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Misconception of Student: Difference Field Independent-Dependent Cognitive Style

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ABSTRACT
This study aims to describe the differences in students' misconceptions with field-independent and field-dependent cognitive styles. This research is a descriptive-qualitative research involving junior high school students in Palu city. The subject of this study consisted of two female students, having a field-independent cognitive style and field dependent. The results showed differences in the misconceptions of field-dependent and field-independent students, namely field-dependent students including: (a) misconceptions in the use of distributive properties and algebraic addition operations, (b) misconceptions of basic mathematical concepts in determining mathematical models in the form of equations, (c) misconceptions in applying the concept of equivalent equations. While, field-independent students only experienced misconceptions in applying the concept of equivalent equations. The causes of misconceptions filed-dependent are the initial concept of the wrong student, the stage of cognitive development of the student, students' associative thinking and intuition. While field-independent is associative thinking and intuition is wrong.

Keywords: *Misconceptions, field-independent and field-dependent, cognitive styles*

1. INTRODUCTION

Concepts in mathematics are interrelated with the next concept, so it takes the correct understanding of concepts [1]. Understanding concepts is a person's ability in mathematics that is expected to be achieved during mathematics learning [2]. The ability to understand concepts in mathematics is necessary in learning mathematics [3][4]. Mathematics is the science of logic about shapes, structures, magnitudes, and concepts that are interconnected with each other. Thus, one of the competencies that students need in mastering mathematics is a deep understanding of mathematical concepts [5].

When answering math problems, it is possible for students to make mistakes, for example not reading the questions carefully or because of misconceptions [6]. Misconceptions in mathematics are defined as a consistent error, as well as being an obstacle for students in solving math problems [7][8]. It is important to recognize misconceptions and re-educate students to improve their mathematical thinking [9]. Misconceptions on prerequisite concepts will have a significant impact on misconceptions of related concepts, so that misconceptions can become a problem in the process of developing mathematics learning [10][11]. Misconceptions in mathematics will become a serious problem if they are not addressed immediately, because misconceptions can lead to continuous errors [12]. Revealing and finding the cause of the misconceptions that occur, is the first step that must be taken to overcome misconceptions [13].

Students' cognitive style can provide an overview for teachers of how students remember and process the information obtained. Cognitive style is related to the process of obtaining and processing student information in the form of information delivery [14]. Cognitive style is a term to describe the way individuals think, perceive and remember information [15]. In addition, cognitive style also affects the way students solve problems and make decisions to process information that is consistent in nature [16][17][18].

Students with field-independent cognitive style are able to process information using mathematical notation and their own language, and can model mathematical problems correctly. Students with field-dependent cognitive style tend to view in general in understanding and processing information [19]. Field-independent is generally more analytical and independent [20]. Meanwhile, field-dependent requires learning activities

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that are openly in a social context and require interaction with peers who function as learning reinforcers and counselors [21]. In addition to being sensitive to social cues and interested in words and what others do, field-dependent is relatively dependent on others and likes to group [22][17][18].

The basic concepts of mathematics are often considered easy by teachers and students, but in reality there are still many students who do not understand mathematical concepts, especially if they are presented in different forms, such as in the form of symbols, story problems and graphs or pictures [23]. Based on the results of semi-structured interviews with mathematics teachers at Junior High Schools in Palu city, it was obtained that the students made mistakes in solving the given problem, students were able to solve the problems given but students experienced misconceptions in mathematical concepts. Mathematical concepts are ideas or ideas that are formed by looking at the same properties of a set of abstract ideas that can be used to group a set of objects.

2. METHODOLOGY

2.1 Research Design and Subjects

This type of research is descriptive with a qualitative approach. The subjects in this study were junior high school students in the city of Palu, which consisted of field-independent students and field-dependent students.

2.2 Data Collection

Research data collection was carried out in the following stages: 1) Researchers used The Group Embedded Figure Test to determine the cognitive style possessed by students. The Group Embedded Figure Test consists of 3 sessions. The first session consisted of 7 images used for practice, sessions 2 and 3 consisted of 9 images for testing and scoring. If students get a score of 0-9 then it is categorized as field dependent while 10-18 is categorized as field independent [17-19; 34-35], (2) Written assignments to get students who have misconceptions. (3) Semi-structured interviews to find out the misconceptions experienced by the subject. Interviews were conducted repeatedly so that consistent data were obtained. (4) Discussions between researchers and research subjects related to the results of the analysis that have been made. If the data is in accordance with the intent of the subject, then the data is declared credible.

2.3 Analyzing of Data

The data analysis in this study is divided into three interconnected activities, namely data condensation, data presentation, and conclusion drawing [36]. Data condensation refers to the process of selecting and focusing data on misconception analysis data, data is presented in descriptive form, namely written task result data and interview transcript, conclusion withdrawal is done when data condensation and data presentation has been completed.

3. RESULTS

From 8 students with field-independent cognitive style, 1 (one) student was selected as the research subject, namely S1 with a high The Group Embedded Figure Test score (15), from 10 students with field-dependent cognitive style, 1 (one) was chosen as the subject. The research is S2 with a score of The Group Embedded Figure Test (6). Based on the results of discussions with mathematics teachers, information was obtained that S1 and S2 have relatively the same mathematical abilities and both are female, able to communicate well, and are easily contacted via telephone or WhatsApp.

3.1 Misconceptions Field-Independent Student (S1)

To solve math problems, there are several steps that must be done. Then operate the mathematical model using other related concepts.

Based on the results of the answers in Figure 1 followed by in-depth interviews, as for the interview excerpts, as follows:

R-028 Okay, then try to explain your steps by using the formula for the perimeter and area of a rectangle to solve this problem?

S1-028 Operate all the numbers in the formula until a mathematical model is obtained in the form of an equation, then collect similar terms on the same side by moving the constants on the right side and the variable coefficients on the left side. Then operate the constant, and divide it by the coefficient of the variable so that the value of the variable is obtained. Next, substitute the value for the variable to get the width of the rectangle. After the width and length values are obtained, then substitute them into the rectangular area formula, so that the area value is 600 m^2.

Based on the interview, it was found that S1 had a misconception in applying the concept of an equivalent equation because it used the term moving segment or being moved, without understanding how the process or in other words being moved could change the sign of the number. After the observation was extended (S1-028), S1 always answered consistently. In addition, also explain each step of the solution carefully.

3.2 Misconceptions Field-Dependent Student (S2)

We know that before learning a more complex concept first learn the prerequisite concept or the basic concept/ initial concept. Solving math stories requires understanding the right concepts. Starting from the

prerequisite concept / initial concept that becomes the basis, so that it can easily understand the interrelationship between concepts that will be used to solve math story problems

Based on the results of the answers in Figure 2 followed by in-depth interviews, as for the interview excerpts, as follows:

R-029 Do you know what is called a mathematical model in the equation form of your answer?

S2-029 In my opinion, the mathematical model is the second line. Because the shape is different, it has twice as many other brackets as the others.

R-031 How do you get the variable coefficient?

S2-031 I add 2 with 2p to get 4p then I multiply 2 by 10 to get 20.

R-033 Why is 4p suddenly on the left side?

S2-033 Due to changing segments, what I remember is like that and the examples I saw on google are also like that so that 100 and 20 can be added up.

R-042 Why can you conclude that the value of the variable is 120?

S2-042 Because in my opinion 4p has no effect in determining the p value. 4p is 4 lengths, so the value of the length is 120. Then 120 can still be simplified so I simplify it by dividing by 2 2 times. First I divide 120 by 2, the result is 60, then 60 I divide again by 2 so the result is 30.

Based on the interview excerpt above, obtained S2 experienced misconceptions in applying the distrubitive nature of multiplication to reduction, and experienced misconceptions in applying algebraic forms to addition operations (S2-031). In addition, she also experienced misconceptions about the concept of a linear equation of one variable so that he did not make an example to bring up a variable (S2-027), make a false conclusion to the value of a variable (S2-042) and experienced misconceptions on the concept of an equivalent equation because of the use of segment shift term (S2-033). After an extension of the observations, it was found that S2 was always confused when answering the questions asked in other words inconsistent with his answers and also not being thorough in explaining each step of the solution. When explaining S2, they often forget or even get confused when explaining.

This study discusses the differences in misconceptions experienced by S1 and S2 in understanding mathematical concepts. One indication of not achieving the optimal math learning objectives is the problem of student misconceptions [37].

Cognitive style is one of the factors causing misconceptions, because the cognitive structure of students in receiving, processing, storing and using information to solve a problem. In addition, misconceptions can also be seen as cognitive structures that exist within students that are not in accordance with generally accepted conceptions, especially in the field of mathematics.

Based on the results of the study, when solving the S2 problem is difficult to distinguish the related material on the problem, it is difficult to modify the knowledge already possessed. The statement is in line with the opinion that field-dependent individuals tend to accept a pattern as a whole [38][39]. S2 has misconceptions including misconceptions in applying the distrubitive nature of multiplication to subtraction, misconceptions in applying algebraic forms to addition operations, misconceptions in the concept of linear equations of one variable and experiencing misconceptions in applying the concept of equivalent equations. When solving the problem given S2 is not structured neatly. The statement is in line with the opinion that field-dependents are unstructured and not well organized in learning, in this case including when solving problems [23][17][18].

Misconceptions in the application of distributive properties result in S2 making an error when optimizing $100 = 2\ (2p - 10)$ S2 summing 2 by 2p and multiplying 2 by 10, in the use of distributive properties $a(b + c) = (a \times b) + (a \times c)$. Students equate distributive properties with summing operations, in addition when optimizing integers students do not understand the function of negative signs in a number [12]. The misconception in algebraic addition operations is that addition operations can be performed if the two terms to be added are of the same type. However, S2 adds up two different terms so that there is a misconception. Students experience errors in combining letters and numbers by assuming that operating symbols are not part of the answer as in the concept of multiplication of algebraic forms, students consider multiplication notation as addition [40].

Misconceptions of equation concepts result in S2 not making the description of variables, erroneous in determining mathematical models of equation forms and making incorrect conclusions in determining the value of a variable. Changing the problem into a mathematical model of the equation form of the student is able, but at the time of interviewing the student could not so that the student made a transformation mistake [41][42]. The mistake students make is not to write them, because in linear equations one variable must contain a variable [43].

S2 also experienced misconceptions in applying the concept of an equivalent equation, S2 uses the term moving segment such as $100 = 4p - 20$, then 20 moves to the right side without knowing the actual process. Equivalent equations are equations that have the same solution or root. This is because in solving equations problems symbolically, namely by adding or subtracting the left side or the right side with the same number so that the equation remains equivalent, many students use the term moving segment because it is considered easier to understand than the way it should be used [23]. The causes of S2 misconceptions are the initial concept of

the wrong student, the stage of cognitive development of the student, associative thinking and incorrect intuition.

While S1 is able to explain the relationship of the concepts used, is able to show mathematical models in the form of equations. Thus S1 can solve the problems given in a structured and well-planned manner. This statement is in line with the opinion that one of the individual characteristics of field-independent is more planned and structured and more independent than field-dependent [21].

However, S1 has a misconception in understanding the concept of equivalent equations. Misconceptions in connecting the concept of equations equivalent in solving mathematical models of equation shapes. S1 assumes that a number can be moved or moved a field so that the number mark changes when the corresponding number is moved. The statement is in line with the opinion that in solving mathematical problems can be done symbolically by adding or subtracting, multiplying or dividing the left or right segments by the same number to keep the equation equivalent, many students use the term move segment because it is considered easier to understand than the way it should be used [23]. When a number is moved or moved the number mark field changes opposite to the actual number sign. The statement is in line with the opinion that field independent individuals are able to explain in a well-structured and organized manner [23][17][18] The causes of misconceptions S1 are students' associative thinking and wrong intuition.

So that the difference between S1 and S2 misconceptions is that S2 has misconceptions in the use of distributive properties, misconceptions in operating algebraic forms, especially addition operations, the concept of equations, and also misconceptions in applying the concept of equivalent equations. While S1 only experienced misconceptions in applying the concept of equivalent equations.

4. CONCLUSION

Based on the description above, it appears that the misconception experienced by students with a cognitive style filed-independent is experiencing misconceptions in applying the concept of similarities equivalent to the use of the term move segment or moved. The cause of field-independent misconceptions is associative thinking and wrong intuition. While the misconceptions experienced by students with field-dependent cognitive style are experiencing misconceptions in the use of distributive properties, misconceptions in optimizing the algebraic form of summation operations, misconceptions of equation concepts that result in misconceptions in determining mathematical models of equation forms, not making explanations to bring up a variable, as well as making incorrect conclusions to the value of a variable and experiencing misconceptions in using the equation n which is equivalent to the use of the term move segment. The causes of misconceptions filed-dependent are the initial concept of the wrong student, the stage of cognitive development of the student, associative thinking and incorrect intuition. Therefore, it is recommended to researchers who have relevant problems to examine more deeply about misconceptions in mathematical learning.

RECOMMENDATIONS

Teachers are expected to pay more attention to the understanding of concepts experienced by students if they find misconceptions in students to be followed up immediately, if misconceptions are allowed to affect students' understanding of mathematical concepts that are interrelated or more complex.

LIMITATIONS

In general, the research has limitations, so it is necessary to conduct further assessments related to misconceptions experienced by students on other mathematical concepts.

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