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THE EFFECT OF *PROBLEM BASED INSTRUCTION (PBI)* LEARNING WITH USING *APTITUDE TREATMENT INTERACTION (ATI)* APPROACH TOWARDS MATH PROBLEM SOLVING ABILITY

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Abstract

Education Innovation is performed to improve the quality of learning in the classroom. The problem that arises allows educators to manipulate the circumstances to resolve the problem in accordance with the existing educational theory. This study was aimed to determine significant differences in mathematical problem solving ability of logical and union subjects between students who learned to use problem based learning Instruction (PBI) Aptitude Treatment Interaction approach (ATI) and students who learn to use expository model of learning in the first semester of the school year 2013/2014 mathematics education department of UIN Suska Riau. This research was a quasi experiment research using the randomized design Pre-test – post-test control group design. The research used simple random sampling technique, but with the class that was randomized. Class 1C was selected to be an experimental class, and the control class was Class 1D. Data of mathematical problem solving ability of students was gathered by test instrument with descriptions. Based on data analysis, it was obtained t_count = 5.86 and t_table (at significance level of 5 %) = 2.31 . This meant that t_count > t_ table, so that it could be interpreted that there were significant differences in mathematical problem solving ability between the experimental class students (learning by Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach and a group of students control class (learning with expository teaching model. Thus, Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach and students who learn to use expository model of learning between the experimental class and the control class.

Key Word: Problem Solving, *Problem Based Instruction, Aptitude Treatment Interaction*

Background

As a practical education providers in the university, Department of Mathematics Education UIN Suska Riau always makes innovations in learning. Learning innovations made are based on continuous research and educational agreement between theory supported by the latest advances in technology today. Basic research is conducted to determine the extent of the problems that occur in the classroom and to find solutions to problems that arise. A study conducted by Department of Mathematics Education UIN Suska Riau examined the extent to which the understanding of mathematical problem solving of new students, in this case the first semester students. The first-year students were originated from different schools with different backgrounds majors. For that, there was needed source of data describing their mathematical skills as a reference in applying appropriate learning innovation.

The study began by providing a description tests that contained the union and logic to the students of first academic year 2013/2014, and after being analyzed, the data obtained:

Table 1. Preliminary Test Results of Problem Solving Ability

Steps To Solve	To give right answer				
	Class 1A (30 students)	Class 1B (30 students)	Class 1C (30 students)	Class 1D (30 students)	Class 1E (30 students)
Understanding problems	11	12	10	13	11
To make solving plan	10	11	8	11	9
To plan problem solving	10	11	8	11	9
To re-check	It's not done by students				

It was seen that about more than 50% of total students from each class had problem-solving abilities that were less good. It was demonstrated that their inability to formulate troubleshooting steps so many of them did not able to resolve the problem well. This indicated that their understanding of mathematics was not maximum. According to Anderson (2001: 70), a person is said to have the capability of understanding if the student is able to construct meaning from the messages that arise in teaching such as oral communication, writing, and graphics. Understanding a mathematical concept (problem), among others, when they establish a relationship between the newly acquired knowledge and prior knowledge. Thus, an understanding of a problem is part of solving the problem.

From the above problems, the learning that is expected to improve the understanding of concepts, problem solving skills and self-efficacy (confidence) students are learning of *Aptitude Treatment Interaction (ATI)* approach as well as *Problem Based Instruction (PBI)* learning model. This is reinforced by the opinions Cronbach (1983: 249), which said that the ATI approach was trying to find and locate suitable treatment of students with different abilities, which optimally effective treatment is applied to students of different ability levels. This means that the ATI approach is to create learning conditions that is suitable with the capabilities of the students.

Moreover, ATI approach and PBI model were chosen for the reason of its material characteristics and is also supported by the theory described by many experts, including Pennen, et al (2001:12) stated that through the PBI, the students are helped to be able to learn in the field of science, encourage students to have responsibility in their learning, emphasis on thinking and reasoning skills, understanding, learning how to learn, and works by cooperating with others. From Pannen's thinking, it will become clear that this is suitable for all students, whether the students with high, medium and low capability.

It is also supported by the opinion of Smith (1989:45) who stated that the PBI was one of good teaching because, good teaching has two goals which develop a deep understanding of the material and increases the ability of higher learning. Thus, the approach learning of ATI with PBI was predicted to increase the understanding of the concepts, problem solving and self-efficacy toward mathematics.

ATI and PBI instructional modifications were ever done by researchers (2011) on the junior high school students to see a significant effect on student learning outcomes and efficacy, because at that time the problems that arose and should be given the action was low and the efficacy of student learning outcomes. While the problems that arise at this time for new students is the low ability on mathematical problem solving. Thus, the researchers continued the

research more broadly, to see significant influence of Problem Based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach that were compared with the expository learning toward the mathematical problem solving ability of students of 1st semester of the school year 2013/2014.

Library Reviews

Problem-Based Instruction (PBI)

PBI is a model of learning in which students work on authentic problems with the intent to construct their own knowledge, develop skills of inquiry and higher-level thinking, develop independence and self-confidence (Arends, 2008: 56). Furthermore, according to Ronnis (2001:12) declared that PBI requires students to be able to identify what they know and should look for concepts that are relevant to answer the problem.

The core of mathematics learning with PBI is learning that uses real-world problems as a context for students to learn for understanding mathematical concepts and skillfully to solve problems, and gain knowledge and basic concepts. PBI always begins with the problem by placing the students as active problem solvers who are faced with a problem. PBI has a syntax that includes orientation to learning problems, organizing learning, guided inquiry, develop and present the results, analyze and evaluate the problem-solving process.

Aptitude Treatment Interaction (ATI)

Substantively and theoretically, "Aptitude-Treatment Interaction (ATI) can be interpreted as one approach that has a number of learning strategies (treatment) is effectively used for certain individuals according to their respective capabilities (Nurdin, 2005:37). ATI's approach is an approach that can accommodate differences in learning characteristics of learners, to be able to adapt to diverse learners. This approach can also serve individual differences of students, namely adjusting treatment *(teaching method)* with the characteristics of learners. In applying more emphasis to the provision of treatment which differ in learning, according to the diversity *(differentiation)* their ability to learn different. This learning strategy can be implemented effectively through changes or adjustments between them in the hope of learning abilities/targets, allocation of time, awards/prizes. assignments/works, and the assistance given to the children of each of the diverse groups, although they are learning in the classroom, with themes and subjects alike.

Problem Solving Ability

Definition of problem-solving abilities are revealed Polya (Gani, 2007: 22), the problem solving as an effort to find a way out of a difficulty to achieve a goal. Meanwhile, according Hudojo (2005: 165) problem solving ability is the admissions process as a challenge problem to solve those problems. It can be said problem solving ability is the ability to identify the elements that are known, asked, and the adequacy of the required elements; able to make / construct a mathematical model; able to select and develop coping strategies; able to explain and verify the answers obtained.

The four steps in solving problems, which are presented in sequence (Polya, 1981:67), namely: (1) understanding the problem (understanding the problem), (2) devising a plan (planned completion), (3) carrying out the plan (implement the plan), and (4) looking back (to

re-examine the process and outcomes). The importance of the use of measures and strategies to solve a problem, show that the answer to solving the problem is not easily obtained, but must go through a variety of procedural steps and were able to link the concepts that have been there before. Thus, the learning needs to direct the students to make the steps of solving that are connected to existing concepts so that they can be a problem-solver in the learning.

Research Methods

The research looked at the effect of Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach that was compared with the expository learning of mathematical problem solving ability of 1st semester students of the school year 2013/2014, then this was an experimental research study. This included quasi-experimental research, which was the research to obtain information which was an approximation to the information that could be obtained by actual experiment in a state that did not allow it to control all of relevant variables.

The study design is *The Randomized Preetest-Posttest Control Group Design* or design pretest-posttest control group were randomly taken involving two groups: the experimental group (treated) and control group (without treatment). In this design decision group did not fully randomized, and treatment effect was observed in a more controlled situation by comparing the difference between pretest and posttest in the experimental class and the control class. Experiment class is a class 1C and control class is class 1D. The statistical analysis for this design was to find the gain scores, ie by subtracting the value before from the value after treatment.

Table 1. Reserach Design

Class	Pretest	Treatment	Pos-test
Experiment	O_1	X	O_2
Control	O_3	-	O_4

with $O_{1.3}$: Pre-test
X : Treatment with PBI and ATI model
$O_{2.4}$: Pos-test

The procedure of this study were :

1. To create group of students according to the results of initial tests and the results of IQ tests in the experimental class, which is in the category of low, medium, high IQ.
2. To implement PBI learning with ATI approach in experimental class
3. To provide post-test for the experimental and control classes.
4. To analyze data using parametric statistical tests which use-t.

Results and Discussion

From analysis with using t-test, it was found the following data :

Table 2. Data Analysis

Class	Average Difference	T_{count}	df	t_{table}	Sig.	Ha
Experiment Control	90,70 > 86,65	5,86	72	2,31	0,05	Accepted

From the table above, it can be seen that for aspects of mathematical problem solving ability, calculation of t values obtained for 5.86 with a significant value of 0.05, as the value of t which was greater than the value ttable with significance level $\alpha = 0.05$, then H0 was rejected, while Ha was accepted. Thus it can be concluded that there were significant differences in mathematical problem solving ability between students who learn to use Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach was compared with expository learning.

Wood argued that success in solving the problem depends on the extent to which the functioning of one of the elements is a basic knowledge related to the problem, whereas Polya found problem solving as an attempt to find a way out of a difficulty, to achieve a goal which is not immediately achievable (Gani, 2007: 22). Similarly with problem solvings involving varying contexts are derived from connection of problems in daily life for mathematics situations posed (NCTM, 2000). Students can solve some of the problems raised for them by others. However it easier for them to formulate their own problems based on personal experiences and interests.

Based on both opinion, PBI models with ATI approach is the right solution to improve the problem-solving because ATI approach students are grouped based on ability so that they will be easier to construct their own knowledge to solve problems based on experience and interest.

The average value of problem-solving abilities in the experimental class was higher than the average in the control class. The value gave the sense that there was an effect of giving action towards problem solving abilities of students. Due to the difference between the average of the two sample test, where the experimental class was averages above 75, with both categories, whereas in the control class average was still below 75. From the above, it was known that to provide PBI learning with ATI approach gave positive effect on problem solving ability of the students to the material of union and logic.

Conclusion

Based on the results of the study, there were significant differences in the difference between the mathematical problem-solving ability of students that learn to use Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach was compared with expository learning, where the t value > t table value. There was also the average difference of tests between the two samples, where the experimental class was averages above 75, in both categories, whereas in the control class, the average was still below 75. From the above, it was known that with providing Problem based Instruction (PBI) learning with Aptitude Treatment Interaction (ATI) approach gave a positive effect on problem solving ability of the students to the material union and logic.

Mathematical skills possessed by the most of the experimental class students were able to remember concepts better and to provide arguments for the answers correctly and systematically, compared to the conventional classroom. At the time of completing the problem-solving questions, students were able to choose the appropriate problem-solving strategies better and were able to solve problems related to real life.

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