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The Influence of Inquiry Learning on Concept Mastery Ability and Physics Problem Solving Ability of Students on Work and Energy Material

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Abstract: The aim of the study was to determine differences in students' concept mastery abilities and students' problem solving abilities in the material of effort and energy using inquiry learning with students who learned using conventional learning as well as the correlation between concept mastery abilities and students' energy and effort problem solving abilities. This research is a quantitative research with a Quasi Experiment research design and the research design is a nonequivalent control group design. This study involved an experimental class that used the Inquiry learning model with learning stages according to the Inquiry learning model syntax and a control class that used conventional learning with learning stages according to the learning model used by the teacher when teaching. Taking the research sample using random sampling technique. The data collection instrument used tests with physics concept mastery skill instruments in the form of 10 multiple choice questions and 5 physics problem solving questions in the form of description questions. The test data were obtained through the pretest and posttest which were then subjected to prerequisite tests. The prerequisite test results stated that the data were normally distributed, homogeneous, and the test was linear. The data that has passed the prerequisite test is then used to test the hypothesis using Ancova. The results of the data analysis test showed that there were significant differences in students' concept mastery and problem-solving abilities between classes using Inquiry learning and classes using conventional learning. In addition, the results of the research data analysis show that there is a correlation between the ability to master the concept and the ability to solve problems, which means there is a relationship between the ability to master the concept and the ability to solve problems. The conclusion of the research shows that inquiry learning on work and energy materials can improve students' concept mastery and problem-solving abilities.

Keywords: Concept mastery; Inquiry learning; Problem-solving.

Introduction

The purpose of learning physics in general is to train students to master concepts and solve problems competently (Hedge & N, 2012; Khol & Finkelstein, 2008). However, achieving this goal is not easy, there are still many students who have difficulty understanding physics concepts (Elmehdi et al., 2013). Most students still have a negative view of physics, this is due to students' poor physics learning (Halim et al., 2014) the way students understand concepts that are inconsistent with the views of other students (McDermott et al., 2000). Basically, students always experience difficulties in using a concept to solve a problem (J. L. Docktor et al., 2015; Sujarwanto. E., Hidayat. A., 2014). Students often solve physics problems by studying formulas or formulas and looking for examples of problems they solve without paying attention to the concepts involved (Ding et al., 2011). The phenomenon of student difficulties can also occur because students do not fully understand the concept (J. L. Docktor et al., 2015) which causes students not to understand personal knowledge (Tuminaro & Redish, 2007). This will help students solve plug and chug problems and ignore conceptual information. Troubleshooting with plugs and chugs is a less effective way of solving problems (Ding et al., 2011).

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Important for research in physics education (Buteler & Cleoni, 2016). Research on improving physics problem-solving skills through group discussions has begun to gain attention in the last two decades (Yerushalmi & Eylon, 2013). Problem solving is also emphasized in the physics curriculum in schools and universities to develop students' problem solving skills (Leak et al., 2017). Physical education research (PER) also emphasizes research on conceptual understanding and problem solving (Docktor & Mastre, 2014).

Several physics education researchers have studied students' problem solving abilities as professional students and novice students with solving physics problems (Riantoni et al., 2017). Beginner students solve problems simply by looking at surface features; they solve problems by following steps for problems that are similar to the problems they solve (Ding et al., 2011; Khol & Finkelstein, 2008). Students tend not to use the concepts they master to solve problems (Rosengrant et al., 2009) while students' success in solving problems is determined by the level of students' mastery of concepts. Assessment of student success in solving problems in general can be seen by using problem solving instruments (Docktor & Master, 2014). Problem solving can be solved in stages consisting of 5 stages, namely: useful description, physics approach, specific application of physics, mathematical procedures, and logical progression (Docktor et al., 2016).

One of the most confusing topics in physics is work and energy (Lindsey et al., 2012). This might happen because students have misconceptions in their understanding of the topic of work and energy (Dalaklioğlu et al., 2015). Students tend to be unable to recognize the causes and effects of the work-energy theorem so that this will prevent them from realizing the phenomenon of the work-energy theorem (Lawson & McDermott, 1987; Pride et al., 1998). Students always feel confused in determining the work done by the force component when the system experiences a collision or does work (Arsa et al., 2012; Dalaklioğlu et al., 2015). Students also still experience difficulties in understanding various forms of energy (Singh & Schunn, 2009). Other research shows that students also experience difficulties in understanding the energy contained in the system and there are still very few students who understand the law of the conservation of mechanical energy (Dalaklioğlu et al., 2015; Singh & Schunn, 2009). In general, the concepts of work and energy are important topics that are useful in science and are useful in everyday life (Serway et al., 2014) (Serway & Jewett, 2004; Singh & Schunn, 2009). Therefore, the concepts of work and energy are important to teach because the concepts of work and energy are a source of research in science education.

Science education in America has mandated practice-based learning (Council, 2012). Therefore, students must learn to use learning that involves practice and inquiry. Question-based learning has been shown to increase students' ability to understand physics concepts and solve problems. The change from teacher-centered learning to student-centered learning. One of the Inquiry-based and student-centered learning models is the Inquiry Learning model (Hairida, 2016). The inquiry learning model is a learning model that refers to student activities through inquiry activities to develop knowledge and gain knowledge from direct observation. Students carry out scientific investigations similar to scientists so that they gain knowledge about scientific processes. Inquiry-based learning models are more effectively used in learning (Ong et al., 2020). Question-based learning brings many benefits to students. Students gain advanced reasoning skills and students can solve problems competently using the concepts they learn (Ardono et al., 2018; Chen, 2019). Several studies have been conducted which can conclude that the inquiry learning model can improve students' mastery of concepts and will have a positive impact on students' problem-solving abilities.

Some of the physics material that has been taught using the Inquiry learning model is Vectors on the concept of electrodynamics (Bollen et al., 2018; Ong et al., 2020), Simple swings (Husnain et al., 2019) as well as temperature and heat (Kurniawati et al., 2014), some of these studies still explain the increase in students' mastery of concepts. However, Learning Surveys to improve the conceptualization of work and energy are still rarely carried out. Therefore, it is necessary to conduct research to determine the effect of inquiry learning on the ability to understand concepts and solve work and energy problems. It is hoped that learning material on work and energy will be able to develop students' knowledge through scientific inquiry activities so that they can influence students' mastery of concepts and problem-solving skills.

Method

This research is a quantitative study with a semi-empirical research design and a non-equivalent control group design. The design of this research can be presented in Tael 1.

Table 1. experimental research design

Class	Pretest	Treatment	Pos-test
Experiment	O_1	X	O_2
Control	O_1	Y	O_2

(Creswell, 2012).

This study involved 2 classes, namely the experimental class and the control class. Treatment in the experimental class used the Inquiry learning model with learning stages according to the Inquiry learning model syntax, while the control class used conventional learning with learning stages according to the learning model used by the teacher when teaching.

The population in this study were all class X MIA even semester. Sampling used the cluster random sampling technique so that 2 classes were selected, namely class X MIA 2 as the experimental class and class X MIA 4 as the control class with 34 students in each class. The instruments used in this study consisted of two types, namely treatment instruments and measurement instruments. The treatment instrument is used to provide treatment to students during the learning process, while the measurement instrument is used to measure the results of the treatment given to students both during the learning process and from the learning outcomes.

Data collection technique

1. Class selection

In this study there were 2 classes, namely the experimental class and the control class, both classes as research subjects were taken from the population. The experimental and control classes were selected randomly (clusster random sampling).

2. Test before learning activities (pretest)

Giving a test (pretest) before students participate in all learning activities. The test was carried out to measure students' initial abilities. The test items consist of 10 multiple choice questions (concept mastery skills) and 5 descriptive questions (problem solving skills).

3. Learning activities

Learning in the experimental class with the Inquiry learning model is in accordance with the lesson plans that have been prepared and conventional learning models in the control class. As long as the learning takes place, observations of the implementation of learning are carried out using learning implementation sheets assisted by two or more observers.

4. Tests after learning activities (Posttest)

Giving a test (posttest) is carried out after students take part in all learning activities. The test was carried out in both classes, namely the experimental class and the control class.

Data analysis technique

Statistical analysis in this study aims to determine whether there are differences in the ability to master concepts and problem-solving abilities of students who learn by Inquiry learning and students who study conventionally. Before testing the hypothesis, the data obtained must be tested first, namely the normality test and homogeneity test. If the prerequisite test has been fulfilled then the hypothesis testing uses parametric statistics. However, if there is a prerequisite test that is not met, then hypothesis testing uses non-parametric statistics.

Test Requirements Analysis

1) Normality Test

To find out the data obtained is normally distributed or not, the normality test is used. The normality test uses Kolmogorov–Smirnov with the help of SPSS 16.0 for windows at a significance level of 0.05. Decision making from the analysis as follows;

- if the sig value > 0.05 then the data obtained is normally distributed
- if the sig value <0.05 then the data obtained is not normally distributed.

Homogeneity Test

To find out two or more groups originating from populations that have the same variance, it is necessary to carry out a homogeneity test. Homogeneity testing was carried out using the Test of Homogeneity Variance at a significance level of 0.05. The homogeneity test in this study used Levene Statistics with the help of SPSS 16.0 for windows. Decision making from the analysis as follows:

Lintearity TEST

The linearity test was carried out to determine the linearity relationship between the dependent variable and the covariate variables. This test was carried out on posttest data (concept mastery ability and problem-solving ability) and initial ability data (pretest). If there is a significant linear relationship, the initial ability data needs to be controlled, which means that the initial ability affects the ability to master concepts and problem-solving abilities. If there is no significant relationship, then the initial ability data does not need to be controlled.

Hypothesis testing

If all the prerequisite tests have been met, the hypothesis testing uses a parametric statistical test. Hypothesis testing in this study used ancova test. Ancova test is a statistical analysis that is performed when there are one or more independent variables and one or more dependent variables, as well as controlling confounding variables that can affect the dependent variable (Leech et al., 2005). In this study, there is one independent variable which is a learning model, two dependent variables, namely the ability to master the concept and the ability to solve problems as well as the initial ability (pretest) as covariate variables that need to be controlled. Ancova test calculations were carried out with the help of SPSS 16.0 for windows at a significance level of 0.05. The hypothesis in this study is as follows.

First Hypothesis

H0: There is no difference in the mastery of the concepts of work and energy of students who learn using inquiry learning and students who learn using conventional learning

H1: There are differences in the mastery of the concept of work and energy by students who learn using inquiry learning and students who learn using conventional learning

Second Hypothesis

H0: There is no difference in solving the problem of effort and energy of students who learn using inquiry learning with students who learn using conventional learning

H1: There are differences in solving the problems of effort and energy of students who learn using inquiry learning and students who learn using conventional learning

Result and Discussion

Learning Description

In this study, learning took place according to the lesson plan for 6 meetings. The first and second meetings discussed the concept of work and work and kinetic energy theorems, the 3rd and 4th meetings discussed the theorem of gravitational potential energy and work potential energy, the 5th meeting discussed mechanical energy and the law of conservation of mechanical energy. and the 6th last meeting trains students to solve problems.

Learning in the experimental class

The first learning stage is the teacher conducting questions and answers related to the material with students, for example the teacher asks "what happens if this chair is pushed (the teacher pushes the chair)" and the students answer "the chair moves". and motion". Then the teacher presents questions related to the concept of work and energy in the form of provocative questions. For example, on the topic of the concept of work and the work-kinetic energy theorem" on Newton's 2nd law (this is $(\vec{F}) = m. (\vec{a})$ at a certain moment), if an object moves under the influence of a work force, what if you apply a force to an object so that it moves and stops at a certain distance, what happens?"

The third learning stage is data collection, which is carried out by proving to explore the concept. Previously, the teacher distributed worksheets to each group for presentation instructions and observations. The introductory guide is shown in Figure 1.

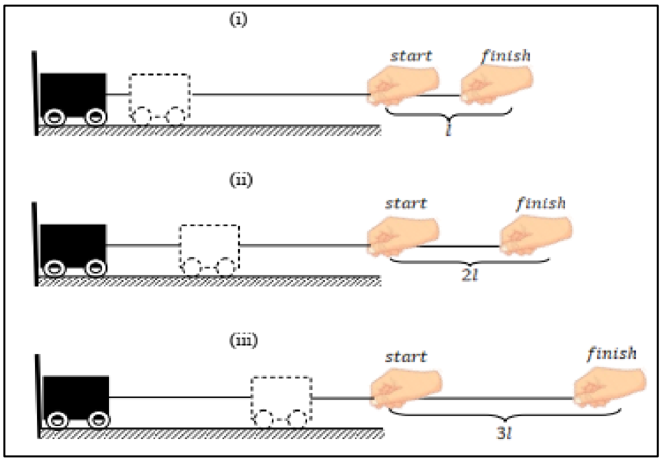

Figure 1. demonstration guide

At this stage, the teacher asks 2 student representatives from each group to make a presentation. Demonstrating using a full track cart, the cart is placed in the same initial position until the teacher instructs the first student to pull (do the style) of the first cart to L until the cart moves and immediately stops. Other students were directed to pull the cart with 2L pull until the cart moved a few seconds (not stopping immediately) and then stopped. Finally, the teacher asked the third student to pull the cart 3L away until the cart moved for a long time then stopped. An example of student activity can be seen in Figure 2. Students who did not take part in the demonstration were asked to observe the phenomena that emerged from the demonstration and then write worksheets based on their observations.

Figure 2. Demonstration Activities

After the presentation, the teacher asked several questions about the demonstration and directed students to answer questions about the student worksheet that was distributed. The mindset of students involved in demonstrations can be seen in Figure 3.

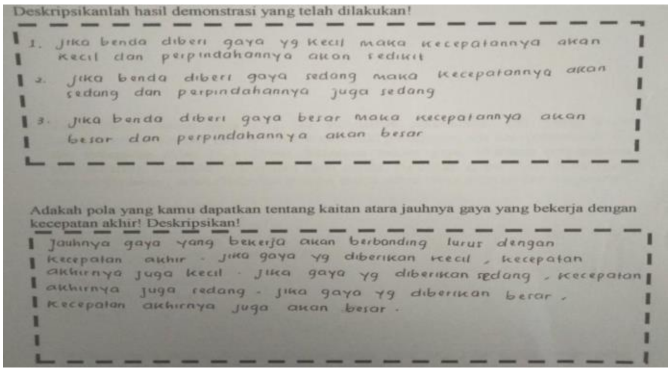

Figure 3. Description of Mindset during Student Demonstrations

The fourth stage is data processing, where students are directed to answer the questions contained in the student worksheet. Students are directed to carry out group discussions where questions are answered in student worksheet. Student discussion activities are shown in Figure 4.4. The teacher encourages students to ask questions to make it easier for students to answer questions. Questions and answers of students and teachers are presented in Table 2.

Table 2. Teacher's Questions and Answers with Students

Teacher	Teacher
Based on these 3 experiments, is the trolley said to be moving?	Yes. The trolley from rest is given a tensile force, increasing its speed after traveling a certain distance.
What is the initial speed of the trolley?	The initial speed of the trolley is the same i.e. zero (rest)
What is the final speed of the trolley?	The final speed of the trolley is different. The farther the trolley is from the starting point, the faster it will move. It is evident from the pulling force exerted on the trolley and stopped as far as l, the trolley also moves as far as l and then stops. When a pulling force is applied to the trolley and is stopped when it is 3l away, the trolley moves along, and at a distance of 3l the trolley is still moving fast.
In which case did the trolley cover the farthest distance?	The trolley on the 3rd try covered the farthest distance.
Based on the experiment, it can be said that the farther the trolley is from the initial point, the final speed will be....	The farther the trolley is from the starting point, the higher the final speed will be.


Figure 4. Group discussion activities

In this fourth stage students face problems, meaning that students are trained to solve problems using their own knowledge, students process the information provided by the teacher to perform calculations. In this phase, students are guided to discover the concept of energy business directly. Students' mastery of concepts automatically increases, this is due to frequent problem-solving exercises and repeated feedback from the teacher. When an error occurs, students immediately know how to correct it so that students can generate and record new correct information. In this phase, students are guided to discover energy business concepts directly. The results of student calculations are shown in Figure 5.

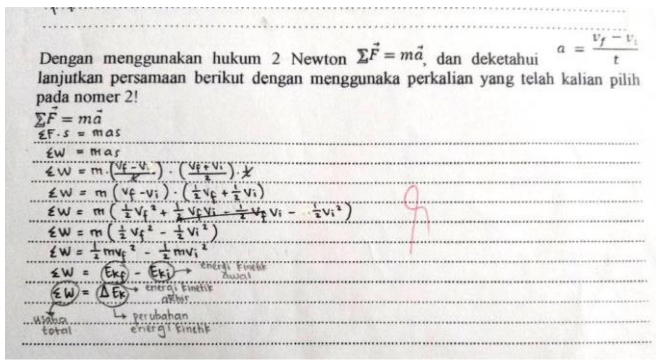

Figure 5. The results of students' calculations to find the concept of work and energi

The fifth lesson is learning where students are asked to convey what they find in a conversation (presentation). Group representatives make presentations. Representative groups that appear are students appointed by the teacher. The group that did not participate was asked to withdraw and the group whose representative appeared was asked to finish the presentation. Objections from other groups must be conveyed. Objections are submitted to train students' ability to express opinions and complete the results of group presentations. Here, students discover the concept that "the work done by all the forces acting on an object must equal the change in the object's kinetic energy". This concept is known as the kinetic energy theorem of work. The student findings are shown in Figure 6.

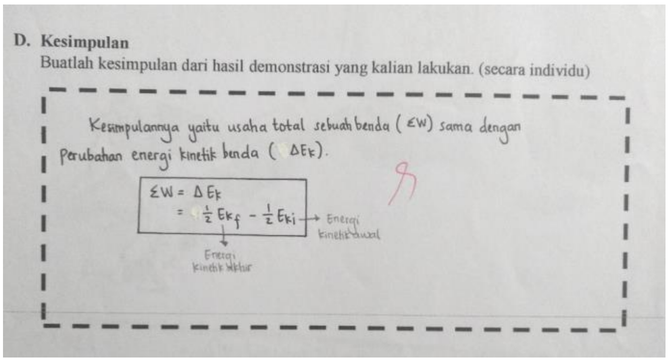

Figure 6. Student Findings

In addition, after the presentation is over, the teacher checks and confirms student concepts, the teacher explains the completed STUDENT WORKSHEET and directs students to answer questions in the early stages of learning. After confirmation, the teacher submits a series of practice questions to find out mastery of the concept and how well students are able to solve problems based on the material they have learned. After finishing work, students immediately get feedback from the teacher to improve thinking from the analysis made by students, and students know which answers are wrong so that students can then improve their written answers. If the student's answer is correct, the teacher continues to provide feedback to strengthen the concept.

The last (sixth) step of learning is the phase in which students are guided towards the completion of their learning. After completing the 6 trial classes, the teacher gave a final test (post-test) with the same questions (pre-test) as the first.

Control class learning

Learning in this class begins with a review of the previous material. After reviewing the material, the teacher asks several questions about the material to be taught, such as: B. "What happens if I push this chair?". The teacher invites students to open student worksheet and look for material to study. The teacher asks students to read the material and discuss it with their peers.

In the second stage, the teacher asks students questions such as "What do you mean by effort?" Then the student answered: "Work is the magnitude of the force acting on and moving an object". At this stage, the teacher wants to check the level of students' knowledge of business material. The next stage, the teacher explains the efforts to increase student knowledge.

After explaining the energy business material, the teacher asks questions to students and asks if there has been a change in their thinking pattern. After completing a series of lessons from start to finish, the teacher gives exercises to students to assess the level of mastery of concepts and the level of students' ability to solve problems using the material they have learned. After completing their work, students receive instant feedback from the teacher to improve their thinking about the analysis they have done. Students can see which answers are wrong so that students can then correct their own answers.

Description of Research Results

In this study, two data were collected, namely conceptual mastery data and problem-solving ability data. Concept mastery data were obtained from concept mastery tests (pre-test and post-test). The pre-test was carried out before the treatment and the post-test was carried out after the treatment. The Concept Mastery Test consists of 10 multiple choice questions that have been validated and tested empirically.

Problem solving ability data obtained from problem solving ability tests. The problem-solving ability test consists of five essay questions. Questions are validated and tested empirically before use. Concept acquisition and problem-solving skills tests are administered in less than 70 minutes for both classes. The data obtained is shown in Table 3.

Table 3. Value of Mastery of Concepts

Experiment (*inquiry*)				Control (konvensional)
Data	Concept mastery		Concept mastery	
	Pre-test	Post-test	Pre-test	Post-test
N	34	34	34	34
Value max.	60	80	55	65
Value min.	30	45	30	35
Average	35.97	64.12	36.21	48.09
Average difference		28.50	11.88	

Based on Table 3, the average score before the concept mastery test in the experimental class was 35.97 the average value after the concept mastery test was 64.12 and the average difference between the two tests was 28.15 In the control class, the average score before the concept mastery test is 36.21 and the average score after the concept mastery test is 48.09 with an average difference of 11.88. We found that the average difference in conceptual mastery ability in the experimental class was higher than in the control class. This means that the ability to master the concept in the experimental class is better than the control class. The value of concept mastery ability is obtained from data processing of student response values when answering 10 questions of concept mastery.

Table 4. Value of Problem-Solving Ability

Data	Experiment (*inquiry*)		Control (konvensional)	
	Problem Solving		Problem Solving	
	Pre-test	Post-test	Pre-test	Post-test
N	34	34	34	34
Value max.	50	85	60	70
Value min.	30	55	30	35
Average	35.59	72.21	36.18	48.53
Average difference		36.62		12.35

Based on Table 4, students in the Experiment class had an average pre-test problem solving score of 35.59 and an average post-test problem solving score of 72.21 with an average difference of 36.62 between the two tests. The control class had an average pre-test problem solving score of 36.18 and an average post-test problem solving score of 48.53 for a mean difference of 12.35. It can be seen that the experimental class has a higher average difference in problem solving than the control class. This means that the experimental class has better problem-solving abilities than the control class. The problem-solving ability score is obtained by processing the value of the answer data when students answer 5 problem-solving questions. Student responses were analyzed from the perspective of problem-solving useful description, physics approach, specific application of physics, mathematical procedure, and logical progression can be seen in Table 5.

Table 5. Analysis of Student Answers for Each Question in Each Each Class

Question	Usefull description		Physics approach		Specific application of physics		Mathematical procedure		Logical progression	
	I	K	I	K	I	K	I	K	I	K
1	34	34	34	34	26	21	22	18	21	18
2	34	33	33	32	25	21	21	18	21	18
3	34	34	34	32	27	22	26	20	25	19
4	34	34	32	32	24	20	20	17	20	16
5	34	33	32	31	23	18	20	15	20	15

Based on Table 5, all students were able to complete useful description levels for items 1-5 in the experimental class. At the physical approach stage, students successfully completed points 1 and 3 of this phase, 33 students completed points 2, and 32 students completed points 4 and 5. Specific application of the physics phase. In this phase, 26 students completed task 1, 25 students successfully completed task 2, 27 students were able to complete task 3, 23 students were able to complete task 5, Twenty-three students successfully completed task 5. Complete this phase. 22 students successfully completed item 1, 21 students were able to complete item 2, 26 students were able to complete item 3, and 20 students were able to complete this stage and 5. I. The level of logical progress only consisted of a small number of students who were able to complete this level. 21 students can complete this stage at point 1, 21 students at point 2, 25 students at point 3, and 20 students at points 4 and 5 who are able to complete the items.

In the control class, all students were able to complete this stage, namely items 1, 3, and 4, while 33 students completed items 2 and 5. In the physics approach stage, students successfully completed this stage at point 1, 32 students were able to complete at point 2, 3, and 4, and 31 students completed at point 5. 21 students were able to complete tasks 1 and 2, 22 students successfully completed point 3, 20 students were able to complete point 3, 18 students were able to complete Task 5 and complete this phase. For tasks 1 and 2, 18 students can complete this stage successfully, 20 students can complete task 3, 17 students can complete the task. Fifteen students were able to complete this stage in Task 5. The logical progress level consisted of only a small number of students who were able to complete this level. 18 students on points 1 and 2, 19 students on point 3, 16 students on point 4, and 15 students on point 5 were able to complete this point.

Data Prerequisite Test

The prerequisite test is a test that is required before carrying out the Ancova test. Prerequisite tests in this study include the normality test, homogeneity test and linearity test.

Normality test

The normality test in this study used the Kolmogorov-Smirnov test. This is done to see whether the data is normally distributed for each respondent. If the significance is greater than 0.05 then the data is normally distributed. Normality test data in the form of concept acquisition data and problem-solving ability data. The calculation results show a significance value of 2.229 for the pre-test of mastery of the concept and a significance value of 1.149 for the post-test of mastery of the concept. Because the significance value of the pretest and posttest mastery of the concept is greater than 0.05. it can be concluded that the pretest and posttest scores for mastery of the concept are normally distributed. The results of the pretest normality test for problem solving abilities have a significance of 1,833, and the posttest of problem-solving abilities has a significant value of 1,201. The significance value of the pretest and posttest of problem-solving ability is greater than 0.05, it can be concluded that the pretest and posttest value of problem-solving ability is normally distributed.

Homogeneity Test

The homogeneity test in this study uses Levene Statistics, which is carried out to find two or more groups from a population with the same variance. The results of the calculations show that the pre-test and post-test significance values for mastery of concepts are 0.356 and 0.099 > 0.05, respectively. The significance value of problem-solving ability before and after the test was 0.622 and 0.515 > 0.05, respectively. Based on these data it can be concluded that the data on students' conceptual abilities and problem-solving abilities are homogeneous or come from the same variant.

Linearity Test

The results of the linearity test between the posttest conceptual abilities and initial abilities (pretest), which showed a significant value of 0.721 > 0.05, indicated that students' conceptual abilities and students' initial abilities. We found a significant linear relationship with ability. initial ability. The significance value of the linearity test between post-test problem-solving skills and initial abilities (pre-test) is 0.150 > 0.05, meaning that there is a significant linear relationship between students' problem-solving abilities and initial abilities. Therefore, it is necessary to control the covariate variable (initial ability) so as not to affect the dependent variable (concept mastery ability and problem-solving ability).

Hypothesis testing

Based on the calculation results obtained a significance value of students' mastery of the concept of 0.000. Significance value <0.05, then H0 is rejected and H1 is accepted. This shows that there are differences in the mastery of the concepts of effort and energy of students who learn through inquiry-based learning compared to students who learn through traditional learning.

Based on the calculation results, the significance value of students' problem-solving ability is 0.000. Significance value <. 0.05 rejects H0 and accepts H1. This shows that there are differences in problem-solving effort and energy of students who study using inquiry learning with students who learn using conventional learning.

Calculating the relationship between concept mastery ability and students' ability to solve problems produces a significance value of 0.000. Significance value <0.05 rejects H0 and accepts H1. This shows that there is a relationship between the effort and ability of students in mastering the concept of energy with the efforts and abilities of students in solving energy problems.

Differences in the Mastery of the Concepts of Work and Energy for Students who Learn to Use Inquiry Learning and Students who Learn to Use Conventional

Learning From the results of the data analysis test it is known that there are significant differences in the acquisition of concepts between inquiry-based learning classes and conventional learning classes. This significant difference is also evident in the fact that the average score for ability to master concepts is higher for inquiry-based learners than for traditional learners. These results prove that inquiry-based learning is more effective than conventional learning. Differences in how each class learns can trigger different internal processes for each student (Gallagher & Zahavi, 2012). Experimental learning classes emphasize direct experience and observation, with students actively involved in every stage of learning, including conducting experiments to identify concepts (Varvoglis, 2014). Students who learn by discovery learning understand more than those who learn by traditional methods (Luginbuhl, 2010). In inquiry-based learning, students are also encouraged to discuss the results of their experiments, and students are also expected to communicate the results through presentations. The ability of students to understand the concepts of the material being taught and to reproduce the concepts learned is one of the learning outcomes (Sanjaya, 2007). One learning model that can stimulate students' curiosity is inquiry-based learning (Hairida, 2016). Inquiry-based learning is a method that refers to student activities to develop knowledge and gain knowledge from direct observation (Oguz et al., 2011).

Research-based learning is more effectively used in learning. This is evidenced by research conducted by (Kurniawati et al., 2014), which found differences in the abilities of students who studied in inquiry-based learning with the acquisition of concepts in conventional learning. (Sani & Syihab, 2010) suggest that students' mastery of concepts is increased through the use of inquiry learning models. Inquiry-based learning is very effective in motivating students, developing their ability to work in complex environments, stimulating them to think more critically (Suarez et al., 2017).

This study found differences in the ability to master concepts using inquiry-based learning for several reasons. First, inquiry-based learning is effective learning that engages students in active learning (N.R.C., 2000), and students understand how scientists carry out research procedures to gain knowledge about scientific processes (Bell et al., 2010). Second, inquiry-based learning activities allow students to think and act like scientists (Furtak, 2006). Meaningful learning occurs because three students directly participate in learning. Four students design and conduct their own scientific research, including gathering information, collecting and analyzing data, providing explanations, and discussing results (Pizzolato et al., 2014). Active student involvement at all stages and an emphasis on discovering physics concepts through demonstration activities give students hands-on experience.

Differences in Solving Work and Energy Problems for Students who Learn to Use Inquiry Learning and Students who Learn to Use Conventional Learning

Data analysis reveals that inquiry-based students are better at solving problems than conventional-based students. This is because inquiry-based learning allows students to independently discover and search for the concept of work and energy through investigation, so that they can better understand and solve the problems posed (Docktor & P, 2014; Varvoglis, 2014). Inquiry-based learning has very important benefits in improving students' logical abilities because it allows them to apply the concepts they have learned to solve problems (Ardono et al., 2018). Inquiry-based learning encourages students to work in small groups to discuss how to solve problems with teacher support so that teachers can overcome student misunderstandings (Bollen et al., 2018). This shows that the inquiry learning model is effective for learning (Ardono et al., 2018).

The results of the study found that there were several factors that distinguished the problem-solving abilities of students using inquiry-based learning. First, discovery-based learning activities and secondly, learning activities involve students actively at every stage of learning. Inquiry-based learning is student-centered, and teachers help students navigate through each stage of learning. The role of students can be identified through the stimulus stage, defining the problem, collecting data, processing data, and validating. Students are actively involved at all stages and focus on discovering physics concepts.

Conclusion

Based on the research data, the following conclusions can be obtained: (1) Students who learn using inquiry learning have a better mastery of the concept of work and energy than students who learn using conventional learning. This shows that there are differences between the two learning models. The results of the Ancova test obtained the probability value of the ratio Fcount the effect of the learning model on the ability to master the concept of 102.672; (2) Students who learn using inquiry learning can solve work and energy problems better than students who learn using conventional learning. This shows that there are differences between the two learning models. The results of the Ancova test obtained the probability value of the ratio Fcount the effect of the learning model on the ability to master the concept of 141.792.

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