quite strong. Because the value of the correlation r> 0, it means that there is a positive correlation. So the higher the understanding of concepts and problem-solving, the higher the student achievement. Based on the significant value, it is known that the significant value of 0.000 is less than 0.05 (0.00 <0.05), so there is a significant relationship between understanding the concept and solving problems. Furthermore, if looking at the interrelated variables between the two variables, it is 46.1%.

Correlation of Concept Understanding with Achievement

The value of understanding the concept with the achievement value on the correlation test shows the results for a relationship of r = 0.939; this means a fairly strong relationship. Because the correlation value is > 0, there is a very positive correlation. So if the level of understanding of students' concepts is high, student achievement also reaches a high level, based on a significant value of 0.000 less than 0.05 (0.00<0.05), then there is a significant relationship between understanding the concept with student achievement. The variable that is mutually binding between the two variables is 88.2%.

Problem-Solving Correlation with Achievement

The problem-solving value with the achievement value on the correlation test shows the results for a relationship of r = 0.887; this means a fairly strong relationship. Because the correlation value is > 0, there is a very positive correlation. So that if the level of problem-solving with learning achievement increases, student achievement also reaches a high level, based on a significant value of 0.000 less than 0.05 (0.00<0.05), so there is a significant relationship between problem-solving and learning achievement. The variable that is mutually binding between the two variables is 78.7%.

Discussion

From the level of correlation of the three variables, it is by Bowen & Bodner's (1991) research that the problem-solving process will bring a person to a better understanding of the problem at hand because a reciprocal process occurs. Based on the research results, the test results of students who obtained the Problem-Solving learning approach on motion material were better. It can be seen from the tests that have been described previously, such as giving student discussion sheets. It is one of the factors that has supported the achievement of learning outcomes because students are seen to be active in learning and motivated because learning is interesting and fun.

In this study, there is a difference with the theory stated by Nasution (2002) that problem-solving can be considered as a systematic manipulation of information, step by step, by processing information obtained through observation to reach an idea as a response to the problem at hand. Because in this study, the emphasis is on students' understanding of science learning, especially in physics material, which in learning uses a problem-solving learning approach that is oriented towards developing students' abilities to minimize the use of formulas by way of understanding that has been trained by researchers so that students become interested and motivated in learning so that it affects learning outcomes which tend to increase (Arda, 2022).

Based on the study results, students who have obtained a problem-solving learning approach using discussion sheets can improve their understanding and skills in the meaning of motion influencing learning outcomes (Guntara, 2014). The above statement aligns with the theory put forward by Hariawan (2014), which states that problem-solving allows students to play an active role in learning activities. Problem-solving requires the ability to process information to make certain decisions. In addition, efforts to find answers to the problems faced require thinking creatively and exploring new fields (Husniah, 2016) because the learning uses student discussion sheets which require student creativity in each group to solve problems in new, innovative ways (Rohman, 2018).

CONCLUSION

The value of understanding the concept and the value of solving problems in the correlation test shows that the relationship between examining concepts and problem-solving is obtained by a relationship of r = 0.679; this means that there is a relationship between the two variables that are quite strong. Because the correlation value is > 0, there is a positive correlation. So the higher the understanding of concepts and problem-solving, the higher the student achievement. Based on the significant value, it is known that the significant value of 0.000 is less than 0.05 (0.00 <0.05), so there is a significant relationship between understanding the concept and solving problems. Furthermore, if looking at the interrelated variables between the two variables, it is 46.1%. The value of understanding the concept with the achievement value on the correlation test shows the results for a relationship of r = 0.939; this means a fairly strong relationship. Because the correlation value is > 0, there is a very positive correlation. So that if the level of understanding of students' concepts is high, student achievement also reaches a high level. Based on a significant value of 0.000, less than 0.05 (0.00<0.05), a significant relationship exists between understanding concepts, problem-solving and achievement in student learning.

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