

THE ANALYSIS OF STUDENTS' MISCONCEPTIONS ON THE MATERIALS OF THE UPGRADE AND DECLINE FUNCTIONS OF CLASS XII BDP SMK PGRI 13 SURABAYA

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ABSTRACT

Misconception is one of the issues that frequently arises in all areas of learning science. Mathematics is among the subjects with the greatest number of misunderstandings. This is because according to PISA 2019 data, the ability to understand an Indonesian Mathematics concept has decreased quite drastically. Another finding in class XII BDP SMK PGRI 13 Surabaya was that more than 50% of the students had difficulties understanding the ideas presented by the teacher as well as those found in books used as learning resources, particularly in this study that concentrated on the material of ascending function and function down. This study intends to discover what proportion of students have misconceptions and to investigate the origins of misconceptions in order to suggest alternative preventative strategies. The research design is descriptive qualitative, and the methods for collecting data are a three-tier written diagnostic test (the "three tier test"), two-stage interviews, and direct observation. According to the findings of this study, eighty percent of BDP class XII students had misunderstandings, which were classified as theoretical misconceptions, calculation misconceptions, and systematic misconceptions.

Keywords: Misconception; Up Function and Down Function; Three Tier Test

1. Introduction

Mathematics is the science of logic regarding shapes, arrangements, quantities, and concepts that relate to each other with a large number divided into three areas, namely algebra, analysis, and geometry (James and James, 1976). Mathematics is a subject that is taught at all levels of education (Elementary School to College) this is because the basic concepts taught in mathematics are important things to learn. However, facts on the ground show that many students do not like and are afraid when they are going to take Mathematics lessons.

Misconception is a misunderstanding in connecting one concept with another between a new concept and a concept that already exists in the student's mind before he receives learning from school, resulting in the formation of a wrong concept with expert thinking. (Nurulwati, 2014). The characteristics of students who experience misconceptions according to Malikha & Amir (2018) include; Misunderstanding of concepts learned and accepted is inaccurate or inaccurate with what has been agreed by experts, re-stated concepts inappropriately, wrong in grouping objects from the concepts taught, misrepresenting examples of concepts and not concepts, mistranslating concepts into simpler forms or in mathematical symbols, not knowing exactly the terms of a concept learned, wrong in applying concepts using certain procedures or operations, unable to manage concepts appropriately, and not using concepts taught to conceptualize themselves.

Misconceptions of concepts learned and accepted are inaccurate orIn addition to being

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able to know its features misconceptions can also occur of course due to factors that according to Paul Suparno (2009) among others ; Wrong initial knowledge, students' associative thinking, wrong intuition, low student interest in learning, low learning intensity. The ascending function and the descending function are one of the sub- chapters studied in the mathematics subject of class XII. The function $f(x)$ is called the ascending function at interval I, if for each $x_a < x_b$, then $f(x_a) < f(x_b)$. The function $f(x)$ is called the descending function at interval I, if for each $x_a > x_b$, then $f(x_a) > f(x_b)$.

According to the results of the 2018 Programme for International Student Assessment (PISA) study conducted on 73 countries in the world which was released simultaneously on Tuesday, December 3, 2019 through the Ministry of Education and Culture of the Republic of Indonesia stated that for Mathematics, Indonesia is ranked 7th from the bottom (73) with an average score of 379. Down from 63rd in 2015. According to the research of Syamsul and Novaliyosi (2019) published in the Proceedings of the National Seminar and Call For Papers, there is a survey conducted by the International Association for the Evaluation of Educational Achievement (IEA), namely the Trend In International Mathematics And Science Study (TIMSS) which is an international study of the tendencies or directions and development of mathematics and science. through this survey in 2015 Indonesia ranked 44th out of 49 countries.

Reviewing the results obtained by Indonesia from a survey conducted by PISA and TIMSS shows that the interest in learning, the ability to understand mathematical concepts of students is still low. If the interest in learning and the ability to understand concepts owned by students can be a trigger for mathematical misconceptions, including in the material of the ascending function and the descending function.

Through this study, researchers want to find out how many percent of research subjects experience misconceptions in the material of ascending and descending functions and why these misconceptions can occur, what triggers misconceptions continue to be experienced by students.

2. Research Methods

The research approach that researchers use in this study is a qualitative approach. In this study, researchers used a type of case study research with the number of subjects of 15 students of class XII BDP SMK PGRI 13 Surabaya, where these 15 students will be given a three-tier diagnostic test to find out the misconceptions that occur, then students who are detected to have misconceptions will be interviewed in depth. written diagnostic tests, interview questions, recorders. The data obtained is then analyzed by the process of data reduction, data presentation, and drawing conclusions.

3. Results and Discussion

To find out the misconceptions experienced by students, it is necessary to give a diagnostic test first to students. The diagnostic test given in this study is a three-tier test. Three tier test is an in-depth diagnostic test to determine misconceptions in students. This test is composed of three levels of first-tier questions, namely in the form of multiple-choice questions or descriptions, the second level (two tier) is in the form of falsifying the reasons for choosing answers at the first level, and the third level (three tiers) is in the form of student beliefs based on answers at the first and second levels. The following is a table of grouping student comprehension categories according to the three-tier test method.

Table 1. Student Understanding Categories

Student Responses			Categories
Level 1	Level 2	Level 3	
True	False	Believe	Misconception (false positive)
False	True	Believe	Misconception (false negative)
False	False	Believe	Misconception

In this study, researchers used 3 questions with 2 indicator points that would represent the type of misconception to be sought. The

following is a table that is the researcher's reference for classifying.

Table 2 Problem Indicators and Misconceptions

Indicators Misconceptions	Types of Misconception
- If the student is unable/wrong in explaining the difference between the ascending function and the descending function scientifically according to the opinions of experts - distinguishing mathematical notations often used in the matter of ascending functions and descending functions (e.g. signs : $<, >, f'(x)$)	Theoretical Misconceptions
Students are unable to solve problems with the right computational process (the steps are right but the final result is wrong)	Misconceptions of Calculations

Through the Three Tier – Test test that has been carried out, a combination of student answers at the first level, second level and third level is obtained in the table as follows:

Table 3 Combination of Student Answers

No	Categories	%	Total Students
1	Misconceptions	0%	0
	Misconceptions (false positive)	67%	10
	Misconceptions (false negative)	33%	5
2	Misconceptions	0%	0
	Misconceptions (false positive)	67%	10
	Misconceptions (false negative)	33%	5
3	Misconceptions	0%	0
	Misconceptions (false positive)	53%	8
	Misconceptions (false negative)	47%	7

After being given a three-tier test and known to students who experienced misconceptions, the following are the results of the misconception analysis on the three question items:

a. Students' Understanding of the Concepts of Ascending Function and Descending Function

Question Number 1

The answers of the subjects that appear the most are as follows:

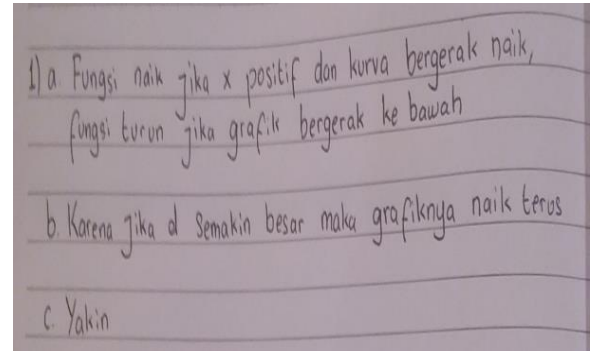


Figure 1. Sample Misconception Answers

After calculating the answers of class XII, BDP students of SMK PGRI 13 Surabaya in question item no. 1, there were 10 students who answered correctly but were unable to explain the reason, based on the criteria of misconceptions, there were 10 class XII BDP students who experienced false positive misconceptions. In addition, there were also 5 students who were unable to answer correctly but were able to give a valid reason, based on the misconception criteria, the 5 students experienced false negative misconceptions. This is shown from the communication of the answers of the 10 students who answered B-S-Y and the combination of the answers of the other 5 students S-B-Y, the reason for the completion given was not in accordance with the concept, namely if $f'(x)$ is *positive*, ($f'(x) > 0$) then the function is an ascending function, if $f'(x)$ is *negative*, ($f'(x) < 0$) then the function is a descending function.

Questions Number 2

The answers of the subjects that appear the most are as follows:

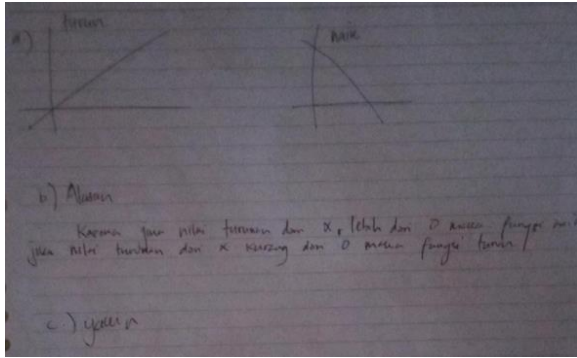


Figure 3. Sample Misconception Answers (false negative)

After calculating the answers of class XII BDP students of SMK PGRI 13 Surabaya in question item no. 2, there were 11 students who answered correctly but were unable to explain the reason, based on the criteria for misconceptions, the 11 students experienced false positive misconceptions. This is shown from the communication of the answers of the 11 students who answered B-S-Y, the reason for the completion given is not in accordance with the concept, namely Because a function is said to rise when the value of x moves to the right of the number line, the graph of the function moves up, and down if the graph of the function moves down.

In addition, there were 4 students who answered incorrectly but were able to explain the reason, based on the misconception criteria, the 4 students experienced false negative misconceptions. This is shown from the communication of the answers of the 4 students who answered S-B-Y, the answers written were not in accordance with what was taught as well as those written in the learning module.

Therefore, it can be concluded that 67% of students experience false positive misconceptions and 33% of students experience false negative misconceptions related to the concept of ascending function and descending function, Based on the results of interviews with related students, it is known that the misconception of this concept is because students do not understand and experience confusion in understanding symbols and also mathematical language, making it difficult to understand the explanations explained scientifically either by teachers or books as sources learn.

Based on the indicators of the type of misconception, questions no. 1 and no. 2 of students who experienced misconceptions, both false positive and negative, were categorized as experiencing theoretical types of misconceptions

because students were unable to distinguish the basic concepts of ascending function and descending function.

a. Students' Ability to Perform Up Function operations and Descending Functions

Question Number 3

The answers of the subjects that appear the most are as follows:

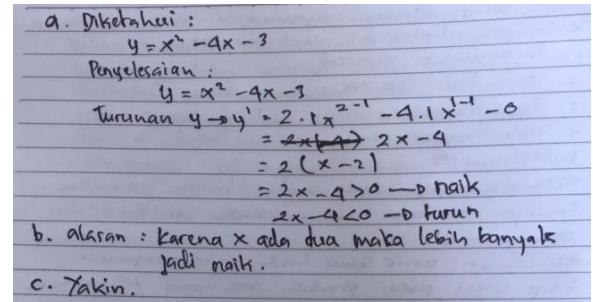


Figure 4. Sample Misconception Answers (false positive)

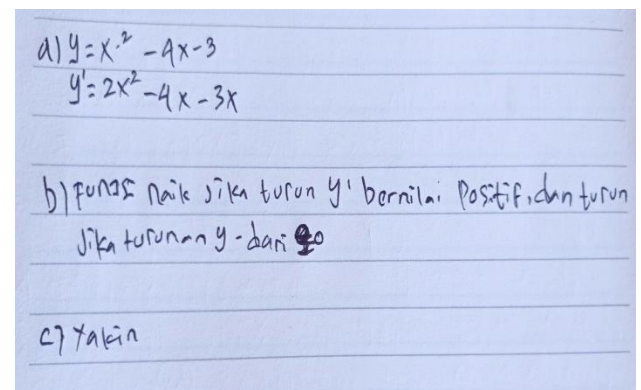


Figure 5. Sample Misconception Answers (false negative)

After calculating the answers of class XII BDP students of SMK PGRI 13 Surabaya in question item no. 3, there were 8 students who answered correctly but were unable to explain the reason, based on the misconception criteria, the 8 students experienced false positive misconceptions. This is shown from the commutation of the answers of the 8 students who answered B-S-Y, the reason for the completion given was not in accordance with the concept of ascending function and descending function, the correct reason should *because if $f'(x) > 0$, then the function is an ascending function, if $f'(x) < 0$ then the function is a descending function.*

In addition, there were 7 students who answered incorrectly but were able to explain the reason, based on the misconception criteria, the 7

students experienced false negative misconceptions. This is shown from the communication of the answers of the 7 students who answered S-B-Y, the answers written were not in accordance with the correct computational process

Therefore, it can be concluded that 47% of students experience false negative misconceptions and 53% of students experience false positive misconceptions related to technicalities in this case it is the correct computational process, this is because students have not fully understood the computational process that has been taught before, from the initial computational process that has not been understood, students experience misconceptions in understanding the material of the ascending function and the descending function and even completing it. Based on the indicator of the type of misconception, point no. 3 of students who experienced misconceptions, both false positive and negative, were categorized as experiencing a type of misconception calculation.

b. Factors Affecting the Occurrence of Misconceptions

In line with the research of Paul Suparno (2009) who put forward the factors that cause the occurrence of student misconceptions divided into internal and external factors, based on the results of the interview, conclusions can be drawn several factors that cause students to experience misconceptions related to concepts, technicalities, and procedures in the material describing the ascending function and the descending function, are as follows:

i. Students (Internal Factors)

- Lack of interest in studying Mathematics because it is haunted by the scourge of "mathematics is difficult" from the beginning. Low interest in learning mathematics causes students to get bored easily in learning so that there is no deepening of the material absorbed
- Weak initial knowledge (pre-concept), incorrect pre-concept greatly affects the success and failure of student indicators in studying the upcoming material.
- Wrong intuition, scientifically incorrect interpretation is often according to students to be appropriate, this happens because students follow more reasoning that they think is reasonable so that the scientificity of a material is no longer paid attention to

- The intensity of learning is also in the classroom. Many students admitted that they did not repeat the learning in school, nor did they do practice questions other than if there was an assignment. Some students also admitted that they rarely enter classes because of internships or because of factors in themselves such as laziness. The lack of learning intensity also enters the classroom makes students quickly forget the material and the material received is incomplete so that they are prone to misconceptions

ii. Teachers

The teaching method used by the majority is lectures, this is what students think is boring, so what was originally boring mathematics will be even more boring. As a result, students' enthusiasm and interest in learning are getting lower.

iii. Environment and Learning Time

The hours of studying mathematics at school are the last hour, as a result, many students are tired, have disappeared as soon as when learning mathematics, this makes the material given not absorbed completely so that it is prone to misconceptions The class located near the canteen and the teacher's room makes many students and teachers pass by, this kind of learning environment makes the student's learning focus disturbed so that the material provided is not absorbed completely.

iv. Book Text

The learning module as a learning resource according to students the content is incomplete, there are also many examples of questions whose work process is not complete directly on the final result, the incompleteness of this module is one of the factors causing misconceptions due to incomplete material

4. Conclusions

Based on the results of research and discussion, it can be concluded that from the results of the Three Tier-Test students of class XII BDP, it is identified that:

- a. Students who experienced theoretical misconceptions on the material of the ascending function and the descending function were 15 students
- b. The students who experienced misconceptions of calculations on the

material of the ascending function and the descending function were 15 students

The factors that cause the occurrence of misconceptions in class XII BDP students are as follows:

- a. Lack of interest in student learning in mathematics subjects
- b. Improper preconceptions
- c. Wrong student intuition
- d. Low intensity of learning and entering classes
- e. The time and environment of learning mathematics in schools is less supportive to focus
- f. The teaching methods that teachers use are boring
- g. Learning Modules whose content is incomplete

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