



## Difficulty Analysis of Mathematical Problem Solving in Accordance with Student Dependent Fields Based on Marzano Taxonomy for Grade VIII Students

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### Abstract

Cognitive style is an individual characteristic in using cognitive function (solving problems). One of the widely studied cognitive styles are field dependent cognitive style and field independent cognitive style. Nowadays problem solving abilities are important to our life. Student difficulties in solving problems is very various. Students low abilities can be seen from how many students make the mistakes in solving the problems. Marzano Taxonomy is developed to break the limitation of Bloom Taxonomy. Marzano Taxonomy cognitive level can be divided into four components retrieval, comprehension, analysis, and utilization. The purpose of this observation is analyse the mathematics problem solving according to level cognitive Marzano Taxonomy viewed from students field dependent cognitive style and students field independent cognitive style. This observation was conducted with qualitative method. Population of this observation is 7th grade students from Junior High School 1 Donorojo Jepara District. The observation sampling technique is cluster random sampling which is random sampling. Based on the results of the research and discussion above, it was found that: 1) the difficulties experienced by students with the *Field Dependent cognitive style* in solving mathematical problems based planning. 2) Students with the *Field Dependent cognitive style* lack the courage to solution.

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## INTRODUCTION

Education is a source of quality development of human resources. In essence, the learning program aims to understand, master, provide understanding and mastery about something that happened (Wena, 2011). One effort to improve the quality of human resources is through the learning process in schools. Difficulties in learning are often encountered in learning activities at school. Based on discussions with peers, one of the most difficult subjects is mathematics.

Problem solving has become a major focus in school mathematics teaching. One of the agenda of the *National Council of Teachers of Mathematics* in the United States in the 80s was that problem-solving should be the main focus of school math in the 1980s (Suherman, 2003). The results of the study show that mathematics problem solving can improve students' thinking processes (Kusumaningrum, 2012). The teacher is the main source for students in helping problem solving (Kahyaoglu, 2012). The result of early observation at SMP N 1 Donorojo shows that mathematics learning is only seen as a monotonous and procedural activity, that is the teacher explain the material, give the example, assign the students to do the exercise question, check the student's answer in passing, then discuss the solution of the problem which is then emulated by students so that students still have difficulties in solving mathematical problems. The difficulties experienced by students in solving mathematical problems still vary. The difficulty of understanding the meaning of the problem, the difficulty of determining what mathematical operations should be performed and the difficulty of converting known variables into the form of a mathematical language are common. Students do not yet understand the algorithm that can be used to assist them in solving mathematical solving problems. One of these facts was seen during the preliminary study to determine the students' mathematical problem solving abilities of class VIII on the flat form material where students have not been able to solve the given problem solving problem.

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When referring to the purpose of education, the taxonomy can be used to analyze or classify a view related to educational activities in their daily form. In this regard, an educational psychologist developed a taxonomy which became known as Marzano Taxonomy. Marzano's new taxonomy is made up of three systems and knowledge domains, all of which are important for thinking and learning. The three systems are self-systems, metacognitive systems, and cognitive systems. When faced with the option of starting a new task, the self-system decides whether to continue the current habit or to enter into a new activity; the *metacognitive* system puts in order the various goals and keeps the level of attainment of those goals; the cognitive system processes all the information needed, and the domain of knowledge provides its contents (Krathwohl, 2002). The three domains of knowledge in Marzano Taxonomy are domains of information, mental procedures and physical procedures. The information domain is the

process of collecting information. Mental procedures are the process of proving the truth of the information obtained. Physical procedure is a problem solving process based on information obtained and mental procedures that have been carried out. Nakyam's (2013) study showed that the curriculum compiled based on Marzano's taxonomy provides a new experience in learning English.

From what was described, the researcher intends to conduct an analysis of the difficulty of solving mathematical problems according to the *field dependent* students based on the *cognitive* level of Marzano's taxonomy.

## METHOD

A qualitative approach was used in this research. This approach was used to find a stage where students have difficulties in solving mathematical problem that are arranged based on Marzano's taxonomy in accordance with the field dependent cognitive style or the independent field cognitive style they have. According to Moleong (2010), a qualitative research is a research that intends to understand the phenomenon of what is experienced by the subject of research, for example behavior, perception, motivation, actions and others, holistically and by means of descriptions in the form of words and languages, in a specific, natural context and by utilizing various natural methods. The selection of qualitative methods in this research was carried out with the consideration that qualitative methods are the most appropriate method used to describe students' difficulties in solving mathematical problem based on Marzano's taxonomy in accordance with the style of field dependent cognitive the students have.

The procedure in this study is divided into three stages, namely preparation, implementation, and exposure. The preparation stage includes the arranging of instruments, namely problem solving which are compiled based on Marzano's taxonomic cognitive level, interview guidelines and GEFT questions. Problem solving question will be a tool to find students' difficulties in solving problems. Interview guidelines were used to explore deeper information about students' difficulties in answering problem solving questions. The GEFT test was used

to determine the *cognitive style* of each student. Mulyono (2012) divides the GEFT test into 3 sessions. The first session consists of 7 items, the second and third sessions consist of 9 items each. The first session is only used as an exercise. The score results in the second and third sessions are used as a reference in determining students' *cognitive style*. Students with a score of 0 to 9 enter into Field Dependent students. After the instrument was compiled then data collection was carried out. The qualitative method was used in this research.

In the implementation, the instruments that had been made at the planning stage were validated by experts before being used in the research. Once the instrument was ready for use then the next step was the process of data retrieval. Data collection was done by testing GEFT test (Group Embedded Figures Test) for the students. Students worked on the GEFT test to determine the cognitive style of each student. Subsequent data retrieval was carried out by testing the problem questions in the form of problem solving questions that were prepared by referring to Marzano's taxonomy. After a written test, then 4 students were asked to be interviewed. Interviews were conducted towards 4 students who had a field dependent cognitive style with high and low abilities, and 2 students who had independent field cognitive style with high and low abilities. Interviews were conducted as long as 30 to 45 minutes. The interview was conducted by using a voice recorder.

At the exposure stage the results of the analysis were presented and used to determine the *cognitive style* of each student, to find out the difficulties and causes of difficulties for students who had a field dependent cognitive style in answering problem solving question that are prepared based on Marzano's taxonomy. Data collection methods in this study were written test methods.

This research was conducted at Donorojo State Junior High School 1 (SMP Negeri 1 Donorejo), Jepara Regency, with consideration of: (1) heterogeneous students' academic abilities so that it was interesting to study, (2) mathematics learning at Donorojo *State Junior High School 1* was still found to be a barrier to students in solving math problems.

According to Lofland (in Moleong, 2007), the main data in a qualitative research are the remaining words and actions and additional data such as

documents, photos, videos, written data sources and statistics. Qualitative data were obtained from the results of student problem-solving tests to see students' thinking processes and in-depth interviews to find out the reasons behind the answers. The qualitative data was also obtained from expert validation of the research instruments, feedbacks, responses, criticisms, and suggestions from various stakeholders. Sources of data in this study were students of class VIII B of Donorojo 1 State Junior High School consisting of 21 students. The selection technique of the research subject used was purposive sampling, namely the data source was taken with certain considerations. The main data source in this research was observation on the implementation of the learning process of mathematics in the classroom, interviewing the students of class VIII B. Documentation of test results was in the form of student answer sheet to analyze students' problem solving difficulties. The subject of the interview was selected based on the GEFT test results and the mathematical problem-solving test results prepared on the basis of Marzano's taxonomy. The main data source was recorded or documented through photos and videos. Recording the main data sources was done through interviews and observations as the result of a combined effort of viewing, listening and asking questions.

Data collection techniques are the most important step in a research because the main purpose of research is to get data in terms of ways or techniques of data collection. Data collection techniques can be done by observation, interview, questionnaire, documentation and the all four combination (Sugiyono, 2013). Data collection techniques used in this study consisted of observation, interviews and documentation.

Inspection techniques were required to obtain the validity of the data. The implementation of these techniques is based on four criteria, namely credibility, transferability, dependability and confirmation. (Moleong, 2007: 324). Qualitative data analysis is inductive, that is an analysis based on the data obtained, then developed a certain relationship pattern or become a hypothesis (Sugiyono, 2008: 335). The method of data analysis conducted in this research is as follows. a) The researcher corrects the results of the answers and interviews given by the

subject of the given mathematical problem. b) Analyzing the test results and the results of the interview to describe the difficulties of field dependent students in solving mathematical problem solving based on Marzano taxonomy. Before being analyzed, the interview data were checked for validity using triangulation method that is comparing the results of interviews with the results of student tests in solving the problem. Re-analyze the data of the results of answers and interviews to determine a definite conclusion.

## RESULTS AND DISCUSSION

### Results

Based on the results of GEFT tests that had been done, there were 11 students with Field Dependent cognitive style. Students with this Field Dependent category got scores ranging from 0 to 9 of the two GEFT test sessions that had been conducted.

Based on the research that had been conducted towards student difficulties with the *field dependent cognitive* style on problem solving problems that are prepared by referring to the *cognitive level* of Marzano's taxonomy, the results are presented in Table 1 below.

No	Cognitive Level	Problem Understanding	Solution Planning	Planning Implementation
1	Retrieval	4	5	1
2	Retrieval	3	5	2
3	Comprehension	4	5	
4	Comprehension	4	5	
5	Analysis	6	4	1
6	Analysis	5	6	
7	Utilization	5	6	
8	Utilization	5	4	4

**Table 1.** Results of FD Student Difficulties Analysis

### Discussion

In this research, 25 GEFT questions were divided into 3 sessions. In session 1 there were 7 images to be solved. In session 2 there were 9 images to be solved, and session 3 there were 9 images to be solved. Of the three sessions, the first session was

only used as an exercise. While the second and third sessions were used as a reference in determining the cognitive style of each student. Referring to Mulyono (2012), students who got the FD predicate FD were students whose score was from 0 to 9.

Based on the results of the research that has been done, it was found that 45% of students with Field Dependent cognitive style had difficulties in the first stage of the problem solving process, namely understanding the problem. There were 50% of students who experienced difficulties in the second stage i.e. planning of mathematical problem solving and the remaining 5% experienced difficulties in the third stage, namely in the implementation of the problem solving plan that had been made.

## CONCLUSION

Based on the results of the research and discussion above, it was found that the difficulties experienced by students with the *Field Dependent cognitive style* of class VIII B 1 Donorojo State Junior High School 1 Jepara District in solving mathematical problems based on the *cognitive level* of Marzano Taxonomy is in the second stage of the problem solving process, namely compiling plans solution to problem.

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