

CHAPTER I

INTRODUCTION

1.1 Background

Mathematics is defined as a branch of knowledge that is exact and systematically organized. Apart from that mathematics is the science of logical reasoning and problems related to numbers. Mathematics is also defined as an assistive science in interpreting various ideas and conclusions (Fathani, 2009). In *Kamus Besar Bahasa Indonesia*, mathematics is defined as the science of numbers, the relations along numbers and the operational procedures used in solving problems regarding numbers. (Alwi *et al.*, 2002).

Mathematics learns about regular patterns, about organized structures. Starting from undefined elements (undefined terms, basic terms, primitive terms), then to defined elements, to axioms/postulates and finally to theorems (Ruseffendi, 1988: 50). To understand a structure or abstract thing, it is necessary to understand the previous concepts contained in the component. In mathematics, these concepts are referred to as prerequisite concepts as the basis for understanding the next concept.

The Ministry of Education and Culture has stated the aims of learning mathematics based on the 2013 Curriculum, which is to emphasize the modern pedagogical dimension in learning, namely using a scientific approach. There will be many activities that can be done to make mathematics learning more meaningful, namely observing, asking, trying, reasoning, presenting, and creating. All of the stated abilities are expected to be possessed by students (Fuadi *et al.*, 2016). The general purpose of mathematics learning is so that students can have the following abilities:

1. Understand mathematical concepts, explain the relationship between concepts and apply concepts or algorithms with efficient, in a flexible, accurate and precise to solve problems.

2. Use reasoning on patterns and characteristics, performing mathematical manipulations in generalizations, compiling proofs and explaining mathematical ideas and statements.
3. Solve the problems which include the ability to understand problems, design and solve models and interpret available solutions.
4. Communicate ideas with symbols, tables, diagrams or other media to clarify situations
5. Have an attitude of appreciate the benefits of mathematics in life, namely having an interest in learning mathematics, curiosity, confidence, and resilience in solving problems (Negara *et al.*, 2013).

Based on the previous explanation, it appears that the students' understanding concepts in mathematics is one of the competencies that students must have. This is because in studying mathematics, the previous concept which is a prerequisite, have to thoroughly mastered to understand the next topic or concept. Because concepts in mathematics are arranged hierarchically, structurally, logically and systematically from the simplest concepts to the most complex concepts.

Geometry is one of the mathematics subjects taught in elementary schools. According to Adjie & Rostika (2006: 267), geometry is a mathematical system. Learning geometry starts from a root concept that is not clearly defined, but we believe and can be illustrated. The root of the concept is point, line, intersect, lie at, between, and congruent. A point can be described as a point on an object. Geometry describes two-dimensional (square, trapezoidal, circle, etc.) and three-dimensional (cube, cuboid, cylinder, etc.) shapes. Geometry, both in the group of flat shapes and spatial forms, is an abstract concept. This means that these forms are not concrete objects that can be seen or held. Geometric shape is a property, whereas what is concrete, which is usually seen or held, and is objects that have properties such as geometric shapes. For example, rectangle, the concept of a rectangle is an abstract concept identified through a characteristic. From the description above, it can be concluded that geometry is an abstract concept that can be described with concrete objects that have the same properties as geometric shapes.

According to the National Council of Teachers of Mathematics (NCTM) (Saragih, 2002: 9) stated that in general the geometric skills that students must possess are: 1) Able to analyze the characteristics and properties of the two-dimensional and three-dimensional figures; and be able to build mathematical arguments about geometric relationships with other people; 2) Be able to determine the position of a point more specifically and describe the spatial relationship with other systems; 3) Applying transformations and using them symmetrically to analyze mathematical situations; 4) Using visualization, spatial reasoning, and geometric models to solve problems. For this reason, the objectives of learning geometry in general are so that students gain confidence in their mathematical abilities (skills), become good problem solvers, are able to communicate mathematically, and are able to reason mathematically.

In studying geometry, students need a good understanding of concepts so that students are able to use their skills in geometry such as visualizing, recognizing various shapes and spaces, drawing pictures, sketching shapes, labeling certain points, and recognizing differences and similarities between geometric shapes. Difficulties in understanding the concept of geometry will indicate the low mastery of students' geometry material, which results in students' failure to learn geometry at that level. In addition, solving geometric problems requires a pattern of thinking in applying concepts and skills in solving these problems. But in factual students still have difficulties in learning and solving geometric problems. This is shown by several research results.

Research on teaching geometry in schools has been widely carried out. Clements and Battista (Teguh, 2002) conducted a study of students in 7th grade junior high school and declare their findings that: (1) only 64% of 52 students knew that a rectangle was a parallelogram; (2) 50% of students do not like the question of proof; (3) students were better at solving geometric problems presented visually than verbally. Therefore, learning geometry in schools should be aimed at investigating and exploiting ideas and relationships

between geometric properties. In geometric learning, students expected to be able to visualizing, describing and comparing geometric shapes in various positions so that students can understand them.

In addition, as stated by Saragih (2002) in his research on seventh grade junior high school students, it was found that they did not have good abilities regarding the characteristics possessed by each type of triangle in students. So that students can not classify it. The classified triangles are isosceles triangles, equilateral triangles, and right triangles. Overall, students' knowledge of examples and non-examples in learning about the concept of triangles is only limited to what is taught by the teacher during learning. Students do not know that the concept of triangles can be modeled in various forms. Based on this, it is very necessary for students to pay attention to understanding the concept of triangles and other supporting skills in understanding geometric concepts such as visual, verbal and logical.

Based on the result of studies that the researcher has described, it can be concluded that students' geometric abilities are still relatively low. The low ability of geometry is made possible by the weak understanding of concepts and geometry skills of students in solving geometry problems. Another reason is that the treatment given by the teacher (models, methods, and learning approaches used by the teacher) tends to be the same for each student, even though students have different ways of learning and thinking. According to Endang (2003) good geometry teaching must be in accordance with the child's abilities. Children's abilities can be seen from the thinking process and the application of skills in solving geometric problems.

From some of these descriptions, it is necessary to follow up that can improve students' understanding of geometry concepts. One of them must be wiser in choosing a model or approach or method in conveying mathematical material, especially geometry by utilizing the findings of theoretical research to solve students' difficulties in geometry. One of the results of research that can overcome students' difficulties in geometry learning is a study conducted

by van Hiele in 1959. In theory, van Hiele (Afgani & Sutawidjaja, 2011) explains that the combination of time, teaching materials, and learning methods is an element that can improve students' abilities and students' thinking to a higher level. So it can be said that to improve students' ability in geometry, the three elements must be designed properly by the teacher in learning geometry.

Safrina *et al.* (2014: 9-20) stated that in the preparation of geometry learning materials, both form and content are expected to be in accordance with students' cognitive development. The selection of learning models must be adjusted to the material to be taught which aims to facilitate the achievement of the desired learning objectives. In learning geometry, students must go through learning stages that are adjusted to their level of thinking in order to get the expected results.

To improve the ability to understand the concept of geometry, we need a learning that is able to create an environment that accommodates students' thinking processes. Increasing the effectiveness of geometry learning, such as increasing student involvement, providing learning conditions to stimulate cognitive activities, encouraging students to discuss and share, is one thing that must be done. Through learning geometry, attitudes or activities to visualize the relationship between elements and characteristics of geometric objects are expected to be developed by students. Therefore, students must be given adequate opportunities and supportive learning media so that students can observe, explore, and discover geometric concepts. Both concrete and interactive media can precisely distinguish the relationship between elements of a spatial object. It is also necessary to know that misconceptions are prone to occur if students are not provided with concrete media and only rely on their visualization skills.

The results of the researchers' observations show that most of the learning implemented in schools is still traditional. One of the traditional learning indicators is that geometry is still taught through paper and pencil.

One of the difficulties of this method is that it does not present an accurate representation of geometric objects (Sariyasa, 2017: 1). This has an impact on students' difficulties in understanding geometric concepts.

Learning difficulties experienced by students, need an appropriate assistance (scaffolding) so that they can overcome their difficulties. According to Chairani (2015) scaffolding is prepared by the teacher and it does not meant to change the nature or level of difficulties of the assignment, but with the scaffolding provided to enable students to complete the task successfully. Scaffolding or the provision of assistance provided to students can be in the form of pictures, instructions, motivations, and warnings, outlining problems into solving steps, providing examples, and other actions that allow students to learn independently (Hasan, 2015). Scaffolding is a form of gradual assistance given by teachers to students to solve mathematical problems so that students can solve them independently. Scaffolding is closely related to the Zone of Proximal Development (ZPD). ZPD is the range between the actual developmental level and the higher potential developmental level. Students are able to reach the maximum area if assisted sufficiently. If not assisted, students remain in their actual area without being able to develop to their potential level of development.

According to Ahktar (2014: 77), the use of scaffolding has proven to be helpful in building concrete concepts in mathematics and higher order thinking skills and will be very helpful in increasing a good level of confidence in mathematics. This is supported by the existence of a significant influence between the control class and the experimental class using a learning model by providing scaffolding.

Based on the problems above, researchers are interested in studying more deeply about the learning model by providing scaffolding. Therefore, the researcher gave the title of the thesis with the title: **“Analysis of Students Understanding of Geometry Concepts through Learning by Giving Scaffolding”**.

1.2 Identification of Problem

Based on the background of the problem above, problems that arise can be identified, among others:

1. Students geometric ability in Junior High School is still relatively low.
2. Students understanding of geometry concepts and skills in solving geometric problems in Junior High School is still weak.
3. The treatment given by the teacher (models, methods, and learning approaches used by the teacher) tends to be the same for each student.
4. The results of the researchers' observations show that most of the learning implemented in schools is still traditional.
5. The learning method does not present an accurate representation of geometric objects.

1.3 Scope of Problem

Based on the background and identification of the problems above, the authors provide limitations on the problems studied so that this research is more focused, and clear. This research is limited to the tendency of each article to learn by giving scaffolding on students' understanding of geometry concepts. The results of the research used are research journal articles for the last 10 years, namely articles in 2013-2022 at the Junior High School level.

1.4 Formulation of Problem

Based on the identification and problem boundaries above, the problem formulations in this research are:

1. How is the effect of learning by giving scaffolding on students understanding of geometric concepts?
2. How is the improvement of students understanding of geometry concepts taught through learning by giving scaffolding?
3. What are the advantages of learning by giving scaffolding?
4. What are the disadvantages of learning by giving scaffolding?

1.5 Purposes of Research

The objectives of this study are:

1. To determine the effect of learning by giving scaffolding on students understanding of geometric concepts.
2. To know the improvement of students understanding of geometry concepts taught through learning by giving scaffolding.
3. To find out the advantages of learning by giving scaffolding.
4. To find out the disadvantages of learning by giving scaffolding.

1.6 Benefits of Research

Based on the achievement of the research objectives above, the following research benefits are obtained:

1. For students, through learning mathematics by providing scaffolding, it is hoped that students will no longer experience geometric misconceptions so that students can improve their ability to understand geometric concepts.
2. For teachers, it can expand knowledge about mathematics learning by providing scaffolding to help students improve their ability to understand geometric concepts.
3. For schools, as material for consideration in developing and perfecting mathematics teaching programs in schools.
4. For researchers, as information material as well as guidance material in carrying out teaching assignments as prospective teachers in the future, information as well as guidance material in carrying out teaching assignments as prospective teachers in the future.
5. For readers, as information material for readers or other researchers who wish to conduct similar research.

1.7 Operational Defenition

To avoid misunderstandings in the interpretation of the title of this study, several terms used will be explained, namely:

1. Conceptual understanding in mathematics is one of the ability that are expected to be achieved in mathematics learning, mathematical ability are shown by showing understanding of concepts in mathematics that students learn, explain relationships between concepts and apply concepts or algorithms flexibly, accurately, efficiently, and precisely in problem solving.
2. Geometry is one of the mathematics subjects taught in elementary schools. According to the *Kamus Besar Bahasa Indonesia* (2017), geometry is a branch of mathematics that explains the properties of lines, angles, planes, and spaces. Adjie & Rostika (2006: 267), geometry is a mathematical system. Learning geometry starts from a root concept that is not clearly defined, but we believe and can be illustrated. The basic concepts are point, line, intersect, lie at, between, and congruent. A point can be described as a point on an object. Geometry describes two-dimensional (square, trapezoidal, circle, etc.) and three-dimensional (cube, cuboid, cylinder, etc.) shapes. Geometry, both in the group of flat shapes and spatial forms, is an abstract concept. This means that these forms are not concrete objects that can be seen or held. Geometric shape is a property, whereas what is concrete, which is usually seen or held, and is objects that have properties such as geometric shapes. For example, rectangle, the concept of a rectangle is an abstract concept identified through a characteristic. From the description above, it can be concluded that geometry is an abstract concept that can be described with concrete objects that have the same properties as geometric shapes.
3. Scaffolding means giving a large amount of support to the child during his/her early stages of learning then the child takes over increased responsibility as soon as the child can do it himself. This support can be in any form, such as instructions, warnings, encouragement, media, giving

examples, problem solving or other things that allow students to progress on their own.

4. Influence is encouragement or persuasion and is forming or is an effect. Influence is a power that causes something to happen, something that can shape or change something else and submit or follow because of a power.
5. Improvement is an effort made by students (teachers) to assist students (students) in improving the learning process to make learning easier. Learning is said to increase if there is a change in the learning process, learning outcomes and the quality of the learning experience changes.
6. Advantage means too much state. Another meaning of excess is more.
7. Disadvantage means do not have or it can also be said something that is not owned by someone compared to others.

