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IMPROVEMENT OF PROBLEM SOLVING ABILITY IN KINEMATICS THROUGH LEARNING MODEL BASED ON PROBLEM SOLVING PEDAGOGY

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Abstract

The purpose of this study was to determine the effectiveness of the pedagogy kinematics problem solving based learning model to improve of problem solving skills student teachers. The study design was used The One group- Pretestt - Posttestt experimental design. The samples were 36 students of Physical Education, in one LPTK in Medan. Given to samples a description of the kinematics problem solving test before and after the learning physics.The data will be analyzed with SPSS 16 paired samples t uji-based. The results showed there are increase problem solving skills from before and after learning through kinematics based pedagogy troubleshooting based learning model.

Keywords : Problem Solving Ability, kinematics, Learning Model, Problem Solving Pedagogy

A. INTRODUCTION

Kinematics is about understanding how to describe movement by using concepts, methods graphical and mathematical equation right. You will apply these methods to solve problems involving movement in a straight line, like the motion of objects in free fall. you, too will understand how type movement non- linear occurs, and will learn one type of projectile motion detaily. Kinematics topics was first introduced in most of the basic physics class, because it is associated with most other physics topics. Without a solid understanding of the concepts of kinematics, the student experiencing a shortage of the necessary foundation to successfully understand the concepts of advanced physics is more abstract. Due to the nature of the kinematics contained in the whole concept of physics, any increase students' understanding of these concepts creates the possibility of improving the understanding on almost all other physics concepts to be faced. Besides, this topic is contained in other subject areas, such as Biology and Chemistry. Connectedness concepts in kinematics is shown in Figure 1. This connectedness shows the relationship between concepts defined by other concepts.

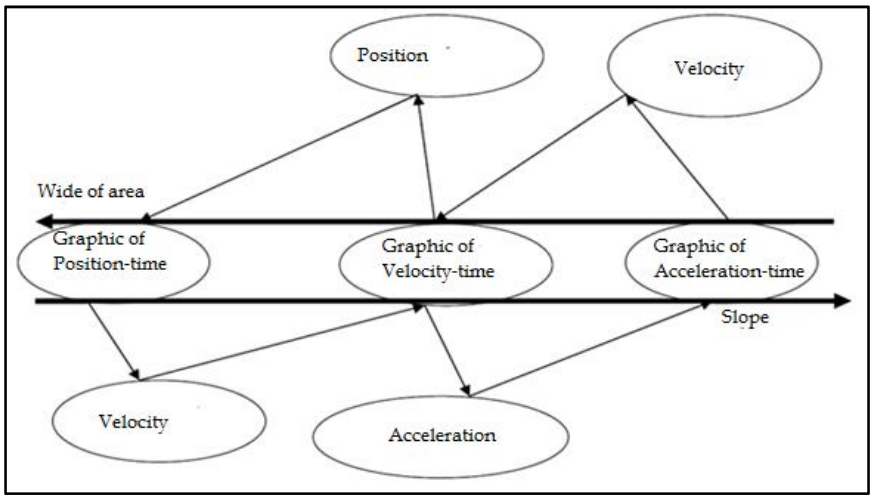

Figure 1. Connectedness concepts in kinematics

According Dahar (1989), problem solving is a human activity that combines the concepts and rules that have been obtained before, and not as a generic skill. This notion implies that when a person has been able to resolve an issue, then one has to have a new ability. This capability can be used to resolve the relevant problems. The more problems can be solved by someone, then it will be more and more have capabilities that can help him to navigate daily life. Therefore, a person's ability to solve problems need to be trained so that one is able to live a life that is full complexity of the problems.

Problem solving should be an integral part of the teaching process is run. According to Heller &Hollabaugh (1992), there are 5 stepsof problem solving that can be used as the basis of teaching approaches, namely: (1) Focus Issue: Available Information. In this step, designed problem-solving strategies to construct an initial understanding qualitatively from the problem situation with how to write what is known, was developed to focus also determines what it wants to be known (claims), magnitudes of physics and assumptions to be used in problem solving; (2) Description physics: Physical Overview of global information, In this step, use a physical image to transfer an initial understanding of the problem, by implementing a number of known kinematics components, asking questions, and other possibilities that can inferented in solving problems (3)Solution planning: lines of reasoning, At this stage, the necessary understanding of physics knowledge to solve problems and express equations of physics in term of mathematics to be used to solve physics problems in question; (4) Execution planning, In this step necessary ways of solving of physics problems by using the physic equations of mathematical to answer of questions form the target used with a mathematical equation; (5) Evaluation of answers, In this stage, the evaluation of the results of the execution plan

obtained by getting the value of the target quantity requested. Evaluation is done by looking at the feasibility and validity of the target.

Reality on the ground, generally only a little could learn of physics, experimental activities ranging from only 10% of the activities of the learning process, because of the difficulty in designing and tested experimentally. Results of the analysis of the material shows that many of the kinematics in featuring diagrams, graphs and thematical formulas (Manurung, 2010). In general, teachers are still dominated learning. Lecturers teach the material with a lecture in question and answer. Practical implementation of general physics still verification, so it seemed only carry out each step in the procedure as lab models recipe that aims to prove the existing theories are less encouraging students to develop thinking in experimenting and finding things that are new (Manurung, 2010). Lecture method used in the lecture general physics has been made the students glued to listen and really boring, because goal of learning situations is ionlyto know, and the problems presented tend to be academic (book oriented). Students lacking the experience to be able to solve problem was given and have a little reference to the contextual issues closer to everyday life, so learn physics generally less meaningful for students. This is evident in the low participation of students in discussions during learning and their learning achievement is also unsatisfactory. Solving physics problems in a multi representation of high school students conducted by Gaigher *et al* (2007), states that the conceptual understanding can be demonstrated by writing comprehension of students in learning through problem solving. The process of developing a conceptual understanding of the modeling framework was explored Greeno about solutions to scientific problems and reasoning. It was found that all students have a structured problem-solving strategies to master a better conceptual understanding in physics and tend to adopt the conceptual knowledge for problem solving.

The task of solving the problem can be seen as an attempt to process the information provided be certain completion stages to formulate the information in question. Solving the problem by using pedagogy of subject-matter as the view of pedagogy by Siregar*et al*, (1995) defined as Scheme of Problem Solving (SPM) is done in this study. Primarily study is done to know the overcome the rigidity in the process of reasoning portrays a result of lack of subject-matter. SPM is one way to determine the cognitive structure of students in solving a given problem naturally is and does not involve explicit aspect of the algorithm, but logic aspects of cognitive psychology students. SPM is characterized by progressions dimensions and elaboration dimensions. Progression

dimension of load steps to be taken while the dimensions of the elaboration of the concept contains elements which are built or developed based on the stage.

Based on the view Siregar *et al* (2009), the cognitive analysis should be used to explain the nature of the discourse of solving the problem, because the process to get the result refers to the cognitive process of students. SPM is designed primarily to describe the cognitive strategies undertaken. Line of reasoning in the cognitive analysis is an important thing to look for systematic differences in students' reasoning. If the student has been classified in the top, middle, and bottom group, then this model can show how solving the problem by each of the different groups. The scheme systematically underlying psychological problem-solving process necessary to find explanation students. Broadly speaking Siregardescribe troubleshooting analysis in Figure 2.

Selection dimensional problem solving into progressions and elaboration of the implications of the theory and application of discourse analysis to problem-solving strategies. According to the application Siregar et al (2009) allows the use criteria of clarity and accuracy criteria for an explanation. The first phase is a phase of explanation, while the second phase is the phase of application. The accuracy of the theory imposed on elaboration dimension refers to the clarity of criteria to determine the suitability of steps to resolve the relationship as a procedure doubt, while the suitability criteria of the subject matter of the dimensions of elaboration with the formal structure referred according to expert knowledge.

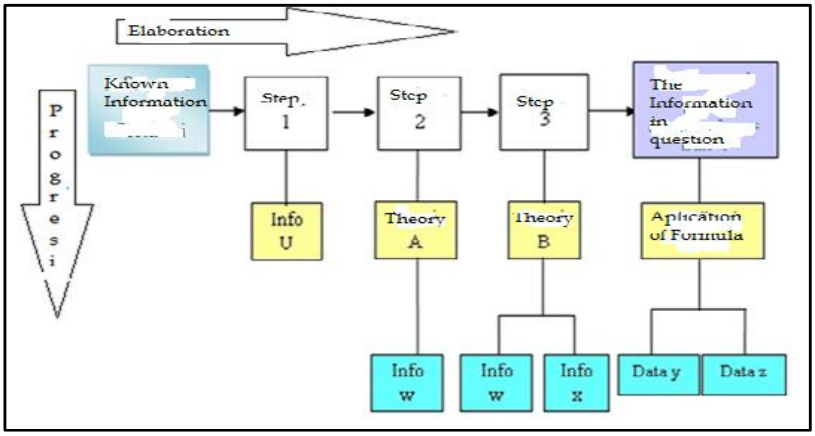

Figure .1 Scheme Troubleshooting (Siregar et al, 1995)

Method of solving the problem in the form used when the SPM aims to develop students' thinking process through the provision of a problem to be solved. Reasoning ability of thinking maintained. Depending on the nature of the problems to be brought into the classroom, the solution technique can be carried out in groups or individually, can be

done inside or outside of class assignments. Besides, students have continuing think so as to argue for the conclusion by solving plan

B. RESEARCH METHODS

The study design used was The One - Group Pretestt - Posttestt experimental design (Fraenkel et al, 2012). The research sample for the implementation of learning models are 36 students from one LPTK in the field consisted of 10 male students and 26 female. All samples were given a description of the test solution in the concept masaah kinematics before and after the study. Data will analyzed SPSS to test the hypothesis by engineering uji- paired samples

C. RESULTS AND DISCUSSION

Statistical description of data and problem solving domains of its aspects at posttest shown in table below

Table 1. Descriptive Statistics Score of Problem solving.

	Focus Problem	Physic Explanation	Planning of Solution
N	Valid	36	36
	Missing	0	0
Mean	2.69	2.69	2.81
Std. Deviation	.52	.52	.75
Minimum	2.00	2.00	1.00
Maximum	4.00	4.00	4.00

Implementation of Planning	Evaluation of Answer	Solution to problem
36	36	36
0	0	0
2.78	2.78	13.75
.80	.80	2.95
1.00	1.00	7.00

Table 1 presents the descriptive statistics (frequency of, percentage, average, standard deviation) sedtiap aspects of problem solving. Problem solving ability is almost close similarity to all domains of its aspects. These results indicate that the problem solving ability of students are already well on the fifth aspect. The highest in the problem-solving aspect of planning a derived "using information that is known to compile new information" (= 2.81). Lowest focal = 2.69) and a physical description = 2.69. Aspects of the focus problems downloading gasses person's skills in problem solving organized information from the problem statement into a representation appropriate and useful that summarizes key information symbolically and visually. The focus of the problem is

considered "useful" if guiding a further step in the process. The focus of the problem may include repetition of information are known and unknown, to put symbols that correspond to the numbers, determine the quantity of goals or objectives, visualization (sketches or drawings), establishing expectations qualitatively, diagrams physics abstract (force, energy, motion, momentum , light, etc.), draw graphs, set the coordinates of the coordinate system, and choose the system.

Troubleshooting on the test, the lowest score in the pretest condition is 2 and numbered as many as 10 people. While the highest score in the same condition is 10 and amounted to only one person. Posttest scores showed improvement in conditions, where the lowest score in these conditions is 7 and amounted to 1 person. The highest scores in the same condition is 18 and amount to as much as 6 people. The state of descriptive data on group problem solving scores low, medium, high and shown in Table 2 and the state of the graph shown in Figure 3.

Table 2. Descriptive Calculations Based Problem Solving Test Interval Grade

Type of Tests	Group Based on Value	Pretestt (f)	Posttestt (f)
Tests Troubleshooting Overall		Mean = 4.55 SD = 2.28 Score Min. = 2 Score Max. = 10 N = 36	Mean = 13.75 SD = 2.95 Score Min. = 7 Score Max. = 18 N = 36
Troubleshooting Test Interval Per Class	Under Mean Mean SD Middle Mean SD Upper Mean SD	27 3.51 1.39 8 7.37 1.18 1 10.00	27 13.81 2.98 8 13.37 3.15 1 15.00

To see more clearly the differences in pretest and posttest, the researchers also measured the variation in the test Troubleshooting. In the first component, it was found that the variation in the pretest and posttest was significant, Z = -5108, p = 0.000. These results indicate that as many as 33 respondents get a rise posttest scores in condition and only 3 respondents who have the same score.

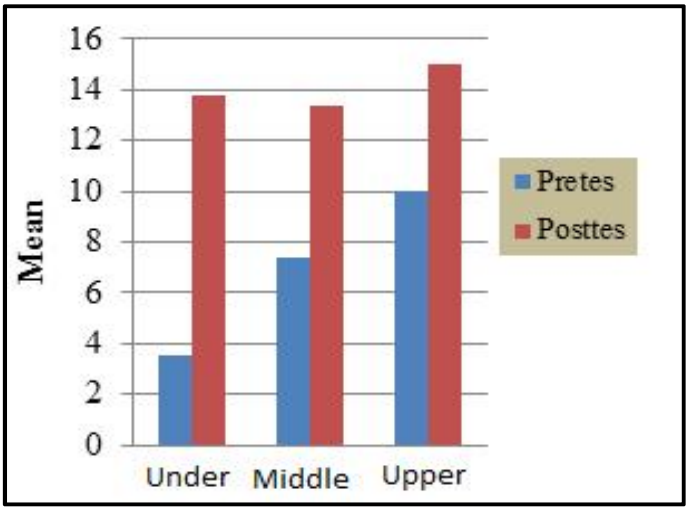

Figure 3. The difference in the mean graph on condition pretest and posttest Foreign m intervals in each class.

Researchers using the same analysis technique, ie Wilcoxon, to see the difference that occurs in conditions of pretest and posttest. The first results show that there are differences in scores on the pretest and posttest was significantly different, Z = -5236, p = 0.000. The first result was also found that all respondents (36) gets the increase in scores on the posttest condition, after learning pedagogy applied problem solving. To see more clearly the differences in pretest and posttest, the researchers also measured the differences that occur in every component in problem solving tests, namely visual components, descriptions, planning, implementation and evaluation. At all of the components, it was found that differences in pretest and posttest occurred with values, Z = -5108; -5.260; -5.220; -5.145; -5.248, And p = 0.000. These results indicate that respondents get a significant increase in post-test conditions.

To see the difference in value pretest posttest of problem-solving abilities after learning to use statistical tests applied different test pairs. Here are the results of calculations paired difference test using SPSS-16 shown in Table 3.

Table 3. Descriptive problem solving ability

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest of Problem solving	4.92	36	3.20	.533
	Postest of problem solving	17.64	36	10.33	1.72

		N	Correlation	Sig
Pair 1	PreProsolv&PosProblSolv	36	-131	445

The above table shows that the average, the sample size, standard deviation, and standard error of the mean problem-solving abilities. Of the 36 students, the student's ability to solve problems increased between 12.74 points after applying the learning model. The correlation value is obtained through a statistical calculation is 0.131. The results showed that the correlation between pretest and posttest problem-solving ability, a significant result. Further tested two different test values as shown in Table 4.

Table 4. The Result Test Paired Difference Of Pretest And Posttest of Probllem Solving Understanding.

		Paired Differeces				
					95% Confidence Interval of the Difference	
		Mean	Std-Dev	Std-Error Mean	Lo-wer	Upper
Pair 1	PreProbSolv-Post-Prob-Solv	1,27	11,21	1,87	8,93	16,51

T	df	Sig (2-tailed)
6,81	35	000

The results of the calculations in Table 4 show that the average difference between pretest and posttest understanding of problem solving is 12.74, which means that there is a rise in problem-solving abilities after learning model implemented SPM. The table above shows that the results of calculation of the value of t is 6.81 with a p-value of 0.000 and t table value of t distribution table is 1.689. This means that Ho is rejected and we can conclude that statistically there is a significant difference between pretest and posttest mean problem-solving abilities after learning model is applied. Improved learning outcomes through web-based electronic module with a mobile version with the acquisition format normalized score of 0.32 (Suyoso and Nurohman, 2014). Additionally, Mokros & Tinker (1987) found that the activity of micro-computer-based laboratory can be enhanced graphics capabilities.

In accordance with the findings of Gok, who said that the problem-solving process can improve metacognition which is the development of cognitive structures, and give students learn an exact science. Additionally, Atmojo (2013) states the learning material environmental management is a problem based learning model can improve student learning outcomes in the junior class VII A Bhakti Kedungtuban with criteria that managed

to reach the standard form of mastery learning in the subject matter of environmental management as much as 80% of students with the value of learning outcomes ≥75,

D. CONCLUSION

Based on research that has been conducted, as follows. First, learning outcomes solving (problem solving) is the result of high-level cognitive learning. To level intellectual skills, students are required to use the rules in accordance with troubleshooting. In this case the student is able to identify permasalahn and skilled in selecting the troubleshooting steps; second, problem solving interpreted as an attempt to find a way out of trouble. Therefore, solving the problem is the high level of intellectual activity. This type of learning is a process that not only psychological proposition of application, the law, or theorems teorena- studied, it mustThe above table shows the mean, sample size, standard deviation, and standard error of the mean problem-solving abilities. Of the 36 students, the problem solving ability of students increased between 12.74 points after applying the learning model. The correlation value is obtained through statistical calculations is 0.131. The results showed that the correlation between pretest and posttest problem-solving ability showed significant results. Further tested two different test values as shown in Table 4.Further tested two different test scores as shown in Table 4.

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