Analysis of Student's Misconceptions in The Subject Material Circle in View of Learning Readiness and Student's Think Style

Endang Purwati Wardani[1], Abayneh Kebede Fantaye[2], Jimoh Azeez Ade[3]
[1]Faculty of Teacher Training and Education, Universitas Sebelas Maret, Jawa Tengah, Indonesia
[2]Debre Tabor University Ethiopia
[3]University of Ilorin, Cameroon

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ABSTRACT

Purpose of the study: This study aims to: (1) find out the characteristics of misconceptions, and (2) find out the causes of misconceptions in students in the material equations of circles and tangents to circles seen from the readiness and learning styles of students.

Methodology: Qualitative research was applied in this research. The research subjects were high school students. Data sources were taken from informants (students), documentation (questionnaires), and tests. Data collection was carried out by interviews, diagnostic tests, and questionnaires. Data validity uses source triangulation. Data analysis uses the concept of Miles and Huberman, namely data collection, data reduction, data presentation, and drawing conclusions

Main Findings: secara umum miskonsepsi yang terjadi pada semua siswa dalam materi lingkaran adalah dalam menentukan persamaan lingkaran (menentukan titik pusat dan jari – jari lingkaran), memahami kedudukan suatu titik terhadap lingkaran dan menentukan persamaan garis singgung pada lingkaran. Secara khusus siswa yang siap belajar dengan gaya berpikir sintetik (S1, S2, S3) mengalami miskonsepsi dalam memahami kedudukan suatu titik terhadap lingkaran dan menentukan persamaan garis singgung pada lingkaran. Siswa yang tidak siap belajar dengan gaya berpikir sintetik (S7, S8, S9) mengalami miskonsepsi dalam menentukan persamaan lingkaran (menentukan titik pusat dan jari – jari lingkaran) dan menentukan persamaan garis singgung pada lingkaran.

Novelty/Originality of this study: Improving communication and closeness with students and arousing students' interest and motivation towards mathematics.

Corresponding Author:
Endang Purwati Wardani,
Faculty of Teacher Training and Education, Universitas Sebelas Maret, Jl. Ir Sutami No.36, Kentingan, Kec. Jebres, Kota Surakarta, Jawa Tengah, Indonesia
Email: endangprwardani97@gmail.com

1. INTRODUCTION

The concept is an idea or understanding that is abstracted from a concrete event, the concept also means a mental image of an object, process or anything that exists outside of language, which is used by reason to understand other things [1]–[4]. Concept is an abstraction that represents a class of objects, events, activities or relationships that represent the same attribute. Concept refers to basic understanding. Students develop a

concept when they are able to classify or group objects or when they can associate a name with a certain group of objects [5], [6].

Concept learning activities are learning to develop logical inferences or make generalizations from facts to concepts. By learning concepts, students can understand and distinguish objects, events or incidents that exist in the surrounding environment [7]. Through concept learning activities there are several advantages, namely (1) reducing the heavy burden of memory because the human ability to categorize various stimuli is limited, (2) is an element of thinking development, (3) is the basis of higher mental processes, and (4) needed to solve the problem. Classification of learning activities in several ways, including concept learning, according to him, this concept learning activity is related to various responses at the same time to a number of stimuli in the form of different concepts from one another.

The conception that students have before learning is called pre-concept. Preconcepts that students have are not necessarily correct. If this is lacking or not paid attention to by the teacher in the learning process, it will affect the learning process, and then it will have the opportunity to cause misconceptions in students. Misconception refers to a concept that is not appropriate. A misconception occurs when someone believes a concept that is objectively wrong. In connection with the nature of human subjectivity, it can be assumed that everyone always has a misconception. If a concept cannot be proven right or wrong, it cannot be said that the disbeliever has a misconception about the concept [8]. This cannot be done by people who believe (believers) no matter how people who believe want a concept to be true or vice versa. Misconceptions arise because of preconceptions, preconceptions are the initial concept that someone has about an object. This initial concept was obtained by someone from a certain formal level of education. The initial concept of an object that is owned by a child may be different from the concept taught at school on the same object.

Misconceptions are defined as differences in a person's conception with those of experts, these differences arise due to preconceptions that are not necessarily true [9]. Misconceptions experienced by students on previous concepts can hinder understanding of subsequent concepts. For this reason, misconceptions that occur in students must be addressed immediately. In dealing with misconceptions that students have, it is necessary to know in advance what misconceptions students have and where they get them. Thus, you can think about how to overcome it. In concept learning students are expected to be able to define the concept in question, explain the difference between the concept in question and other concepts, explain the relationship with other concepts, explain the meaning of the concept in everyday life and apply it to solve problems in everyday life. - day.

Misconception is a problem that is often faced by students in learning mathematics and is often a barrier to understanding mathematical concepts. Things that cause misconceptions include the difficulty of abandoning pre-existing student understanding or preconceptions (especially wrong ones) that may be obtained from the learning process first, the lack of precise application of concepts that have been learned, the use of visual aids that do not represent precisely the concepts described, the teacher's instability in displaying the essential aspects of the concept concerned, the teacher's instability in the use of terms, and the instability in connecting one concept to another concept when the situation is right. Furthermore, there are four things that cause misconceptions, namely the meaning of words, practical aspects of simplification, pictures.

Thinking style is a person's perspective on a problem and then responds [10]–[12]. Every individual has a way of thinking that is not the same, a person's thinking style will be very useful in the process of receiving information, where information that has just entered will be processed and connected with information that already exists in the brain, then with this style of thinking the information is processed into new understanding and knowledge. . In the learning process, a student will obtain new information which, with their respective thinking styles, the new information will be processed and will become new knowledge or understanding for the student. Where in reality there are no people who are 100% pure in one of the categories of thinking styles, everyone must have a combination of these thinking styles, but usually someone has a tendency to be more dominant in one of these thinking styles. The thinking style is divided into two, namely the analytical thinking style and the synthetic thinking style. People who think analytically will have the following characteristics: (1). In looking at something tends to be more detailed, specific, organized and orderly. But less able to fully understand the problem. (2). In carrying out the assigned tasks, they will carry out their duties regularly, from one stage to the next. So that in solving a given problem, people with an analytical thinking style will divide the main problem given into several parts to be solved in stages. (3). Requires more time to complete the task. (4). Thinking about something based on logic and assessing the facts that happened beyond his feelings. (5). In doing something less able to understand the intent and purpose. (6). It is very difficult to study when there are distractions, because usually his mind is only focused on one problem. (7). Requires a regular and clear daily schedule.

People who think synthetically will have the following characteristics: (1). They tend to see things as a whole, with the big picture, but they can see the relationship between one part and another. (2). In solving a given problem, people with a synthetic thinking style will combine elements or elements that have a relationship with one another, see the similarities to then be assembled to solve the main problem. (3). Can see

that there are many choices in doing tasks and can complete several tasks at once. (4). Can cooperate with others, sensitive to the feelings of others, and flexible. (5). Happy to give and receive criticism / praise. (6). Having trouble if you have to explain something step by step. (7). Lacks neatness. (8). His mind can never focus on one problem. (9). If they are working on one task, then a new task appears, then they will start working on the second task, even though the first task has not been completed.

The purpose of this study was to determine the characteristics and causes of misconceptions that occurred in senior high school on the subject matter of Circle Equations and Circle Tangent Equations, in terms of student learning readiness and students' thinking styles.

2. RESEARCH METHOD

The research was conducted in one of the high schools in Central Java, Ethiopia, Cameron and Zambia. This type of research is a qualitative descriptive research that seeks to analyze the characteristics and causes of misconceptions experienced by students.

The subjects in this study were students of senior high school. The selection of subjects was by purposive sampling and snowball sampling, as stated by [13] namely "In qualitative research, the sampling technique used was purposive sampling and snowball sampling". Data collection techniques in this study used questionnaires, tests and interviews. The questionnaire in this study was a questionnaire about student learning readiness and a questionnaire about students' thinking styles. Diagnostic tests aim to assess students' conceptual understanding of fundamental concepts in a field of science, especially concepts that commonly cause misconceptions. The interviews used were structured interviews accompanied by assignments.

This study uses data analysis techniques in the form of qualitative data analysis, which follows the concept given by Milles and Huberman which suggests that activities in qualitative data analysis are carried out interactively and continue continuously until complete until the data is saturated. Activities in data analysis, namely: data collection, data reduction, data presentation, and drawing conclusions [14]–[17].

3. RESULTS AND DISCUSSION

From the results of data analysis, it was found that students experienced several misconceptions about circle material. These misconceptions include determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point to a circle and determining the equation of a tangent line to a circle. The existence of these misconceptions is an obstacle to the smooth learning process of students. The misconceptions experienced by these students can be seen in Table 1 below:

Table 1. Misconceptions in Students

Misconceptions experienced by students	Learning Readiness Qualification – Thinking Styles											
	Students are ready to learn with an analytical thinking style			Students are ready to learn with a synthetic thinking style			Students are not ready to learn with an analytical thinking style			Students are not ready to learn with a synthetic thinking style		
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Determine the equation of a circle (determine the center point and radius of the circle)	V	V	V	V	V	V	V	V	V	V	V	V
Understand the position of a point with respect to the circle	V	V	V	V	V	V	V	V	V	V	V	V
Determine the equation of the tangent line to the circle	V	V	V	V	V	V	V	V	V	V	V	V

Description: V = experiencing misconceptions

From Table 1 regarding student misconceptions above, it can be seen that overall students experience misconceptions. In students who are ready to learn with a synthetic thinking style (S1, S2, S3) generally experience misconceptions in determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point to a circle and determining the equation of a tangent to a circle. To determine the equation of a circle (determining the center point and radius of the circle) undergraduate,

postgraduate and postgraduate students experience misconceptions about circles with centers (a, b) and misconceptions about the general form of circular equations.

Students who are ready to learn with an analytical thinking style (S4, S5, S6) experience misconceptions in determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point to a circle and determining the equation of a tangent line to a circle. Students who are not ready to learn with a synthetic thinking style (S7, S8, S9) experience misconceptions in determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point to a circle, and determining the equation of a tangent line to a circle. Students who are not ready to learn with an analytical thinking style (S10, S11, S12) experience misconceptions in determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point to a circle and determining the equation of a tangent line to a circle. The misconceptions experienced by these students can be expressed in the classification of misconceptions which can be seen in Table 2 below.

Table 2. Classification of Student's Misconceptions

Misconceptions experienced by students	Klasifikasi Miskonsepsi											
	Students are ready to learn with an analytical thinking style			Students are ready to learn with a synthetic thinking style			Students are not ready to learn with an analytical thinking style			Students are not ready to learn with a synthetic thinking style		
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Determine the equation of a circle (determine the center point and radius of the circle)	1	1	1	2	2	2	3	2,3	2,3	2, 3	2, 3	2, 3
Understand the position of a point with respect to the circle	3	3	3	3	3	3	3	3	3	3	3	3
Determine the equation of the tangent line to the circle	3	3	3	3	3	3	3	3	3	3	3	3

Information :
1. Classificational Concepts
2. Correlational Concept

1. Theoretical Concepts

From Table 2 above it can be seen that students who are ready to learn with a synthetic thinking style (S1, S2, S3) experience misconceptions in the classification concept in determining the equation of a circle (determining the center point and radius of a circle). Experiencing misconceptions theoretically in understanding the position of a point to a circle and determining the equation of a tangent line to a circle.

Students who are ready to learn with an analytical thinking style (S4, S5, S6) in determining the equation of a circle (defining the center point and radius of the circle) experience a misconception in the correlational concept. And theoretical conceptual misconceptions in understanding the position of a point to the circle and determining the equation of the tangent line to the circle.

Students who are not ready to learn with a synthetic thinking style (S7, S8, S9) experience misconceptions in determining the equation of a circle (defining the center point and radius of the circle), namely misconceptions in correlational concepts and theoretical concepts. This is because there are several forms of circular equations, so that students experience theoretical conceptual misconceptions about certain circular equation forms and experience correlational conceptual misconceptions about other circular equation forms. In understanding the position of a point to the circle and in determining the equation of a tangent to a circle, students who are not ready to learn with a synthetic thinking style (S7, S8, S9) experience conceptual misconceptions.

Students who are not ready to learn with an analytical thinking style (S10, S11, S12) experience misconceptions in determining the equation of a circle (defining the center point and radius of the circle), namely misconceptions in correlational concepts and theoretical concepts. This is because there are several forms of circular equations, so that students experience theoretical conceptual misconceptions about certain circular equation forms and experience correlational conceptual misconceptions about other circular equation forms. In determining the equation of a tangent to a circle and determining the position of a point to the circle students who are not ready to learn with an analytical thinking style (S10, S11, S12) experience misconceptions theoretically.

In general, what causes misconceptions in students is the difficulty of students in classifying the forms of equations of circles and equations of tangents to circles. This is because there are several forms for the circle equation, where for each particular form it has a certain tangent equation as well.

In general, students experience misconceptions about Circle material, these misconceptions are:

(a) In the circle equation (determining the center point and the radius of the circle), for the simple circle equation, namely circle $L \equiv x^2 + y^2 = r^2$, students do not experience misconceptions, but in another form of the circle equation, namely circle $L \equiv (x – a)^2 + (y – b)^2 = r^2$ and $L \equiv x^2 + y^2 + Ax + By + C = 0$, students experience misconceptions in correlational concepts and theoretical concepts. Here students experience the application of inappropriate concepts, resulting in the acquisition of concepts that fail to differentiate.

(b) In understanding the position of a point to a circle, students experience misconceptions theoretically, meaning that students experience incomplete attribute assignments, resulting in failure to define the concept correctly and completely.

(c) In determining the equation of a tangent to a circle, students experience misconceptions theoretically, meaning that students experience incomplete attribute assignments, resulting in failure to define concepts correctly and completely.

Misconceptions that occur in students because students experience difficulties in classifying the forms of equations of circles and equations of tangents to circles. The forms of the equation of the circle have certain characteristics, namely for each particular form of the equation of the circle, it has a center point, radius, position of a point and a certain equation of the tangent line as well. This makes it difficult for students to classify the forms of the circle equation.

4. CONCLUSION

In general, the misconception that occurs in all students in circle material is in determining the equation of a circle (determining the center point and radius of a circle), understanding the position of a point with respect to a circle and determining the equation of a tangent line to a circle. In particular, students who are ready to learn with a synthetic thinking style (S1, S2, S3) experience misconceptions in understanding the position of a point to a circle and determining the equation of a tangent line to a circle. Students who are not ready to learn with a synthetic thinking style (S7, S8, S9) experience misconceptions in determining the equation of a circle (determining the center point and radius of a circle) and determining the equation of a tangent line to a circle. In general, in determining the equation of a circle (determining the center point and radius of a circle), students experience misconceptions in correlational concepts and theoretical concepts simultaneously. In particular, students who are ready to learn with an analytical thinking style (S4, S5, S6) experience misconceptions in a correlational concept, and students who are ready to learn with a synthetic thinking style experience misconceptions in a classification concept (S1). In general, in understanding the position of a point to a circle, students experience conceptual misconceptions theoretically, and specifically students who are not ready to learn with a synthetic thinking style (S7, S9) and students who are not ready to learn with an analytic thinking style (S10) do not experience misconceptions. . In determining the equation of the tangent line to the circle, all students experience misconceptions theoretically. In general, what causes misconceptions in students is the difficulty in classifying/sorting out the forms of equations of circles and equations of tangents to circles. This is because there are three forms of the equation of a circle with their own characteristics, where each form has a certain equation of the tangent line as well. Likewise for the position of a point to the circle, where there are three positions, but each particular circle has its own characteristics to determine the position of the point to the circle. In particular, the causes of misconceptions in students are because they do not have learning readiness (S8), have difficulty remembering the formulas (S7, S10) and students are too hasty to work on questions so they forget the concept (S9).

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