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INFLUENCE OF PROBLEM BASED LEARNING AND COGNITIVE STYLE LEARNING MODELS ABOUT ABILITY TO SOLVE PROBLEM GEOGRAPHY OF HIGH SCHOOL STUDENTS

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ABSTRACT

This study aims (1) to analyze whether there are differences in problem solving abilities of students who are studied using problem-based learning models (PBL) ill structured with problem-based learning (PBL) well structured, (2) to analyze whether there are differences in problem solving skills between students which has cognitive style Independent Field and Dependent Field. (3) Analyze the interaction of problem-based learning models and cognitive styles towards problem-solving abilities. This study was a quasi-experimental study with two posttest pretest design groups. The subject of the study involved 128 XI IPS students of SMAN 10 and 19 Surabaya 2017/2018 academic year. Data were analyzed using ANOVA. The instruments used were GEFT cognitive tests and cognitive tests. The results showed (1) there were differences in learning outcomes of groups of students taught with PBL ill structured and groups of students taught with PBL well structured; (2) there are differences in the results of learning problem solving groups of students who have a field independent cognitive style and a field dependent cognitive style; (3) there is no interaction between PBL learning models and cognitive style towards problem solving abilities.

Keywords: Problem based learning, Cognitive style, Problem solving ability.

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1. INTRODUCTION

Ill structured problems have become increasingly important skills in a society that is increasingly more dynamic, complex, and diverse (Collins, Sibthorp, & Gookin, 2016). Hong was reaffirmed that the ability to solve ill structured problems was considered as one of the steps to meet recent social needs which emphasized solving real-life problems faced in modern society (J. Y. Hong & Kim, 2016). Solving structured problems (ISPs) is considered as important learning in education because it allows students to apply learned theories into real practice. Geography learning has also made problem solving abilities the main focus. The importance of problem solving skills in geography learning because in geography learning, students are asked to be able to use skills and experience to analyze phenomena of natural phenomena to find solutions that are appropriate to the situation.

But students' problem solving skills in Indonesia are relatively low. PISA (Program for International Student Assessment) and TIMSS (International Mathematics and Science Trends) show that PSA students in Indonesia are still low in 69th position from 76 countries (Erta Sri wahyu, Sahyar & Ginting, 2017). Low problem solving skills because assessment of geography learning is more focused on student learning outcomes, teachers pay less attention to assessing learning outcomes. Teachers rarely give training in problem solving to students, but if students are given problem solving assignments provided mainly well-structured conceptual problem solving, where the solution is in accordance with the principles or steps that are clear. Therefore it is necessary for students to be given experience in solving complex real-world problems that are unstructured problems.

One way to improve students' ability to solve problems is learning Problem Based Learning (PBL) with ill structured problem solving. PBL models based on ill structured problems and based on constructive theory can make learners have high-level thinking skills such as critical thinking, PSA, and creative thinking. Problem based learning (PBL) is an instructional method that encourages students to learn through authentic problem solving. (Marra, Jonassen, & Palmer, 2014).

Unstructured problem-based learning makes students associate abstract knowledge with everyday life. They learn to reorganize information, focus thoughts that lead to new understanding. So that they can find alternatives, evaluate to find the most appropriate solution. Ill structured problems can be used for the development of high-level thinking skills such as abstraction and reasoning. As the research findings (J. Y. Hong & Kim, 2016) that the level of mathematical abstraction can be improved through a problem solving learning approach using unstructured problems.

The ability to solve problems is greatly influenced by cognitive thinking skills and cognitive styles possessed by students. Students who incorporate adult roles with cognitive skills to handle ISPs will be better able to think. Problem solving that is ill structured problem requires higher cognitive abilities than solving problems that are well structured problems (Namsoo Shin Hong, 1998). In solving a problem, each individual has different intellectual perceptions and abilities that are influenced by individual internal factors to process, and external factors are accepted. Individual internal ability as one of the characteristics in learning is cognitive style. According to Keefe, (1987) cognitive style is part of a learning style that describes the habit of behaving that is relatively fixed in a person in receiving, processing and gathering information.

Formulation of research problems is (1) Are there differences in learning outcomes of problem solving between students taught using PBL ill structured with those taught using PBL well structured?, (2) Are there differences in students who have the cognitive style FI and FD

given PBL is learning and PBL was?, (3) Are there interactions between PBL models and cognitive styles for problem solving abilities?

2. METHODOLOGY

This study was designed with a quasi-experimental design. The design used was a factorial version of 2x2 pretest - posttest nonequivalent control group design (Tucman, 1999). Respondents of this study involved 128 XI IPS high school students consisting of two groups namely the experimental group treated PB learning model and the control group were given PBL learning model WSP.

The instruments used in the study were 2, namely: 1) Instruments for measuring cognitive style using the GEFT test adapted from Witkin, et al. (1971), and Degeng (1996), 2) Instruments to measure problem-solving problem solving skills (pretest and posttest). To analyze research data used inferential statistical analysis techniques. The inferential statistical analysis technique used is factorial 2x2 analysis of variance (ANOVA) to test the research hypothesis. Analysis techniques using IBM SPSS Statistics 20 computer programs. Testing of statistical values is carried out at a 5% significance level.

3. DISCUSSION

3.1. The Influence of VS well-structured problem on Learning Outcomes Problem Solving

Hypothesis test results show that there are significant differences in the learning outcomes of geography problem solving between groups of students who are taught by problem based learning learning models that are ill structured problems with students who are learning problem based learning that are well structured problems) in XI IPS students High school Thus it can be concluded that there is an influence of the type of problem on the learning outcomes of problem solving skills. It is evident that based on the results of the test show a significance value (sig) the problem type variable is 0,000 smaller than $\alpha = 0.05$ this means the null hypothesis is rejected or there are significant differences in the results of learning problem solving.

There are differences in problem solving between study groups taught by problem based learning learning strategies based on ill structured problems and learning groups taught by learning strategies of problem based learning in well-structured problem. In total the average score of learning outcomes of problem solving students on the application of PBL learning strategies ill structured is higher than the average score of learning outcomes in solving students' problems in the application of well-structured problem learning strategies. This means that groups of students who learn through ill structured problem solving can achieve problem-solving skills that are superior to the group of students who are given solutions to well-structured problems.

The results showed that the two types of problems affect student learning outcomes, because the pretest and posttest scores have an increase in each treatment, but there are differences in learning outcomes (post test) between students using ill structured problems and well-structured problems. Based on the data of students who underwent ill structured problem solving the average post test score obtained was 77.51 higher compared to students who presented 69.65 well-structured problems).

The advantages of problem based learning learning strategies are based on ill structured problems because they are based on constructivism understanding. Thus the learner can form (construct) his own knowledge after experiencing a real activity (Jonassen, 1997; Jonassen,

2000); According to understanding constructivism, learning is a process of construction of knowledge by learners based on their knowledge (Baser, 2006; Roblyer, 2006). Understanding constructivism focuses on learners and how learners learn so that in essence learning helps learners construct or develop their knowledge. The constructivism approach emphasizes the importance of learning in context, realistic problem solving, and interaction with other learners.

Learning Strategies Problem Based Ill structured learning is one of innovative learning that is student-centered that can make students active, creative and requires students to be active in investigations and problem-solving processes in learning (Savery, 2006) So that learners not only get knowledge about related concepts with problems but also methods of problem solving skills. Students gain learning experiences through problem solving so students can develop analytical and problem solving skills. .

Learning strategy for problem based learning (PBL) is a learning strategy that starts with open ill structured problems that occur in the real world (real world) to find solutions through group work. This is to develop critical thinking skills and solve problems and construct new knowledge, (Hosnan, 2014)

Furthermore, Setyosari added that to develop the ability to solve problems it is necessary to apply problem based learning learning strategies by linking new information with the cognitive structures that students have (meaningful learning) through group learning activities to find solutions to real world problems. Asri, Setyosari, Hitipeuw, & Chusniyah, 2017).

Learning that starts from presenting a contextual problem that is a problem that is in accordance with real world life will encourage more student curiosity and various questions arise in students. This curiosity will foster intrinsic motivation in students to find out from various sources and through investigation, this means encouraging students to have the initiative to learn independently. This opinion is in accordance with that expressed by Arends (2012), there are three learning outcomes obtained by learners from PBL learning, namely a). problem solving skills, b). learn adult role behaviors and c) skills for independent learning. It further states that the characteristics of PBL according to (Arends, 2012) include learning that prioritizes submission of problems or questions, focusing on interpersonal relationships. discipline, authentic inquiry, cooperation, and produce work or demonstrations.

PBL learning strategies to improve students' ability to solve problems in geography subjects. PBL learning emphasizes the notion of constructivism where students construct their own knowledge through experience and knowledge that they already have and PBL emphasizes learning problems starting from the later problems to find solutions to these problems

Unstructured problem solving does not only involve the process of representing problems and generating solutions, such as those found in well-structured problem solving but most importantly there is the process of building arguments and monitoring and evaluation, either explicitly or implicitly. Whereas well structured problems have a well-defined initial state, known target status, a limited set of logic, and a preferred and determined solution path (Ge, Law, & Huang, 2016). Based on the characteristics of the two types of problems, ill structured problems and well structured problems were used in this study to determine the effect of the two types of problems on problem-solving abilities.

The findings in the field that contributed to the success of the research in the experimental class given ill structured problems were (1) all students seemed enthusiastic and actively involved in problem solving, (2) their learning motivation increased, because students were given opportunity to investigate and find information from various sources, and analyze it to solve problems (3) all group members are actively involved and create complementary cooperation.

Thus the advantages found in PBL learning ill structured include students acquiring new knowledge independently; students are actively involved in learning; students can work well together; they give information to each other and students get new experiences from the problem solving process, and can foster self-learning.

Indicators of problem solving are formulating problems, identifying information relating to problems, evaluating problems systematically, analyzing and formulating various solutions to solve problems, determining the most appropriate solutions to problem solving, and making conclusions (Widajati & Setyosari, 2018). Based on these steps, encourage students to have high-level thinking skills and be creative in solving problems. This method also encourages students to become independent learners

According to the benefits of PBL learning, namely (1) students have the opportunity to carry out investigations; (2) improve cognitive abilities; (3) achieving the objectives according to; (4) involves the learner becoming an expert in a particular field; (5) stimulating learners to create several problem solving alternatives and (6) encouraging learners to learn independently.

Students who have good problem solving skills are very likely able to solve related problems in students' daily lives. Therefore, in learning, problem solving skills are very important abilities developed; this is evidenced by the problem solving abilities being the focus of various learning in various countries. (Saragih, 2018). Learners will achieve success and increase motivation if learners are actively involved in the learning process of problem based learning ill structured problem. The findings of this study are in line with previous research (Parwati et al., 2011; Hong, 2000; Tri Kuncoro, 2012; Hong & Kim, 2016; Setyorari, 2017; Jamara, Zaid, Abdullah, Mohamed, & Aris, 2017; Bathć & Ivkov-Džigurski, 2013; Collins, Sibthorp & Gookin, 2016).

The research findings of Parwati et al. Show that students' ability to solve problems facilitated by open structured problems is higher than those with closed problems or well-structured problems (Parwati, Sudiarta, Mariawan, & Widian, 2011). Namso Hong's research provides evidence that there are differences in students' problem solving skills in approaching well-structured vs. unstructured problems (Namso Hong, 2000). These results support other studies which state that the problems of ill structure and well-structured involve different problem solving processes (Namsoo S Hong, McGee, & Howard, 2000).

Other similar studies show that the level of mathematical abstraction can be improved through a problem solving learning approach using ill structured problems (J. Y. Hong & Kim, 2016). Other findings that are in line with the results of the research group of students were given the type of open problem (problem solving open ended) better than the group of students given closed problems (close-ended problem solving) in problem solving (Kuncoro, 2012). The results of a similar study, namely the application of problem-based learning proved to be able to arouse motivation and learning achievement of social studies students of elementary school fourth grade students (Setyosari, 2017). Other findings revealed that metacognitive scaffolding (MS) is dominant in supporting ill structured problem solving problems (Jamara, Zaid, Abdullah, Mohamed, & Aris, 2017).

Students who are involved in setting up education outside the classroom (outdoors) show a significant increase in ill structured problem (ISP) problem solving skills when compared to their peers who study in traditional classroom settings. This means that the environment has an effect on students' ability to solve ill structured problems (Collins et al., 2016).

The final test results showed that there were significant differences between students who were given PBL learning and students who were given traditional learning. Or it can be concluded that PBL has a positive impact on improving geography learning achievement of students in primary and secondary schools in Indonesia (Mandić & Ivkov-Džigurski, 2013).

The results of the study by Mourtos (2004) show that open ended problem solving or problem solving ill structured problems have a very significant effect on: (1) increasing students' ability in problems, (2) increasing students to identify and formulate problems (3). The level of student confidence in approaching real world problems, (4). Students can make the program more interesting.

3.2. Differences in Student Cognitive Style on Learning Outcomes Problem Solving

To determine the effect of cognitive style on learning outcomes of problem solving, it is necessary to test the hypothesis by using variance analysis. Based on the results of data analysis, there is a significant difference in the learning outcomes of geography problem solving between groups of students who have independent field cognitive style (FI) with groups of students who have a field dependent cognitive style (FD) in high school students of class XI IPS. With other companies. Cognitive style has a significant effect on the learning outcomes of high school students in solving geography problems.

There are several findings in this study, among others: First, the research findings reflect the learning outcomes of learners with a field dependent (FD) cognitive style that is significantly superior to learners with cognitive style Independent Field (FI). Learners with cognitive field dependent (FD) have an average score = 74.63 and the average score of learning outcomes in solving geographic problems students taught with cognitive field independent (FI) = 72.67. So that overall, the learning outcomes of solving geographic problems of students who are taught with cognitive style dependent fields (FD) are better than cognitive field independent (FI) styles. The results of this study agree with that (Sirin & Guzel, 2006, (Gholami & Bagheri, 2013). The cognitive style of students influences the ability to solve geographic problems (Aljaberi, 2015), in his study found that there were differences in learning styles towards learning outcomes in solving geography problems. Students who have a field dependent (FD) cognitive style are easier to understand social problems, while students who have an independent field learning style (FI) are quicker to understand logical questions.

Second, cognitive style field dependent (FD) is significantly superior to learners who have a cognitive field independent (FI) style. That happened only in the social field. Catherine's findings. H. Lee et al. (2005) that students who FD are the best success with socially oriented learning tasks. This is similar to Saracho, (1998). which states that FD students prefer to work on social task-oriented problems. This finding is similar to Okwo and Otubah (2007) and Adeyemi (1992) who found that field dependent students were significantly better than field independent students in the social and arts fields. . Onyekuru Bruno Uchenna (2015). also concluded that field dependent students had higher average achievement in art than independent field students while field independent students had higher achievement in the field of science than field dependent students.

Third, the cognitive style of Witkin and Goodenough (1981) shows that cognitive style influences students in how to assimilate and process information and express what they know. Saracho (1997) states that cognitive correlates with attitudes, strategies and preferences that influence individuals how to understand, solve problems and recall. Cognitive style is defined as a person's unique way of solving problems, thinking, understanding, and remembering (Bendall, Galpin, Marrow, & Cassidy, 2016). Students who enter the role of adults, the cognitive skills to handle ISPs will be better able to solve problems (Collins et al., 2016).

According to Witkin (1971), cognitive styles have two Field Independent (FI) and Field Dependent (FD). Students who have a field dependent cognitive style, have a tendency, among others: (1) have a global mindset; (2) grouped or socially oriented so that it appears friendly,

kind to others; (3) prefer to choose professions oriented to social skills; (4) lacks the ability to have restructuring, so they tend to accept existing structures; (5) have external motivation, so that tend to be enthusiastic in working when given reinforcement such as giving gifts, praise, motivation from others); (6) tend to follow existing instructions.

Field Dependent likes to socialize, integrate themselves with people around them and usually empathize and want to understand other people's thoughts. While Field Independent usually tends to be independent, confident and competitive. They tend not to communicate with people and are not physically or psychologically close to them. They are less influenced by people around and don't like getting feedback. Thus it can be concluded that cognitive style is very influential on learning outcomes is also very influenced by the learning environment, especially teachers as instructors.

3.3. The Effect of Interactions between Learning Strategies and Cognitive Style on Learning Outcomes in Problem Solving Geography

Based on the results of the hypothesis test, there was no significant interaction between the problem-based learning and cognitive style learning strategies towards the learning outcomes of geography problem solving in XI IPS high school students. From the results of the interaction analysis with factorial ANOVA obtained $F_{\text{count}} = 2.684$ is smaller than $F_{\text{table}} = 3.918$ and significance value $= 0.104$ is much greater than $\alpha = 0.05$, then the decision taken H_0 is accepted, meaning there is no interaction between problem based learning (PBL) learning strategies and cognitive style towards learning outcomes in solving geography problems. Thus the effect of learning ill structured problem based learning (PBL isp) and problem based learning well structured (PBL wsp) in improving learning outcomes in problem solving is not influenced by cognitive style.

The results of the study show that there is no interaction effect of problem based learning learning strategies and cognitive styles on learning outcomes in problem solving. This can be interpreted that the superiority of learning strategies structured problem (PBL isp) based learning problems are not influenced by cognitive style.

Thus means the superiority of PBL learning strategies based on structured problem (PBL isp) brings the main effect (main effect) on the learning outcomes of problem solving. This can be demonstrated by the existence of theories and research results that support the understanding of PBL learning strategies based on structured problem problem solving skills.

According to Barrows (1996) and Arends (2004) PBL learning strategies are strategies that are capable of developing ways of thinking, problem solving, intellectual skills, acting like adults through real situations or simulations and becoming independent learners. Learning that is truly done can develop learners to understand concepts and problem solving skills (Lyle & Robinson, 2001)

Learning that involves involving learners, in accordance with constructivist views, can help learners build or shape their own knowledge (Clough & Clark, 1994). Furthermore, it is said that the knowledge built by the learner has the advantage of being easy to remember, easy to understand so that the learner will be better able to provide the right answer, if given questions related to the problem at hand (Kuncoro, 2012).

Empirical studies through research results that are in line show that problem solving strategies and learning styles do not interact to influence learning outcomes (Skelton, 2006; Kuncoro, 2012), Learning styles and use of strategies do not interact significantly to influence learning outcomes.

Research results from various fields of study show superiority and provide a better influence on learning outcomes of learners who are taught using PBL learning strategies than those taught with conventional learning strategies (Tan, et al, 2009; Made, 2009; Liu et al. (2010) Other studies have produced findings that have no effect on the interaction between learning models and the cognitive style of learning outcomes (Saiful Khalid, 2010).

Theoretical implications related to the findings in this study for learning strategies in high schools in general, as follows.

Problem solving is determined by how students understand the problem they want to solve. The results of the study show that understanding of geographic problems greatly influences their ability to solve geographic problems. Students who have an understanding of geographical problems tend to have better geographic problem solving skills. Therefore teaching teachers should provide students with a prior understanding before students are given geographic problem solving. Because mistakes in understanding the problem will have an impact on the solution or the solution obtained will also experience errors.

The ability to solve problems is also very determined by the student's experience in solving problems done before and the first knowledge they have. So the implication is that teachers should provide more training or assignments to solve problems both well-structured and ill structured problems. Because according to Basadur et. al. (1982) showed that training was possible to improve behavior, practice, and creative problem solving performance in applied research organizations. Even Bahadur et al. (1990) said from the results of his research that practice practices improve skills in finding and solving creative problems in the real world and are not programmed.

Students can get a real learning experience, when faced with problems that occur in everyday life to find solutions to these problems. The implication is that teachers should also consider the basic abilities of students in using mastered interdisciplinary knowledge, because if it is not considered it will have an impact on setbacks or not be motivated to complete the task.

It is better not to look for a single answer in each problem that is presented so that students learn to find other alternatives that cause students to learn a lot creative and analyze each problem well. The implication is that the teacher should also accompany him well so that he can give the right direction even though not giving answers because the best solution is determined by a good instructor too.

Lack of information search skills often fails in solving problems, although unstructured problems sometimes have no satisfying answers. This is like the results of a study from Laxman (2010), that information search skills do play an important role in problem solving. In addition, it is better to learn to pay attention to student learning styles, because knowing the student's learning style will have a more positive effect on learning outcomes.

4. CONCLUSION

The learning outcomes of geography problem solving between groups of students taught using ill-structured learning problem-based learning (PBL isp) with groups of students taught using learning problems-based learning well-structured (PBL wsp) showed a significant difference. Students who are taught using PBL isp learning are better than students who are taught using PBL wsp learning. This means that structured problems are more suitable to be used in learning problem based learning in students of class XI IPS Surabaya High School.

There are differences in learning outcomes for geography problem solving between groups of students who have field independence (FI) cognitive style and groups of students who have

a cognitive field dependence (FD) style. Geographical problem solving learning outcomes obtained by students who have a field dependence cognitive style (FD) are higher than students who have field independence (FI) cognitive style. This means that problem based learning learning strategies are more suitable for students who have FD cognitive styles for geographic subjects in high school.

There is no influence of interaction between problem based learning and cognitive style learning strategies on learning outcomes in solving geography problems. This can be interpreted that the superiority of the learning strategy of structured problem (PBL isp) problem based learning is not influenced by cognitive style. Students. Because the success of this model is also influenced by the role of the teacher as a facilitator, mediator and motivator in learning.

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