

## The Ability to Solve Problem Based Learning through Learning Styles Based on F1 Cognitive Style

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### Article History

Received: 02.10.2018

Accepted: 12.10.2018

Published: 30.10.2018



**Abstract:** This Research was made to understand the influence of the learning model of problem-based learning (ill structured problem vs well-structured problem) on the ability to solve geographical problems in terms of students who have no field independence (FI) cognition. This Research Subject are quasi experimental study high school students in class XI IPS with a number of 66 students. Data collection techniques use problem solving description tests and cognitive style tests. Data analysis techniques using t-test. Statistical test results show there are differences in the average value of post-test learning outcomes problem solving skills between experimental and control classes in students who have field independent cognitive style (FI). Sig value. (2-tailed) 0.000 <0.05, and the average value of the experimental class is higher (75.74) than the control class (69.19). This means that learning based problem based learning is ill-structured influence the ability to solve geographic problems for students who have a field independent cognitive style (FI)

**Keywords:** *Problem based learning*, FI cognitive style, problem solving ability.

### INTRODUCTION

Problem solving ability has played as an important role in Geography subjects in high school. Students Conception about geographic phenomena varied as each individual brings a different experience and a different way of thinking about the world [1].

Therefore, the involvement of students in constructing science will depend on the relationship between what they know and the topics taught [2]. In nature, teaching geography is not just presenting concepts and information, but must actively involve students in the process of learning and rational thinking, namely information gathering skills, information processing skills and decision-making skills, as well as problem solving abilities.

But the fact those students' problem solving abilities in Indonesia are low. There are a number of possibilities because of the lack of developing problem-solving abilities including the process of defending the teacher is still centered on the teacher, lack of student involvement in the learning process so that students get material passively and lack of ability to solve problems [3]. According to Johnson *et al.* [4], the experience of solving problems in everyday life is generally not structured, complex, and diverse, but in class students often learn to solve structured problems well [5]. This concurs with Shute *et al.*, that the teacher nature teach problem-solving skills in the classroom, the problems presented tend to differ from the problem faced in the real world, that means the problems presented is usually

defined and structured, while the problems in real life are often unstructured [6].

In solving a problem, each individual has different intellectual perceptions and abilities. This difference is due to differences in individual cognitive types and the internal abilities of individuals to process the external influences they receive. One of the characteristics of an individual's internal capabilities in learning is a cognitive style (cognitive style). Cognitive style is the habit of students in processing information, understanding, thinking, solving problems, and remembering. Witkin *et al.* [7] describes cognitive style as individual differences in ways of thinking, learning, perceiving, solving problems and assimilating new knowledge.

To address the issue needed a learning that is able to make the self-active learning is learning Problem Based Learning (PBL). Boud and Felletti, Fogarty stated that PBL is a learning approach by making confrontations with students with practical problems, in the form of ill-structured, or open ended through stimulus in learning.

Setyosari [8] states that problem-based learning is a strategy or method of learning characterized by the existence of real problems, *real world problems* as a context for the learning process for critical learning and problem solving skills and acquiring knowledge.

The characteristics of PBL learning among the learning begin with problems. Problem as a means for development to stimulate problem-solving skills, cognitive processes of students. Problems presented in PBL style learning can be well structured problem (wsp) and ill structured problem (ISP). As stated by Diyana Jamari that generally, the problem is classified into ill structured problems and well-structured problems [9].

A well-structured problems (*well-structured problem*) can be solved in a straightforward because the solution strategy is linear and easy to remember. *Non-structured problems (ill structured problems)*, require complex cognitive operations and deep thinking. Because of the unique ISP, students need additional support to understand and clarify the conceptual or declarative knowledge learned. FI cognitive style is more dominant in supporting the ability to solve ISP.

Therefore it is necessary to introduce and train students to solve the problem of wsp because they contribute to more meaningful learning, allowing students to describe the relevance of knowledge learned in school and facilitate the transfer of knowledge by contextualizing knowledge in authentic real-world situations.

This is evident from several similar studies which show that students' ability to solve problems by using problem-based learning models is better than conventional learning [10]. Likewise the hypothesis of the average acquisition of critical thinking and problem solving abilities of students taught with problem-based learning is better than conventional learning. This means that there is a deleterious effect of problem-based learning on students' critical thinking and problem solving abilities [10].

General problem solving based learning emphasizes mass well-structured rather than unstructured problems. School should design the learning so that students experience real life authentic through problem solving to help students gain skills on solving a right real-world problems and working in the team [11]. This research will prove whether the application of PBL by using ill-structured problems is better than well-structured in improving geographic problem solving skills for high school students.

## RESEARCH METHODS

Testing the effect of learning strategies on problem based learning ill structured and learning based

learning well-structured on learning outcomes problem solving abilities carried out using a quasi-experimental research design with t-test design. This experiment involved two groups of subjects who had the same field independence (FI) cognitive style. The two groups treated with different strategy learning and giving posttest the group of subjects who are subject to ill treatment structured PBL problem (PBLisp) and a group of subjects were subjected to treatment well-structured PBL problem (PBLwsp). The independent variable in this study is the PBL isp and PBLwsp learning. While the dependent variable is the learning outcomes of problem solving abilities.

The research subjects were high school students in grade XI IPS with a total of 128 students then selected through purposive sampling technique [12]. By taking students who have cognitive style FI totaling 66 students are divided into two classes, namely class A as sejum experimental class was 35 students and class B as the control class number of 31 students. The research instrument was used in the form of problem solving description test (test post), and cognitive style instruments using Group embedded figures test (GEFT), developed by [7].

Analysis of data using independent sample t-test using SPSS 20 for w ind OWS with a significance level of 5%. Before the t test is carried out the prerequisite test is the normality and homogeneity test. The normality test using Kolmogorov analysis smirnow, the test criteria is if the Sig obtained  $> \alpha$ , then the data is normally distributed. Test of homogeneity with the levene test, while testing the variance homogeneity is that the data has a homogeneous variant of sig value  $> \alpha = 0.005$  The test was carried out at a significance level of 5%. If from the results of the normality test and homogeneity of variance, it is known that the sample is normally distributed and homogeneous, so it is continued by t-test analysis with the test criteria if the value of sig. (2-tailed)  $> 0.005$  then  $H_0$  is accepted and  $H_a$  is rejected, and if the value sig. (2-tailed)  $< 0.005$  then  $H_0$  is rejected and  $H_a$  is accepted. The test was carried out at a significance level of 5% ( $\alpha = 0.05$ ) and a confidence level of 95%.

## RESULTS AND DISCUSSION

### Results

Based on table 1 there are differences in learning outcomes between the experimental class and the control class, both of which have field independence (FI) cognitive styles. The average posttest score of each treatment for problem solving with independent field cognitive style obtained experimental class mean values 75, 74 and control class mean value 69.19. Standard posttest deviation of experiment = 4,572 and standard deviation of posttest control = 5,486. Based on these results it appears that there is a difference in the average post test score of the experimental class is higher than the control class students.

**Table-1: Differences in experimental class values and control classes that have cognitive field styles Independence (FI)**

Group Statistics					
	Class	N	Mean	Std. Deviation	Std. Mean error
Learning outcomes	Experiment Class (PBL ISP)	35	75.74	4.572	.773
	Control Class (PBL wsp)	31	69.19	5.486	.985

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Learning outcomes	Equal variances assumed	.456	.502	5.289	64	.000	6.549	1.238	4.075	9.023
	Equal variances not assumed			5.230	58.672	.000	6.549	1.252	4.043	9.055

Hypothesis test results show that there are significant differences in problem solving skills between groups of students who learned *problem based learning* learning strategies based on *ill-structured problems (PBLisp)* with groups of students who learned *problem based learning* learning strategies based on *well-structured problems (PBL wsp)*. The test results showed that the value of significance (sig) variable is 0,000 is smaller than  $\alpha$  0,05. This means that the null hypothesis dit megrim or there is a significant difference between the learning outcomes of study groups taught by PBL strategy isp and study groups taught PBL wsp. L ha can be seen in Table 2.

Based on the data output above (SPSS 20), the sig value is obtained. 2. (tailed) of 0.000 <0.05, according to the basis of decision making in the independent t-test, it can be interpreted that H<sub>0</sub> is rejected and H<sub>a</sub> is accepted, or it can be concluded that there is a difference between the average learning outcomes between groups of students treated PBL learning ill structured problems with groups of students who were treated with PBL well-structured problem learning.

**DISCUSSION**

The results of this study indicate that there are significant differences in the ability to solve problems between groups of students who are taught with PBL isp learning strategies with groups of students who are taught PBL wsp learning strategies. This means that there is an influence between the learning *problem based learning* by *ill* and *well-structured problem structured problem* terhadaphasil learn problem-solving

skills of geography class XI student in high school that has a style cognitive *Field Independence (FI)*.

**Effect of learning strategies on learning outcomes problem solving skills**

Based on the results of hypothesis testing revealed that there are differences in the ability to solve geographic problems significantly between classes that were learned by *problem based learning* strategies based on *ill structured problems (PBL ISPs)* and *well-structured problems (PBL wsp)*. This study found that with *problem based learning based on ill structured problems*, the average ability to solve geographical problems was higher than *problem based learning based on well-structured problems (PBL wsp)*. The test results showed that the value of significance (sig) variable is 0,000 less than  $\alpha$  0,05. This means that the null hypothesis is rejected or there is a significant difference in learning outcomes between the study groups taught by PBL strategy *tructured ill's problem* and *w ell structured Problem*.

The learning process with learning strategy *problem based learning ill structured* significantly gives a better influence on students' ability to solve problems, compared to *learning well-structured problem based learning*. This is in accordance with the statement that Capacity of solving unstructured problems (*ill structured problem*) has become an increasingly important skill in a society increasingly more dynamic, complex, and diverse [13].

PBL learning strategies use problems as a first step to gathering and integrating new knowledge. PBL

design involves real-world, unstructured (ISP) use in a learning environment centered on students with the support of teachers as facilitators [11]. Thus students learn to solve problems collaboratively, in small group settings with guidance from the facilitator. The use of structured issues (ill structured) in PBL involves students who have the cognitive ability are good. This cognitive ability includes identifying and formulating research problems, asking questions, designing and investigating, making comparisons, giving exposure, applying prior knowledge to new situations, generating alternatives, building arguments with justification, making decisions, and monitoring progress.

Some students initially face difficulties in identifying and formulating problems. They may not be used to thinking hard and deeply about complex problems and are reluctant to try. But the teacher gives students the opportunity to involve friends or the environment outside the classroom in the search for information and identification of problems. Then they brainstorm and conduct investigations, making learning more interesting.

Problem-based learning is an instructional method that encourages students to learn through authentic or real-world problem solving. As Kuang-Chao Yu *et al.* said, that to foster students' problem solving abilities, the problems presented in learning must use real-life scenarios that provide opportunities for students to become real-life problem solvers [5]. Simulation on helpful context to foster students' ability to define and analyze the questions and choose and develop solutions. Learning based on context can be effectively enable students to make the troubleshooting process is complete.

Well-structured and unstructured problems can help students learn concepts and ideas because they provoke group discussion and give students experience in solving problems faced in the field. When group discussion can be found there is an influence on the quality of learning, because in groups there is interaction between students, working together to solve problems or tasks given by the teacher. Thus, there are interpersonal and communication relationships with each other, both with friends in groups or with the teacher. They express their opinions constructively so that they can get better understanding of the problem.

Structured problems are not well defined or unclear, can have many solutions, unknown variables, and inconsistent relationships between concepts, rules and principles. The characteristics of unstructured problem solving (ISP) are complex and unclear problems and students need to evaluate alternative solutions and critical thinking to find some alternative solutions to problems [14]. While solving the mass structured problem (wsp) is an iterative process and there is only one correct answer [15]. Therefore the

*problem of being well structured (problem structured)* does not allow students to develop problem-solving skills. As disclosed [8] Retained Earnings general, the problem is considered the most well served to fixers is unstructured problems.

The results of this study indicate that PBL isp strategy is more effective than Wsp, proved that the average learning outcomes of problem solving ability in PBL class isp 75.86 is superior to wsp 69.16, because it has advantages such as developing effective problem solving skills, and developing independent learning skills. PBLisp learning also allows learners to take responsibility for their own learning. Unstructured problems stimulate students to ask questions that map their actions, leading to independent inquiry. If students are given the experience of working on unstructured problems, they will be better prepared to face real-world challenges in their future [16].

Each individual has the capacity to solve problems at different levels [17]. The ability to solve problems creatively is one of the key performances, because every day is faced with a new problem. To create the necessary problem-solving solutions in convergence and divergensi thinking [18]. Capacity of solving ma one also involving causal reasoning, structure, and knowl knowledge system [19].

Individuals with the divergence thinking type are able to provide a choice of new ideas or several alternative solutions so that they are usually associated with creativity, while convergence-thinking individuals are able to analyze ideas and be associated with the ability to solve well-structured problems. Pattern of thinking in this convergence is only one answer that are right. Individu who have this mindset is usually superior in languages (read something, memorizing), so it is more suitable when in erring troubleshooting well structured (well structured).

Most of the subjects of geography in middle school students are given a problem *well structured*, so students regular pitch well structured complete solutions to the problem of ill structured problem. In general, problem solving involves defining a problem, gathering information related to the solution process, reasoning through a problem state to examine solutions and evaluate solutions [20].

### **Influence of Cognitive Style on learning outcomes of problem solving skills**

The process of thinking a person is influenced by individual characteristics. The characteristics that are meant are cognitive styles. Cognitive style is part of the learning style that describes the habit of behaving permanently in a person in accepting, solving problems and in storing information, so that the teacher can accommodate a variety of learning strategies according to the cognitive style character possessed by students .

Cognitive styles are twofold: independent and field dependent cognitive field styles. This characteristic is related to one's ability to solve problems and the effect in the learning process.

Based on the results of data analysis that shows there are significant differences in the results of geography problem solving students who have cognitive FI style between the experimental class and the control class. The experiment class was treated with an ISP problem based PBL learning and the control group was treated with PBL learning based on wsp problems. The results in this study, namely: students with FI cognitive style who are learning with PBL isp are significantly superior than students who study with PBL DSP. The average score of the results of learning the geography problem solving of students who were taught with PBL isp = 75.86 and the average score of the results of learning geography problem solving students who were taught with PBL wsp = 69.16. So as a whole, the results of learning geography problem solving students who are taught with PBL isp better than PBL wsp, especially for students who are FI-style cognitive. This finding is in line with the results of the study [21] which reveals that students' ability to solve geographic problems varies depending on their learning style [22]. The results of the study found that there were differences in individuals who had cognitive abilities in the ability to solve geographic problems.

The type of problem given in this study is a problem related to problems in everyday life. Students who have a *field in dependent* (FI) learning style are able to solve the problem well, because it is easier to understand the problem in a given case problem, and to understand problems that are logical. The cognitive way is a part of learning style that describes the habits of permanent behavior in a person in accepting, solving problems and in storing information, so that the teacher can accommodate a variety of learning strategies according to the cognitive style character possessed by students. So cognitive style is very influential on learning outcomes is also strongly influenced by the learning environment, especially the teacher as a motivator.

The problem of ill structured requires divergent thinking skills and well-structured problems requiring convergent thinking skills. *Ill structured problems* require various alternative solutions to problem solving. Divergent thinking ability is owned by students who are independent cognitive field (FI) styles. Therefore, the results of hypothesis testing say that students who have a FI cognitive style are superior in completing unstructured *problems* (*Ill structured problems*). Findings similar to Adesoji [20] have the effect of problem solving learning strategies on different levels of students' abilities. In addition, there is also a positive relationship between problem solving and academic achievement and student involvement in

problem solving tasks determines problem solving ability to a higher level [23]. Students which have *independent* cognitive style field (FI) gives a better effect on the ability of m emecahkan problems of the students who have the cognitive style *field dependence* (FD).

## CONCLUSION

There are differences in the ability to solve geography problems between groups of students taught with problem-based learning *ill-structured* with groups of students taught with *well-structured* problem - based learning. The findings indicate that the types of ill-structured and well-structured problems have a positive effect on the learning outcomes of the ability to solve geographic problems. The difference in ability to solve this problem is viewed from the cognitive style of the independent student field (FI). Students who have FI cognitive style have the ability to solve *ill structured problems* better than *well-structured problems*. Suggestions for teachers g ne pe Rapan eografi in problem-based learning strategies should be selected types of problems is the problem of unstructured (*ill structuredproblems*). In choosing a learning strategy the teacher should also pay attention to students' cognitive style. PBL isp learning strategy is more suitable for students who have field independence (FI) cognitive style.

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