DIAGNOSIS OF LEARNING DIFFICULTIES IN MATHEMATICS (GEOMETRY) FOR STUDENTS GRADE X AT SMK NEGERI 3 YOGYAKARTA

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Abstract

The objectives of this research are to describe the difficulties of students and their causes in solving geometry problems. The difficulties were observed related to the concept and principles.

This research is a qualitative research with case study strategy. Subjects of this research are seven students of class X KR 1 and X TP 2 at SMK Negeri 3 Yogyakarta whom diagnosed have learning difficulties in solving geometry problems. Qualitative data were collected by test and interviews. The data were analyzed descriptively qualitative.

The results show the concept of geometry that has not understood by students are the concept of solid geometry (cubes and rectangular prism), right triangle, the projection (the point on the line, the point on the plane, and the line on the plane), perpendicular concept (two lines, lines and plane), distance (point to the line, point to the plane and two parallel planes), and angle (lines and plane, two planes). Meanwhile, the principle of which is not mastered by students are the principle of projection, distance calculations, the Pythagorean theorem, calculation of the root, the calculation of the angle and trigonometry comparison. The cause of the learning difficulties by students is students do not have awareness to learn regularly.

Keywords: diagnosis , students' learning difficulties, geometry

INTRODUCTION

Formal education that are demanding public, namely vocational school (SMK). Based on data summary of school in Indonesia, on year 2015/2016, the number of vocational school in Indonesia reached 12.799 schools with 3,574,649 students (dapo.diken.kemendikbud.go.id). Vocational education not only improves the cognitive potential of students only, but also to prepare students to become productive people who have an entrepreneurial spirit and ready to work. This is supported by Nelly Roshida, et al statement (2014: 36), the Vocational School (SMK) is a vocational education that prepares graduates are ready to compete in the world of work. The mission of SMK is to produce graduates who have a national identity and a competitive edge in national and global markets. Therefore, vocational students must passing the standards of all subjects both normative, productive and adaptive. One of adaptive subjects, namely mathematics.

James and James was quoted as saying by Erman Suherman (2001: 18) says that mathematics is the science of logic, composition, scale, and concepts related to each other. Mathematics are divided into three branches, namely algebra, analysis and geometry. Geometry is a branch of mathematics that is taught in schools. Geometry is closely related to our daily lives. Many problems in daily life associated with the geometry and require the application of the concept of geometry to solve it. Geometry, in particular the solid geometry has learned by student since being in high school (Okky, 2015: 180). Learning geometry is very important because it supports a lot of material, such as, vectors, calculus, and develop problem solving skills (sugiyono, et al, 2014: 118-119). Bobango (1993: 148) argues that the objectives of learning geometry are to gain the students confidence in the ability of their mathematics, become good problem solvers, to communicate mathematically, and to thinking mathematically.

Although the geometry is indispensable in life, but in fact a lot of students who do not master the subject. When the researchers conducted observations, the students of grade XII who will participate in the national exams of the school year 2015/2016 difficulty in solving problems associated with distance and angle. This is shown by the percentage of students who answered correctly in his final school examinations for chapter of distance between points to plane only 25.8%, while for chapter of angle between two lines is 52.3%.

For students of class X KR1 and X TP 2 at SMK Negeri 3 Yogyakarta that will receive the geometry proved to have a basic ability geometries tend to be low. This is demonstrated by the students' average value of a pre-requisite knowledge test with questions about the kinds of solid geometry, the elements of geometry, the relationship between these elements, and the concept of a triangle, which only reached 55.26. After class X KR 1 and X TP 2 learned geometry, there are many students who have not mastered the material. It was based on the test scores of chapter geometry at class X KR 1 and X TP 2 SMK Negeri 3 Yogyakarta which indicates that there are 46 students have score less than KKM. Other evidence indicated by documentation of the results of the midterm, the 33 students did not pass the KKM. In chapter geometry, KKM that determined by the teacher is 70. In addition, the results of diagnostic tests conducted by the researchers to the students of class X KR 1 and X TP 2 shows, there are 33 students who made an error more than 50% when solving the diagnostic tests. Based on the documentation of daily tests, midterm, and diagnostic tests, many students have difficulty solving geometry problems of distance between the point to the line, the distance between the point to the plane, an angle between the line and the plane, as well as the angle between two plane. This can be seen from the percentage of students for each number.

Student difficulties in solving the geometry problems, indicating that students have learning difficulties. Learning difficulties of student must be known by teachers to make improvements or remedial teaching. Students' learning difficulties can be assessed through the difficulties of students in solving problems of geometry. The difficulties associated with the direct objects in mathematics such as facts, concepts, math skills, and principles. As Cooney said (1975: 203) that the concepts and principles is a basic knowledge in mathematics. These concepts and principles should be controlled, so the students can solve math problems correctly.

Based on the explanation above, there should be research about the diagnosis of learning difficulties in mathematics specially in geometry for class X SMK Negeri 3 Yogyakarta include student difficulties in solving geometry problems and the factors that cause learning difficulties of students in geometry, so that it can be a reflection by a teacher to follow up on students who have learning difficulties.

RESEARCH METHODS

Type of Research

This research is a qualitative research using case study strategy and descriptive analysis methods.

Time and Place of Research

This research was conducted between February until April 2016 at SMK Negeri 3 Yogyakarta, at class X KR 1 and X TP 2. The school is located at jl. R.w. monginsidi 2, jetis, yogyakarta, yogyakarta 55 241.

Target / Subject of Research

The subjects were students of class X SMK Negeri 3 Yogyakarta who have difficulty in solving geometry problems. Students as research subjects were selected from the observation, documentation, and diagnostic tests. The research subject has been selected as many as 60 students, but because the researchers conducted direct observations only with the class X KR 1 dan X TP 2, the subjects were taken by purposive sampling. The researchers was taken seven students, three students from class X KR 1 and 4 students of class X TP 2 with consideration of the following criteria.

1. The student has been getting geometry.

2. Students have sufficient knowledge and experience in solving geometry problems.
3. Students have been able to communicate orally or writing well.
4. Students are not completed on the daily tests and midterms.
5. Students who made a lot of mistakes while working on diagnostic tests.

Students who meet these criteria can be designated as a research subject. Based on the results of daily tests, midterm, and diagnostic tests can be assigned prospective research subjects are presented in Table 1.

Tabel 1. Candidate Subject Research Based on Daily Tests, Midterm, and Diagnostic Tests

Daily Tests	Midterm	Diagnostic Test
A1, A2, A3, A4, A9, A10, A11, A13, A14, A16, A17, A18, A19, A20, A21, A24, A26, A27, A28, A29, A30, A32, B1, B2, B3, B4, B6, B8, B9, B11, B13, B14, B16, B17, B18, B19, B20, B21, B22, B23, B24, B26, B27, B30, B32	A3, A5, A10, A16, A18, A21, A22, A24, A25, A28, A30, B2, B4, B5, B6, B7, B8, B10, B11, B14, B15, B16, B18, B19, B22, B24, B25, B28, B29, B30, B32	A1, A2, A3, A4, A11, A13, A14, A23, A24, A25, B1, B5, B6, B7, B8, B10, B11, B13, B15, B16, B18, B20, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31

Table 1 shows that there are a lot of candidate research subjects. Teachers at the school suggested seven students who have difficulty learning the dominant tendency and learning achievement unstable in geometry. They are A3, A13, A23, B11, B24, B26, and B30.

Design of Research

The general diagnostic procedures that will be used in this research is the procedure by Cooney, Davis and Henderson (1975: 202-209). This procedure consists of identifying students who have learning difficulties, determine the type and nature of learning difficulties, estimates that causes learning difficulties, learning difficulties solving process.

1. Identify students who have learning difficulties

The purpose of identification is to find students who are expected to have learning difficulties. The steps taken is marking the students in a class who have learning difficulty. How to be taken include:

a. examines the value of daily tests and midterms, and then compared with the average value of the class or the minimum mastery level of competency criteria required,
b. analyzing the results of daily tests and midterms to see the nature of the mistakes made, and
c. observation when the student in the learning and teaching process.

2. Determine the type and nature of learning difficulties

Having found the suspected individuals or students with learning difficulties, determined the type and nature of learning difficulties. In this step in general there are three key issues that must be assessed are:

a. detection of learning difficulties in a particular subject of study,
b. detecting the learning objectives and part of the chapter which happened trouble, and
c. analyzing the records about the learning process.

In connection with the subjects of Mathematics, the possibility of difficulties often experienced by students that the difficulties related to the concept, principles and algorithms. In this case, the procedure used is a diagnostic test.

3. Estimate the causes of learning difficulties

The causes of learning difficulties in this research as has been previously disclosed by Muhibbin Shah that is include the part of internal factors (affective). In this case, the procedures used were interviews and observation.

4. Solving Process Learning Difficulties

Steps in the process of solving learning difficulties include:

a. estimate the possible help,
b. establish possible ways of coping, and
c. follow-up.

Follow-up is doing remedial teaching activities most appropriate to help students learning disabilities.

There are several steps that was not done by the researchers, that are conducted

observations at the time of the student in the learning process and analyse the records of the learning process. It is caused by the limited observations of researchers. In addition, due to the limited time of the study, the researchers just do a diagnosis to reaching a conclusion. For the follow-up to students who have learning difficulties submitted to teachers and schools.

Instruments and Data Collection Techniques

In this research, data collection techniques used are as follows.

1. Diagnostic Tests

The tests that used in this research is a diagnostic test. This test is used to determine the location of student difficulties in solving geometry problems related to concepts and principles. Diagnostic tests were developed after analyzing the formative tests to determine the parts that have not mastered by students. After knowing the parts that have not mastered by students, then made a diagnostic test for these parts.

2. Interview

Interviews were conducted in this study are in-depth interviews. This interview is used to explore in depth the difficulties students in solving geometry related to the concept and principles, and to trace the causes of students' learning difficulties. Before conducting interviews, researchers have developed a reference interview, so the interview process can stay focused and not out of context. This interview was conducted to teachers and students. Interview for teachers aiming to obtain supporting data on the factors that cause learning difficulties of students in geometry. Interview for students aiming to locate the difficulties of students while work on the problems of diagnostic tests and identify the factors that cause learning difficulties of students in geometry. There are two parts in interview guidelines for students. The first section to diagnose student difficulties in solving geometry problems related to concepts and principles. The second part to identify the cause of students' learning difficulties. Guidelines for the teacher interview contains questions to identify the factors that cause lstudents' earning difficulties . Interview guidelines may change according to the needs of researchers.

Data Analysis Technique

In this research, the data analysis performed using descriptive qualitative data analysis techniques. The procedures of data analysis techniques were performed as follows.

1. Data reduction is done in a way summarizes the results of students' mistakes in solving the diagnostic tests were given.
2. Presentation of data, including:
   a. presents the results of the work of students who have been selected as a research subject,
   b. presents the results of interviews that have been made against the student who is the subject of research,
   c. observe the concepts and principles difficulties experienced by students of diagnostic test results and interviews, and
   d. comparing the data obtained (triangulation).
3. Take a conclusion and verification, including:
   a. grouping similar data and
   b. take a conclusions from the data obtained regarding the type and the factors that cause students' learning difficulties using triangulation.

RESULTS AND ANALYSIS

1. Reduction of data

At this step, researchers summarizes the mistakes made by the research subjects when solved the diagnostic tests that have been given. A3 make mistakes as many as 7 problems, A13 as many as 12 problems, A23 as many as 8 problems, B11 as many as 12 problems, B24 as many as 11 problems, B26 as many as 12 problems and B30 as many as 12 problems.

2. Presentation of data

At this step, researchers present data in narrative data. Student difficulties in solving geometry problems, including student difficulties in understanding the concepts and mastery of the principles of geometry are described based on diagnostic tests and interviews. Causes of students' learning difficulties, including internal factors (affective) described based on the results of interviews. Here is the results of the research for each research subjects

a. The diagnosis results of students who have learning difficulties in understanding the concept of geometry.

Based on data analysis of diagnostic tests and interviews, student difficulties in understanding the concept of itemized as follows.

1) A13 difficulty understanding the concept of cubes and rectangular prism.
2) A13 and A23 difficulty understanding the concept of right triangles.
3) A13, B11, and B24 difficulty understanding the projection of point on the line concept.
4) A13, B11, B24, and B30 difficulty understanding the projection line on the plane of concept.
5) A13 difficulty understanding the perpendicular concept of two lines.
6) A13 difficulty understanding the perpendicular concepts between line and plane.
7) A13 and B24 difficulty understanding the distance of point to the line concept.
8) A13, B24, and B30 difficulty understanding the distance of point to the plane concept.
9) A13 difficulty understanding the concept of distance between two parallel planes.
10) A3, A13, B11, B24, and B30 difficulty understanding the concept of the angle between the line and the plan.
11) A3 and A13 difficulty understanding the concept of the angle between the two planes.

b. The diagnosis results of students who have learning difficulties in mastery the principle of geometry

Based on data analysis of diagnostic tests and interviews, the students' difficulty in the mastery principle is specified as follows.

1) A23 and B26 difficulty remembering the necessary steps in solving a problem.
2) A13, B11, B24, B26, and B30 difficulty determining the projected point on the line.
3) A13, A24, B11, B24, B26, and B30 difficulty determining the projected point to the plane.
4) A13, B11, B24, and B30 difficulty determining the projected line on the plane.
5) A13 difficulty using the Pythagorean theorem to solve problems.
6) A3, S13, B24, and B30 difficulty simplifying the root.
7) A3, A13 and B11 difficulty calculating the roots.
8) A3, A13 and B26 difficulty rationalizing the root.
9) A13 difficulty determining the length of a perpendicular line that connecting to point in parallel planes.
10) A13, B11, and difficulty determining the acute angle formed by a line and its projection on the plane.
11) A13, B11, and B30 difficulty determining the angle formed by two lines on each plane, each line perpendicular to the intersection line of the both planes at one point
12) A3, A13 and B26 difficulty using trigonometry comparison.

c. Causes of students' learning difficulties

Having outlined the difficulties experienced by students in solving problems related to the concept and principles of geometry, it is necessary to explore the causes of the students' difficulties. Cause of student difficulties in solving geometry problems based on the results of interviews conducted with teachers and the research subject. The causes explained below.

1) There is one student, he is B24, who has lack of discipline in learning
2) There are two students, they are A3 and B24 who not have motivation to study harder.
3) The whole reserach subject said that they had not had time to study regularly at home.
4) There is one student said that he quickly feel bored while learning geometry.

Based on these descriptions indicate that the most influential factor is that students do not have awareness to learn regularly.

3. Conclusions and verification

The results show the concept of geometry that has not understood by students are the concept of solid geometry (cubes and rectangular prism), right triangle, the projection (the point on the line, the point on the plane, and the line on the plane), perpendicular concept (two lines, lines and plane), distance (point to the line, point to the plane and two parallel planes), and angle (lines and plane, two planes). Meanwhile, the principle of which is not mastered by students are the principle of projection, distance calculations, the Pythagorean theorem, calculation of the root, the calculation of the angle and trigonometry comparison. The cause of the learning difficulties by students is students do not have awareness to learn regularly.

CONCLUSIONS AND SUGGESTIONS

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Suggestion

Based on the research, can put forward some suggestions as follows.

1. For researchers

Researchers can develop this research by reviewing not only the difficulty of understanding the concepts and mastery of principles.

2. For other researchers

a. Other researchers may conduct a follow-up of this study.

b. Other researchers can develop this research or conducting similar research with else subject.

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