

# Misconception's Analysis Of Students Junior High School In Solving Algebra Problems Term Of Field Independent And Field Dependent Cognitive Styles

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**Abstract.** Students who can not mastered mathematical concept well then other concepts that are related will be difficult to understand and ultimately the student will be through misconception. This study is aimed to describe the misconception of junior high school students in solving algebra problems in terms of field dependent and field independent cognitive style. This study is a descriptive research with qualitative approach. The subjects are two junior high school students with categories of cognitive style field-dependent and field-independent, they are female and have medium mathematical skills. The data were collected by giving algebraic problem solving tasks with CRI (*Certainly of Respon Index*) instruments and task-based interview. The results showed that the misconceptions of each type of cognitive style had varies. At the field-dependent students misconceptions that occur in generalizing algebraic forms, notations, and application rules, while field independent be through misconception in generalizing algebraic forms. The causes of misconceptions students field dependent are lack of understanding of the basic concept of algebra and lack of interest in learning. The causes of misconceptions student field independent are lack of understanding of the basic concept of algebra.

**Keyword:** Misconception's, CRI, Cognitive Style

## 1. Introduction

In the learning process students gain understanding of concepts based on their respective learning experiences. Understanding concepts formed based on learning experiences by each student is not necessarily the same as other students. Therefore, each student has a varied understanding of concepts. To learn mathematics, students must be able to understand the concept correctly to develop the next knowledge. If students are not able to understand one of the concept well, then of course it will affect the next related concept.

But sometimes when learning mathematics, students experience obstacles that are unknown to the teacher. One of the problem is that things or information conveyed by the teacher are not captured properly by students, which results in students experiencing misunderstandings in transferring the information obtained into the framework, so that it can be said that students experience misunderstanding of a concept or misconception.

Knowing the misconceptions experienced by students is important. Some misconceptions that exist in students will result in mistakes made in solving the given questions and certainly also affect

learning outcomes. Therefore, this student's misconceptions must not be allowed to last long in students. Durkin & Johnson (2015, p.22) said that "Through out this process of change, it is important to diagnose misconceptions and assess knowledge as a window into the conceptual change process. This will allow researchers and instructors to better understand how misconceptions form and how they change over time".

Based on the experience of researchers, Algebra material is one of the mathematical lesson that results in many students experiencing misconceptions when learning it. This is based on algebra is one of the material in mathematics learning which contains abstract concepts. In line with this, one of the objectives of mathematics learning about algebra material listed in the 2013 curriculum (Permendikbud no. 21, 2016, 119-120) is to understand and recognize various algebraic manipulations and use them to solve problems such as similarities and inequalities.

Several studies have been conducted and show that students often experience misconceptions when learning algebra material. This is consistent with research conducted by Watson (2007, p. 3) which states "Students often get confused, misapply, or misremember rules for transforming expressions and solving equations". In the opinion above, students often experience confusion and make mistakes in applying or remembering rules in solving algebraic equations. While the research conducted by Bush & Karp (2013, p.618) stated "Study found that students often did not interpret expressions such as  $(z-4)^2$  correctly and instead translated it as  $(z-4)(z+4)$ ". it is known that some students still cannot describe  $(z-4)^2$  correctly.

In solving mathematical problems students are required to be able to understand mathematical concepts that are learned and can apply them in solving problems. A person's knowledge is continuously rebuilt and develops along with the experience of the person (Suparno, 2013). In solving mathematical problems, each student has different characteristics. Differences in characteristics include the way students obtain, process, organize and remember information obtained from learning resources.

When students have different cognitive styles, the way to solve problems is different, so that with different cognitive styles will influence students in solving the given mathematical problems. In mathematics learning and problem solving teachers need to pay attention to students' cognitive style. Students' cognitive styles based on psychological differences are translated into two groups, namely independent field and field dependent cognitive styles. The opinion of Alamolhodaei (2010, p.172) which also states "FI/FD specifies an individual's mode of understanding, thinking, problem-solving, and remembering".

Based on the description above, the authors are interested in conducting research on "Analysis of Class VIII Middle School Students' Misconceptions in Solving Algebraic Problems Viewed from Students' Cognitive Styles in the independence (FI) field and dependence (FD) fields".

## **2. Method**

This type of research is a qualitative descriptive study. This research was conducted in the even semester of 2017/2018 school year in class VIII of SMP Negeri 7 Surabaya. The subjects of this study were 1 student with independent field cognitive style and 1 student with field dependent cognitive style who had the highest percentage of misconception. Technique of data collecting were conducted with written test consists of 3 test, namely 1) GEFT Test, 2) Mathematics Ability Test, 3) Problem Solving Test. The GEFT test and the Mathematics ability test aim to determine the subject while the problem solving test aims to get a data about solving mathematical problems about algebra. This ability test and algebra problem solving test is equipped with a CRI (Certainty of Response Index) instrument which aims to find out the misconceptions experienced by students and subjects. And then the last is task-based interviews.

Data in the form of student answers from written tests that have been given, which are equipped with CRI (Certainty of Response Index) instruments, are then analyzed descriptively. Then the test results of each student were analyzed by considering the settlement strategies used in solving the problems/problems given in the test, and the level of quality of the beliefs of each student as indicated

by the CRI (Certainty of Response Index) instrument. Furthermore, to determine the level of student confidence in answering the concept, namely the CRI scale guidelines as follows:

**Table 1. Scale of CRI (Certainty of Response Index)**

<b>CRI</b>	<b>Criteria</b>
1	If students answer by guessing
2	If students answer by guessing but there are elements that are considered
3	If students feel hesitant in answering
4	If students feel confident with the answer
5	If students feel very confident with the answer

Furthermore, the relationship analysis of students' answers on each test item with the quality of the certainty of the students' answers in answering each test item can be seen from the following table:

Table Interpretation of CRI Result

<b>Skala kualitas respon (CRI)</b>	<b>Answer concept questions</b>	
	<b>Wrong answer</b>	<b>Correct answer</b>
<b>CRI low (&lt; 2,5)</b>	Students do not understand the concept	Students do not understand the concept
<b>CRI high (≥ 2,5)</b>	Students experience misconceptions	Students understand the concept well

### 3. Result and Discussion

Based on the data from the GEFT test results and the Mathematics Ability Test (TKM) and suggestions from subject teachers, the researchers finally determined 2 students as subjects in this study. The first subject (SF11) is a student with the initials FA and second subject (SFD2) is a student with the initials WQ.

After determining the 2 subjects above, then an algebra problem solving test is completed with a CRI (Certainty of Response Index) instrument for the two subjects that have been determined above with the aim to find out the misconceptions of the answers from each subject. Based on the results of written tests along with in-depth interviews with five students with Field Independent (FI) cognitive styles and five students with Field Dependent (FD) cognitive styles, data was obtained that students with Field Independence (FD) cognitive style groups experienced misconceptions in almost every concept in fractional material in algebraic form, namely

#### 3.1 Subject Analysis Field Independent 1 (FA)

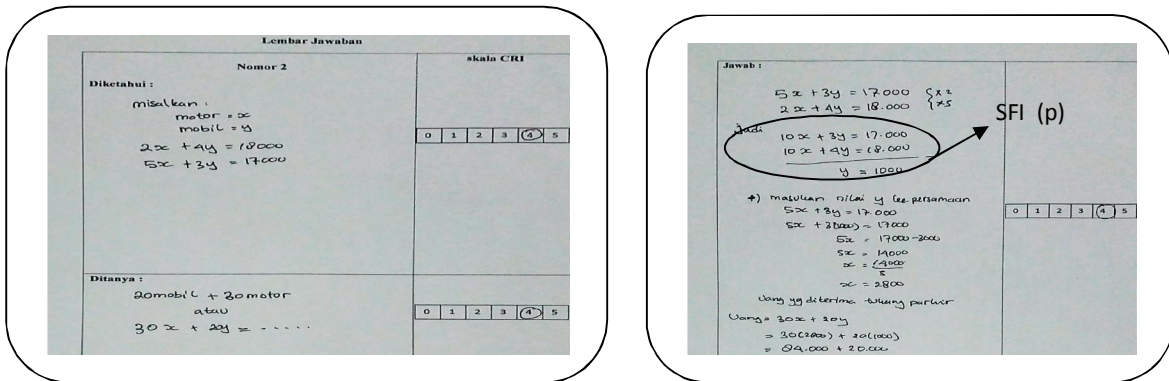
Based on the results of the study, at the stage of understanding the problem students FI identified the problem indicated by mentioning what was known and what was asked using their own language. FI students can assume information that is known and asked in the form of variables or labels (mathematical models). FI students choose a method that they consider the easiest to solve problems. However, FI Students have not been able to apply the method correctly to solve the problem given. FI students use information that is known and asked in the question to choose a problem solving method.

At the stage of implementing the completion plan, FI students carry out problem solving methods that they have chosen to solve the problem. However, FI students are able to give reasons and explain the steps to solve the problem. Based on the results of the calculations, the FI students draw

conclusions and check the truth of the steps and answers found. FI students ensure that the steps taken are in accordance with the method / method chosen previously.

When solving problems given by FI students answer questions with the wrong answers with the average CRI scale given is 4 ( If students feel confident with the answer ). This shows that SFI has high confidence in answering the question. Based on the answers obtained and the average CRI scale given shows that SFI experienced a misconception.

*Misconceptions that occur*



**Picture1.** Student Worksheet FI

- 1) Plan settlement issues  
In test number 2, SFI experienced a misconception of the method to be used in solving the problem.
- 2) Solve the problem in accordance plan  
In problem number 1 and number 2 SFI experiences misconceptions in the application of rules students ignore the signs when manipulating and assume the negative sign in front of parentheses only affects the first term.

*Factors that cause misconceptions:*

It can be seen that the causes of misconceptions experienced by SFI are. The misconception experienced by SFI is due to incorrect preconception, the ability of SFI to understand the concept of the problem.

*Alternative Settlement*

Alternative solutions that can be used to overcome the misconceptions that occur in SFI, by means of a re-explanation, give a re-explanation to the S1 about the formula / method used in solving algebraic problems at number 2.

**3.2 Subject Analysis Field Dependent SFD (WQ)**

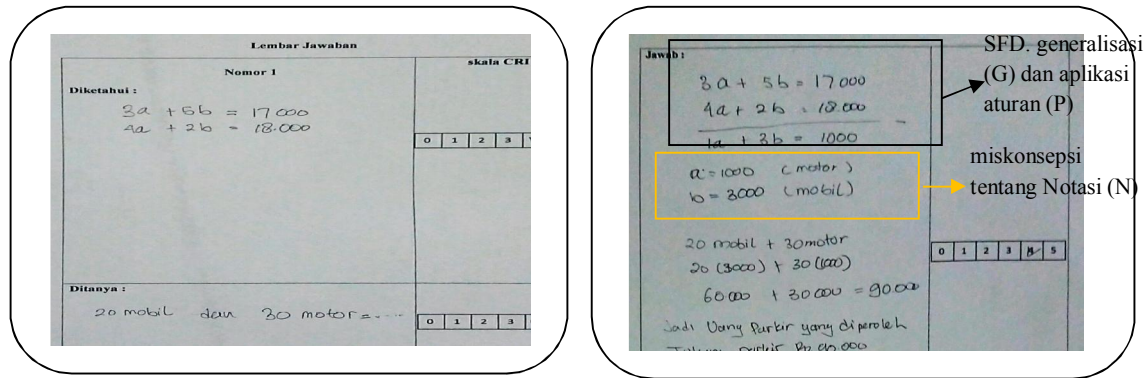
Based on the results of the study, at the stage of understanding the problem students FD identified the problem indicated by mentioning what was known and what was asked using their own language. FD students tend not to be able to prescribe known information and are asked in the form of variables or labels (mathematical models). FD students choose one method that they consider the easiest to solve problems. However, FD students have not been able to apply the method correctly to solve the

problem given. FD students do not use known information and are asked in questions to choose a problem solving method.

At the stage of implementing the completion plan, FD students carry out problem solving methods that they have chosen to solve the problem. However, FD students cannot give reasons and explain the steps to solve the problem. Based on the results of the calculations, FD students draw conclusions and check the truth of the steps and answers found. FD students ensure that the steps are carried out according to the method / method chosen previously.

When solving problems given by FD students answer the questions with the wrong answers with the average CRI scale given is 4 (If students feel confident with the answer ). This shows that SFD has high confidence in answering these questions. Based on the answers obtained and the average CRI scale given shows that the SFD experienced a misconception.

*Misconceptions that occur*



**Picture 2.** Student Worksheet FD

- 1) Plan settlement issues  
 In number 1 and number 2 test questions, SFI experienced a misconception about the method to be used in solving the problem.
- 2) Solve the problem in accordance plan
  - In the test questions number 1 and number 2 SFD experience misconceptions in generalizing algebraic forms where students are unable to generalize because students are unable to determine the method that has been used.
  - In the SFD test questions experiencing misconceptions about notation on the misconceptions of SFD notation is wrong in combining letters and ignoring the parentheses in answering questions.
  - SFD experiences misconceptions in the application of SFD rules ignoring signs when manipulating.

*Factors that cause misconceptions:*

- The misconception experienced by SFD was due to the tendency caused by the preconception of SFD regarding the previous concept, the ability of SFD to understand the concept of the problem.
- The misconception experienced by SFD was due to lack of learning interest.

*Alternative Settlement*

Alternative solutions that can be used to overcome the misconceptions that occur in SFD, by means of a re-explanation, giving a re-explanation to the S1 about the formula / method used in solving algebraic problems in number 1 and number 2.

#### 4. Conclusion

Based on the results of the research described, there are some misconceptions that occur in students in solving algebraic problems in VIII grade junior high schools in terms of the field independent and field dependent cognitive styles. The results of this study show the Misconceptions experienced by the Subject Independent (SFI) and Subject Field Dependent (SFD) subjects differently. In students who are field dependent cognitive style experience misconceptions in generalizing algebraic forms, notation, and application rules, while students in independent field cognitive style experience misconceptions in application rules. The cause of misconceptions in students with field dependent cognitive style is a lack of understanding of the basic concepts of algebra and lack of interest in learning. Students with independent field cognitive style experienced misconceptions due to lack of understanding of the basic concepts of algebra.

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