Analysis of Troubleshooting Ability Reviewed From Student Cognitive Style

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Abstract. : *This study aimed to determine and describe: 1) the level of students' problem solving skills; 2) the students' cognitive profile style 3) the differences in the ability to solve mathematical problems between students who have field independence cognitive style (FI) and field dependence (FD); and 4) the influence of cognitive style on students' problem solving abilities. This research was an ex-post facto research with correlational with a qualitative descriptive approach. When the research was conducted in the even semester of Academic year 2018/2019 at the University of Muhammadiyah Makassar, the population were all students of Mathematics Education Study Program in semester IV with 180 students that spread over 8 classes with sample of 57 people taken through group sampling techniques.Data analysis techniques used in this study include quantitative descriptive analysis techniques and statistical statistics through simple regression analysis. The findings of the study: 1) the level of problem solving ability of students is in the medium category with an average value is73.17 with the highest value ois 94 and the lowest value is 40 with a range is 64; 2) The cognitive style profile of students was dominated by the cognitive style of field independence by 91.2% and the cognitive style of field dependence is 8.8%; 3) There is a difference in the ability of solving problems between students who have a field independence cognitive style and a dependent field cognitive style. Where students with cognitive field independence style have higher abilities (in the high category) compared to students with cognitive field dependence style (in the medium category); and 4) Cognitive style has no significant effect on students' problem solving abilities, this illustrates that the cognitive style possessed by each student was not adequate to improve problem solving abilities for students. In solving mathematical problems, students need analytical skills, reasoning, adapting various approaches and strategies, reconstructing problems in other contexts involving mathematics, building new mathematical knowledge through problem solving, and monitoring and reflecting on the process of solving mathematical problems.*

Keywords: *cognitive style, independent fields, dependent fields, and problem solving abilities*

I. INTRODUCTION

Mathematics is one of the fields of science in general education which has a very important role as expressed by Soedjadi (2004) that mathematics education has two major objectives which include (1) formal objectives, which put emphasis on structuring children's reasoning and personal formation of children and (2) material goals that put emphasis on the application of mathematics and the ability to solve mathematical problems. This is in accordance with the general objectives of learning mathematics formulated by the National Council of Teachers of Mathematics (2000), namely: (1) learning to communicate; (2) learn to reason; (3) learn to solve problems; (4) learn to associate ideas; and (5) the formation of a positive attitude towards mathematics.

Furthermore, Sumarmo (2005) explains that the ability above is called mathematical power (mathematical power) or mathematical skills (doing math). Mathematical skills are related to mathematical characteristics that can be classified in low-level thinking and high-level thinking. Low-level thinking includes the activities of carrying out simple arithmetic operations, applying mathematical formulas directly, following standard procedures (algorithms), while those included in high-level thinking are the ability to understand mathematical ideas more deeply, observing data and exploring implied ideas, constructing conjectures , analogies, and generalizations, reasoning logically, solving problems, communicating mathematically, and linking mathematical ideas with other intellectual activities.

In addition to thinking mathematically low and high level, students also need to be trained to think advanced, for example, the students are trained in constructing and making their own mathematical definition drawings. Through constructing and finding definitions or concepts in mathematics students are expected to develop mathematical abilities. Problem solving is part of following up thinking, both problems relating to understanding the mathematical concept itself and its application. Problem solving in mathematics is an activity

to find solutions to the mathematical problems faced by involving all the stock of knowledge (have learned concepts) and the stock of experience (have been trained and accustomed to face or solve problems) mathematics. In other words, if someone faces a math problem / problem and feels called to solve it, he will certainly try to gather knowledge about the mathematical concepts he has and his experiences in solving his past mathematical problems. The experience a person has of dealing with a problem will naturally appear consciously (analytically) or may appear suddenly (without consideration) when they encounter a similar problem. This sudden appearance is characteristic of thinking.

Prospective mathematics teacher students must get enough opportunities to develop their abilities in problem solving, considering that being included in their assignments later when becoming a teacher is to guide students to learn to solve mathematical problems. Teaching how to solve problems is the teacher's activity to provide challenges or motivation to students so that they are able to understand the problem, are interested in solving it, able to use all of their knowledge to formulate a strategy to solve the problem, implement the strategy, and assess whether the answer is correct. One of the goals of learning mathematics for students is that they have the ability or skills to solve mathematical problems or problems, as a means for him to hone careful, logical, critical, and creative reasoning. Therefore, problem solving skills are the focus of mathematics learning at all levels. Moreover, for a prospective student of mathematics teacher, of course it is not enough if he only has the ability for himself, because someday if he has become a teacher, he will have a difficult task of making students have the ability to solve mathematical problems.

Problem solving is the process used to solve a problem. Mayer defines problem solving as a multi-step process with the problem solver having to find a connection between his past experience (schema) and the problem he is now facing and then acting to solve it (Kirkley, 2003). The importance of learning problem solving in mathematics has been described in the NCSM (National Council of Supervisors of Mathematics) which places problem solving as the first order of 12 essential components of mathematics. Santia (2015) also stated that problem solving has an important role in learning mathematics. In addition, problem solving prioritizes the processes and strategies undertaken by students in completion. Mathematical problem solving can help students improve their analytical power and can help them apply that power to a variety of situations (Wahyuddin, 2017)

Conney (in Hudoyo, 2008) also states that teaching students to solve problems, allows students to be more analytical in making decisions in their lives. In other words, if students are trained to solve problems, the students will be able to make decisions, because students have become skillful on how to gather relevant information, analyze information, and realize how necessary to re-examine the results that have been obtained. With the ability to solve problems obtained from mathematics, students are expected to be able to solve problems in their daily lives, it was revealed by Cooney (in Hudoyo, 2003) namely teaching students to solve problems, allowing students to become more analytical in making decisions in their lives.

NCTM (2000) states that solving problems is not only a goal of learning mathematics, but it is also the main tool for doing that learning. Therefore, problem solving skills are the focus of mathematics learning at all levels, from elementary school to tertiary level. By studying problem solving in mathematics, students will get ways of thinking, persistent habits, and curiosity, as well as self-confidence in unusual situations, as situations they will get outside the mathematics classroom. In everyday life and the world of work, being a good problem solver can bring big benefits.

Many factors can affect students in problem solving skills, one of them is cognitive style. Cognitive style is a typical way for students to learn, both related to how information is received and processed by attitudes towards information, and habits related to the learning environment. Nasution (2008: 94) explains that cognitive style is a consistent way that is done by students in capturing stimulus or information, how to remember thinking and solving problems. In this case not all students follow the same way, they have their own way. Cognitive style is closely related to a person's personality, this is in accordance with the opinion of Uno (2008: 185) that cognitive style is a student's unique way of learning, both related to the way of receiving and processing information and habits related to the learning environment, cognitive style is one of the conditions of learning variables which is one of the considerations in designing learning. Knowledge of cognitive style is needed to design or modify learning material, learning objectives, and learning methods. It is expected that with the interaction of cognitive style factors, goals, materials, and learning methods, student learning outcomes can be achieved to the maximum extent possible.

Every student has a different style when processing information therefore the position of cognitive style in the learning process should not be ignored. There are various kinds of cognitive styles and one of them is the field independence cognitive style (FI) and the field dependent cognitive style (FD). The characteristics of FI cognitive style and FD cognitive style that is in carrying out a task or solving a problem, then the FI individual will work better if given freedom. whereas FD individuals will work better if given extra instructions or guidance. Nasution (2008: 95-96) states that a person has a cognitive style of FD thinking more globally and can be influenced by the circumstances surround, and tends to see the problem as something confusing. Further explained that argued that people who have a cognitive style of FD are categorized as someone who can think globally, behave socially sensitive and be interpersonal oriented.

Each individual has their own ways of doing things in their minds, what they do, see, remember and think about. Individuals will have different ways of approaching the learning situation, in the way they receive, organize, and relate their experiences in the way they respond to certain teaching methods. The differences that persist in each individual in the way they process information and pass it on from their experiences are better known as cognitive styles. This is in line with the results of the 2016 Nugraha study which explains that students 'cognitive styles are very influential on increasing students' mastery of concept concepts. After getting an active learning process through practicum activities and group discussions, the mastery of the concept of cognitive fields dependent groups increases greater than independent fields. The results of another study conducted by Marlissa, 2015 explained that students with independent field cognitive style were better than students with field dependent cognitive style in terms of mathematical problem solving abilities, mathematics learning achievement, and students' appreciation of mathematics.

In order to know the students' understanding of proving problem solving in the linear program problem solving concept, it is necessary to do a study or research. Students have an interest in understanding mathematical concepts and proof problems. One of the concepts learned is a linear program. In proving problem solving, it is very much needed student's reasoning and understanding in linking the concepts related to the problem. Besides that, in a class, students have different characteristics in terms of their cognitive style. Therefore, further information and assessment of students' understanding with different cognitive styles is needed in solving the evidentiary problem.

II. RESEARCH METHOD

This research is an ex-post facto research with correlational with a qualitative descriptive approach. The research was conducted in the even semester of the Academic year 2018/2019 at the University of Muhammadiyah Makassar, the population were all students of Mathematics Education Study Program in semester IV with 180 people spread over 8 classes with a sample of 57 people taken through group sampling techniques. Data analysis techniques used in this study include quantitative descriptive analysis techniques and statistical statistics through simple regression analysis.

III. FINDINGS AND DISCUSSION

The results obtained are divided into two parts, namely the results of quantitative descriptive analysis that consisted of the results of cognitive style tests and problem solving abilities test, each of is described as follows : 1. The cognitive style profiles of 57 students are described in the following table:

TABLE I
Student Cognitive Style Profile

No	Cognitive Style	Amount	Percentage (%)
1	*Field Dependent*	5	8,8
2	*Field-Independent*	52	91,2
3	Total	57	100

2. Comparison of Learning Outcomes

A comparison of the Dependent and field-independent cognitive styles is described in the following table.

TABLEII
Comparison of Learning Outcomes

No	Information	*Field Dependent*	*Field-Independent*
1	Valid	5	52
2	Missing	0	0
3	Mean	70,25	73,42
4	Std. Error of Mean	4,92	2,25
5	Median	72,500	76,62
6	Mode	58,50[a]	60,00
7	Std. Deviation	11,01	16,24
8	Variance	22,75	64,00
9	Range	58,50	30,00
10	Minimum	81,25	94,00
11	Maximum	351,25	3818,25
12	Sum	5	52

3. Problem Solving Skill

Students' problem solving skills are obtained through tests with the results described in thefollowing table:

TABLEIII
Problem Solving Skill

No	Information	Score
1	Valid	57
2	Missing	0
3	Mean	73,15
4	Std. Error of Mean	2,09
5	Median	75,00
6	Mode	60
7	Std. Deviation	15,80
8	Variance	249,84
9	Range	64
10	Minimum	30
11	Maximum	94
12	Sum	4170

TABLEIV
Classification of Problem Solving Capabilities

Percentange (*x*)	Amount	(%)
≥ 87,5 % (Very Good)	5	8,77
75% ≤ < 87,5% (Good)	8	14,04
62,5% ≤ < 75% (Enough)	12	21,05
50% ≤ < 62,5 (Less)	21	36,84
< 50% (Very Less)	11	19,30

4. Inferential Analysis

Inferential analysis used is a simple regression analysis used to determine whether there is a significant influence between the independent variables on the dependent variable as the following results.

TABLEV
Inferential Analysis

No	Information	Score
1	R	0,04
2	R Square	0,00
3	Adjusted R Square	-0,018
4	Std. Error of Mean	15,94
5	F	0,01
6	Sig.	0,976
7	B	0,04
	Constant	72,91

Based on these results it was found that the level of problem solving ability of students is in the medium category with an average value was 73.17 with the highest value was 94 and the lowest value was 40 with a range was 64. Based on these data so that the problem solving ability of students still needs to be improved because problem solving skills are very important for a prospective mathematics teacher, as are other abilities, namely reasoning and proof, communication, connections, and mathematical representation, as evidenced by the determination of standards for these abilities in NCTM (National Council of Teachers of Mathematics, 2003). A prospective mathematics teacher must know, understand, and be able to apply the process of solving mathematical problems. Moreover, for a prospective mathematics teacher, it is not enough just to have the ability to solve problems for himself, because someday if he has become a teacher, he will have a tough task, namely to guide students to have the ability to solve mathematical problems. Indicators that can show whether a prospective mathematics teacher has the ability to solve problems, according to NCTM (2003) are: (1) Apply and adapt various approaches and strategies to solve problems, (2) Solve problems that is in mathematics or in context others involving mathematics, (3) building new mathematical knowledge through problem solving, and (4) monitoring and reflecting on the process of solving mathematical problems.

Furthermore, the cognitive style profile of students was dominated by the field independence cognitive style by 91.2% and the field dependence cognitive style was 8.8%. The data illustrates that cognitive style at the student level has the following characteristics: (1) focus on material details, (2) focus on facts in principle, (3) rarely make physical contact with others, (4) interaction with others is limited in the work being done, (5) likes to work alone, (6) likes competition, (7) can organize itself.

Field independent learning style has several characteristics: (1) less influenced by the environment and the past, (2) educated to stand alone and have autonomy for their actions, (3) do not care about the norms of others, (4) speak quickly regardless of power catch other people, (5) less importance on social relations, (6) more suitable to have experimental psychology, (7) respect humanity and social sciences although more inclined to mathematics and science, (8) prefer lectures, (9) do not requires detailed instructions, (10) can accept criticism for improvement.

In the context of differences in the ability of solving problems between students who have a field independence cognitive style with a field dependent cognitive style. The students with cognitive independence field style have a higher ability (in the high category) compared to students with cognitive field dependence style (in the moderate category). This illustrates that students who have learning styles that are less influenced by the environment, where they will feel less comfortable and bored with the learning process or teacher's explanation that is often repeated. Less like lengthy talks, on the contrary prefer things that are short, practical and tasks that are independent. It has a higher ability in solving mathematical problems.

Furthermore, from the results of the infra-analysis it is found that cognitive style does not have a significant effect on students' problem solving abilities. In solving mathematical problems, students need analytical skills, reasoning, adapting various approaches and strategies, reconstructing problems in other contexts involving mathematics, building new mathematical knowledge through problem solving, and monitoring and reflecting on mathematical problem solving processes.

The results of this study contradict the opinions of Sternberg and Elena (2007: 701), cognitive style is a bridge between intelligence and personality. Cognitive style refers to a person's characteristics in responding, processing, storing, thinking, and using information to respond to a task or various types of environmental situations. FD individuals tend to work with external motivation, i.e. seek guidance and guidance from others. FDI individuals tend to have abilities like FD or FI students because FDI is located between the two.

FI individuals view problems analytically, are able to analyze and isolate relevant details, detect patterns, and critically evaluate problems (Yousefi, 2011). The characteristics of different cognitive styles can affect students' mathematical problem solving abilities.

In another theory also explained that the cognitive style (cognitive style) of students is very important role in increasing the meaningfulness of optimal learning, therefore the cognitive style (cognitive style) students need to be considered in each learning. According to Uno (2006: 185) cognitive style is a student's unique way of learning, both related to how information is received and processed, attitudes toward information, and habits related to the learning environment. According to Arend (2008: 50) students with style cognitive field dependent (FD) perceives something "as a whole" and not "in parts". They see a large picture in most problematic situations. Students who are field independent tend to see separate parts of the whole and not the whole itself. In general, field dependent individuals are more people-oriented, social relationships are important to them and they work well in groups. But the theory also contradicts the results of this study.

The findings of this study are also not in line with the results of previous studies, namely (1) Ulya, 2015 with the results of the study explaining that the correlation coefficient between cognitive styles and students 'problem solving abilities (r_xy) was 0.624 which means that there was a positive relationship in the high level between students' cognitive styles with students' problem solving skills. The coefficient of determination value of 0.390 shows that 39% of students' problem solving abilities are influenced by cognitive style through linear relationships while 61% is influenced by factors other than cognitive style; (2) Marlisa, 2015 with the results of the study explained that a significant level of 5%, showed that there was an influence of the REACT strategy on the ability to solve mathematical problems, mathematics learning achievement, and students' appreciation of mathematics in students of SMAN 10 Ambon. Based on the analysis conducted, students with independent field cognitive style are better than students with field dependent cognitive style in terms of their mathematical problem solving abilities, mathematics learning achievement, and students' appreciation of mathematics; and (3) Murtafiah, 2017 with the results of the study explaining that the problem-solving ability of the subject with independent and dependent field cognitive style. Subjects with independent cognitive field style are more analytical so they are able to understand verbal statements of problems and convert them into mathematical sentences, subjects can determine the right formula in problem solving and are able to express knowledge and appropriate steps to answer the problem; furthermore, the subject can complete each planned step and obtain the correct answer to the problem; in the final step, the subject checks the answer. Subjects with dependent field cognitive style are less able to convert verbal language into mathematical sentences; the subject can determine the right formula but is unable to complete the planned steps so that it gives an incorrect answer; then the subject does not re-check the answers obtained.

IV. CONCLUSION

1. The level of problem solving ability of students is in the medium category with an average value was 73.17 with the highest value was 94 and the lowest value was 40 with a range was 64.
2. Profile of student cognitive style is dominated by field independence cognitive style by 91.2% and dependent field cognitive style is 8.8%.
3. There is a difference in the ability of solving problems between students who have a field independence cognitive style and a field dependent cognitive style. Where students with cognitive independence field style have a higher ability (in the high category) compared to students with cognitive field dependence style (in the fair category).
4. Cognitive style has no significant effect on students' problem solving abilities, this illustrates that the cognitive style possessed by each student is not enough to improve problem solving abilities for students. In solving mathematical problems, students need analytical skills, reasoning, adapting various approaches and strategies, reconstructing problems in other contexts involving mathematics, building new mathematical knowledge through problem solving, and monitoring and reflecting on mathematical problem solving processes

   Based on the conclusions, the following suggestions are proposed: 1) The students continue to improve their problem solving abilities. To improve students' problem solving abilities, it is recommended that lecturers focus more on the details and principles of the material, give students freedom to solve problems in their own way and make more competitions, quizzes, and competitions in learning; 2) It is

recommended to lecturers that learning emphasizes more on applying andragogy learning models and learning models that are centered on students, as well as learning models that can train students to think critically, think logically, think systematically, creativity, and problem-solving ability.

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