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Misconception Analysis Solving Contextual Problems of Algebra Using the *Four-Tier Test* Class VII SMPN 1 Latambaga

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Abstract
This study aims to identify the analysis of misconceptions in solving contextual problems of algebraic material using the Four-Tier Test *for seventh grade students of SMPN 1 Latambaga. The research method used is descriptive research. Sampling using a* purposive sampling technique. *The sample in this study consisted of 30 grade VII students of SMPN 1 Latambaga. These misconceptions will be identified using diagnostic tests. The research instrument used is* the Four-Tier Test. *Based on the results of the study, it was found that students who identified misconceptions on all items in solving contextual problems in algebraic material had the highest percentage of 43.33%,* false positive misconceptions *19.23%, and* false negative misconceptions *had the lowest percentage of 18.97% with 81.54 %. The results showed that the factors causing the misconceptions of class VII students of SMPN 1 Latambaga were due to the lack of students' ability to understand the concept of solving contextual problems in algebraic form material, wrong preconcepts in understanding algebraic form material, and students finding it difficult to understand algebraic form material because the learning system face-to-face in turns (*rolling class*) post-pandemic.*

Key Word*:Contextual Problems; Algebraic Forms; Misconceptions;*Four-Tier t test

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I. Introduction

Education plays an important role in people's lives. Because one important element in education is learning. The trend of learning in the current era is that learning can be anywhere, anytime, with anyone, and through any learning resources (Maudiarti et al., 2015: 116). The era of the industrial revolution 4.0 has changed the way of thinking about education. The changes made are not only in the way of teaching, but much more important are changes in the perspective of the concept of education itself (Rahman &Nuryana, 2019: 40). Education basically aims to grow and develop the innate potentials that exist in students. These potentials are expected to grow and develop by the values that exist in society and the nation's culture (Supardi, 2015: 114). In education, one of the compulsory subjects is mathematics, this is under the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education system Article 37 Paragraph 1 reads "The curriculum for primary and secondary education must contain: (a) religious education; (b) civic education; (c) language; (d) mathematics; (e) natural sciences; (f) social sciences; (g) arts and culture; (h) physical education and sports; (i) skill/honesty; (j) local content".

Mathematics in education is part of science that is very influential on developing other fields of science (Nabhar, 2019: 76). Mathematics is a science that is at the center of our daily lives. So many of our activities have used mathematics both consciously and unconsciously (Huda &Mutia, 2017: 186). Therefore, learning mathematics does not only develop cognitive abilities in the sense of being good at counting, but learning mathematics can develop several other aspects such as affective and psychomotor aspects (Nurhikmayati, 2019: 43). Because mathematics has a strong and clear linkage structure between its concepts (Monariska, 2017: 17). So that it allows anyone who learns to be skilled in thinking rationally and ready to face problems in everyday life.

Mathematics lessons are filled with concepts, so if one concept is not understood it will affect other concepts because the concepts are interrelated (Siagian, 2016: 60). This means, it takes an understanding of the basic concepts so that later it is easier to understand the next concept. The researchers found that one of the low abilities of students in the field of science was due to the lack of understanding of students' concepts, which resulted in students having difficulty in solving math problems. In mathematics in junior high school, one of the materials that must be mastered by students is algebra. Understanding contextual algebraic problems is the basis for overcoming problems in everyday life related to financial management and trading. The concept of algebra

taught to students aims to make students able to use calculations in solving algebraic contextual problems in everyday life.

Based on the 2018 PISA (*Program for International Student Assessment*) data, Indonesia's test and evaluation results are ranked 73 out of 79 countries that are classified as low in mathematics, with an average score of 379 with an average score of 478 for all countries released by the OECD (*theOrganization for Economic Co-operation and Development*). The low understanding of students' mathematics is due to the low ability of students to solve questions that are guiding, studying, giving reasons, and lack of understanding of concepts in the material. Also, the results of research conducted by Kartika (2018: 777) and Sari &Afriansyah (2020: 439) concluded that grade VII students experienced many errors in solving problems; students' ability to understand mathematical concepts was still relatively low in algebraic form material. The location of the most difficulties experienced by students is the difficulty in sequencing the steps to solve the problem until it finds the final solution; difficulty understanding the problem, using formulas, and counting errors. This also happened in SMPN 1 Latambaga according to the results of observations made through one of the mathematics teachers, IpakMarliani, S.Pd. revealed that students' understanding of mathematical concepts in algebraic material is low, with an average score of 60.5 students' daily test scores with a minimum completeness criterion score (KKM) of 70; students have difficulty understanding mathematical concepts. One of the materials that has many errors in answering questions on daily tests is algebra. The lack of understanding of students' material on this material causes students to have difficulty in working on questions. The lack of understanding of the material and the difficulties that students experience is solving contextual algebra problems and errors in using formulas to solve algebra problems, this is by the symptoms of misconceptions that often interfere with the learning process, especially for students in the knowledge accommodation process (Muna, 2016: 310). Various difficulties and errors experienced by students indicate that students have made misconceptions.

Misconceptions are obstacles for students to understand and master the material because misconceptions can be said to be an error or mismatch of understanding that is often experienced by students (Sholihat et al., 2017: 176). Misconceptions often occur in the learning process at school caused by the students themselves, teachers, and learning books. Misconceptions in the field of science have occurred everywhere, both at the low level of education and in higher education (Tompo et al., 2016: 5677). Incompatible concepts lead to the definition of misconceptions. Students do not understand the concept and most of them just memorize it. This is in line with Pakpahan et al (2020: 27) saying that the biggest source of misconceptions is the students themselves because of difficulties in understanding concepts. Not only students, teachers can also experience misconceptions; this can affect the absorption of material that will be accepted by students (Dzulfikar&Vitantri, 2017: 41). The misconceptions that occur are generally caused by students' inappropriate understanding (Sholihat et al., 2017: 175). The higher the misconceptions experienced by students, the lower the knowledge concepts held by students and the lower the misconceptions experienced by students, the higher the students' knowledge concepts (Suniati et al., 2013: 1). So the importance of minimizing the misconceptions experienced by students if it is not minimized, it will cause conflict and have a negative impact on the learning process.

Diagnosing misconceptions can be done with multiple choice tests and interviews (Yolanda, 2017: 43). Multiple choice tests are often preferred because they are easy to apply, but have limitations in determining whether students give the correct response to the test consciously or by chance. Additionally, interviews can provide more complete information about students' alternative concepts and their understanding of certain concepts but it takes a long time to conduct interviews with many students and generalize their alternative concepts. To overcome this, several types of student conception instruments were developed, such as *the Four-Tier Test.*

The Four-Tier Test is a diagnostic test with four tiers. At the first level are student answers, the second level is the level of confidence in the answers at the first level, the third level is the reason for the answers at the first level and the fourth level is the confidence rating for reasons at the third level (Fratiwi et al., 2017: 2). The format *of the Four-Tier Test* is that at the first level it is a multiple-choice question with four distractors and one answer key that students must choose. The second level is the level of students' confidence in choosing answers. The third level is the reason students answer questions, in the form of five choices of reasons that have been provided. The fourth level is the level of student confidence in choosing reasons (Jubaedah et al., 2017: 37). The advantages of the four-level diagnostic test are that it can distinguish the level of confidence in the answers and the level of confidence in the reasons chosen by students so that they can dig deeper into the power of understanding students' concepts, diagnose misconceptions experienced by students more deeply, determine parts of the material that require more emphasis and plan. better learning to help reduce students' misconceptions (Fariyani et al., 2015: 42).

There are several studies that have been conducted related to the analysis of misconceptions in solving algebraic contextual problems using *the Four-Tier Test*. Among them, the research conducted by Safira (2020) on the analysis of the misconceptions of junior high schoolers using *the Four-Tier Diagnostic Test*. The results of this study indicate that there are three types of misconceptions experienced by students; namely

classificational misconceptions, correlational misconceptions, and theoretical misconceptions. Another study conducted by Sari &Afriansyah (2020) on the analysis of junior high schoolers' misconceptions on the material of arithmetic operations on algebraic forms. The results of this study indicate that there are four types of misconceptions that students experience, including generalization misconceptions, notation misconceptions, letter understanding misconceptions, and rule application misconceptions. From some of these studies, it can be seen that the variables are misconceptions, *Four-Tier Test*, and arithmetic operations in algebraic forms. Associated with the developed student conception instruments such as *the Four-Tier Test* with indicators, namely misconceptions, *false positive* misconceptions, and *false negative misconceptions* are things that are rarely studied until now with.

Based on the rationale above, it is important to know the misconceptions and the factors of misconceptions in solving contextual problems of algebraic material, so it is necessary to conduct research entitled "Analysis of Misconceptions in Solving Contextual Problems of Algebraic Forms Using *the Four-Tier Test for* Class VII SMPN 1 Latambaga".

The purpose of this researchto describe the forms of misconceptions in solving contextual problems of algebraic material for seventh grade students of SMPN 1 Latambaga. As well as knowing the factors that cause misconceptions in solving contextual problems of algebraic material for seventh grade students of SMPN 1 Latambaga

II. Material And Methods

This type of research is descriptive research. Descriptive research is research conducted to describe the state of a phenomenon or event systematically according to what it is (Dantes, 2014: 51). In this study, researchers collected data about a symptom that occurs because of the learning process.

Taking the subject using *a purposive sampling technique*, the researchers took the subject as many as 30 students. The research subjects used to obtain data were not chosen at random but were carried out selectively by the objectives to be achieved in the study, namely to find out the misconceptions of class VII students of SMPN 1 Latambaga. Subject selection is done by providing criteria based on the results of the *Four-Tier Test.*

The data collection technique used in this research is the *Four-Tier Test diagnostic test technique*, interviews, and documentation. This qualitative data analysis technique is inductive, meaning that the analysis is based on the data obtained, then a certain relationship pattern is developed to draw a conclusion. According to Sugiyono (2016: 246) activities in data analysis include *data reduction* (data reduction), *data display* (data presentation), and *conclusion drawing or verification* (drawing conclusions).

III. Result

Based on the data and data analysis from the research results that have been described above, it is obtained that the percentage of all items identified as misconceptions is 43.33%, while the *false positive misconceptions* are 19.23% and the *false negative misconceptions are* 18.97%.Where misconceptions occur in students who come from preconceptions obtained from book literature and the internet, student experiences and come from educators as well as teaching and learning activities which are often not carried out due to school activities in the post-covid-19 pandemic season which results in students learning in a *rolling manner. class* (face-to-face learning in rotation after the pandemic).

Based on the results of the study, it was found that students still had misconceptions about the concept of algebraic forms. The percentage of students' misconceptions on algebraic form material is 81.54% of all items which are classified as high, where this result shows that there are still many students who are wrong about the concept of algebraic form material. Students still experience misconceptions related to solving contextual problems in algebraic material. These results are by research conducted by Sari &Afriansyah (2020: 499) where students experience many errors in solving problems in algebraic material in the form of errors in understanding questions, using formulas and counting errors. While the research that the researcher has carried out at SMPN 1 Latambaga, it was found that students still experience many misconceptions in solving contextual problems in algebraic material, this is due to several factors including the lack of the teacher's role as a facilitator and the presence of the covid-19 outbreak that requires students to learn by learning. face-to-face rotations, while learning infrastructure is inadequate in the post-covid-19 pandemic season, in the form of the absence of an Android cellphone, a network that is difficult to reach, the main reason students do not receive comprehensive learning and have an impact on student learning outcomes who are still classified as misconceptions. This is by research conducted by Suparno (2013: 13) which says that the factors that cause students to experience misconceptions are from the students themselves, such as the initial concepts students have in algebraic form material. In addition to factors from the students themselves, teachers or educators are also factors that cause misconceptions. Interview activities conducted by researchers on students showed that students did not undergo

the face-to-face learning process in class, due to school activities that required students to study independently with face-to-face learning in rotation after the covid-19 pandemic.

A diagnostic test using *the Four-Tier Test* was carried out to identify the misconceptions experienced by students in solving contextual problems in algebraic material. In diagnosing misconceptions experienced by students, the researcher refers to the grouping of the results of the *Four-Tier-Test* according to Gurel et al. (2015: 999) namely, understanding concepts, misconceptions, *false positive* misconceptions, *false negative* misconceptions, and not understanding concepts. In line with the opinion of Hestenes and Halloun (Istiyani et al., 2018) which states that students do not understand a concept if the misconception is *false positive*, while students' lack of understanding is due to the lack of information obtained on a concept if the misconception is *false negative*. This is in line with the results obtained by the researchers when interviewing 6 seventh grade students of SMPN 1 Latambaga, namely, students answered the questions given with the correct answer but when asked the reason, the student was unable to give the correct reason, but the student was confident with the answer. experienced *false positive* misconceptions and from the 13 multiple choice numbers given, 81.54% of the 30 students identified misconceptions on all items**.**

The solution to avoid the misconceptions experienced by students, the teacher must find or reveal the misconceptions made by students, try to find the cause of these misconceptions and seek appropriate treatment to overcome the misconceptions. Students are free to express their ideas and thoughts about the material being studied, the teacher can invite students to discuss and the teacher must also conduct private or public interviews in class by finding and choosing methods or strategies for correcting students' misconceptions that are more suitable for the student's situation. Also, the solution to the causes of initial conceptual misconceptions that students have can be improved by showing other experiences, the results of other experiments, students will experience conflicts in their thinking, and it is hoped that students themselves are challenged to change their incorrect concepts. In other words, it is necessary to build conflict experiences or anomalous experiences. Anomalous experiences are real experiences faced by students who are different from concepts they believe to be true. For example, before starting learning, apperception needs to be done by linking the learning material to be studied with examples of real phenomena that occur in everyday life.

IV. Conclusion

Based on the results of research and discussion, it can be concluded as follows:

1. Based on the results of the *Four-Tier Test* given to class VII students at SMPN 1 Latambaga, it was identified that students experienced misconceptions on all items in solving contextual problems in algebraic material with a percentage of 43.33% while 19.23% *false positive* misconceptions and 18.97% *false negative misconceptions*. Misconceptions still occur in each of the material indicators of algebraic form. It is proven that when given multiple choice questions, students are still wrong when answering questions related to understanding and solving story problems related to addition, subtraction and multiplication, as well as the division of algebraic material.
2. The factors that cause misconceptions of class VII students of SMPN 1 Latambaga, namely:
   a. Lack of students' ability to understand the concept of algebraic forms in depth,
   b. The wrong preconcept in solving contextual problems of algebraic material.
   c. Face-to-face learning in turns (*rolling class*) which limits the interaction between educators and students.

Based on the results of the study, the researchers have the following suggestions:

1. To minimize the occurrence of misconceptions, teachers should use apperception, problem-solving methods, and discovery models in learning, especially in solving contextual problems in algebraic material.
2. It is hoped that teachers can consider the *Four-Tier Test diagnostic test* to identify students' understanding of mathematical concepts.
3. It is hoped that when teachers find misconceptions in their students, they will be followed up immediately, because if left unchecked it will affect students' understanding of more complex mathematical concepts.

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