

CHAPTER I INTRODUCTION

1.1 Background

One of the materials which have a special position in the mathematics curriculum is geometry, because of many concepts contained therein. From a mathematical point of view, geometry provides approaches to problem solving, such as drawings, diagrams, coordinate systems, vectors, and transformations. But in general, students most like learning through visual media in the form of images and colors. Although in reality, there are still many students who have difficulty in understanding geometry, especially on the matter of three dimensional object . So it is necessary special attention to this material, considering there are still many problems or difficulties experienced by students while learning the material geometry.

Based on interviews conducted by researchers on mathematics teachers, Mrs. Rumondang Nababan, S.Pd and students at SMPN 4 Balige. She stated some difficulties encountered during the learning process geometry took place, including: 1) students are difficult to recognize and understand geometry objects includes in three-dimensional object and its elements, (2) students are still difficulty in mentioning elements of three-dimensional object, for example, students claim that the edges of three-dimensional object is equal to two-dimensional object; (3) there are students who declare quadrilateral as a box or a cuboid. Whereas the quadrilateral of the two-dimensional object is different from the three-dimensional box or cuboid, and (4) there are also students who do not understand the relationship of queuing properties so it is difficult to define a quadrilateral concept, for example a square is a rectangle whose four sides are equal.

The next major issue, students have poor spatial ability. Where students are still difficulties in visualizing the image and give the right perception of the image or geometry problems.

One of the tests used to diagnose low student spatial abilities is:



Figure 1.1 Cuboids ABCD.EFGH

From the students' answers about the ABCD shape, especially in class VIII, the result is: 14 people or about 45% answered rhombus, 11 people or about 35% answered parallelogram, and 7 people or about 20% answered square. From other data collected by the researcher in the form of student test result on geometry material in class VII year 2016/2017 shows that, about 25% have high spatial ability, 15% have medium spatial ability, and 60% have low spatial ability.

This is also supported by several studies by some experts, such as Sunardi (2001) who found that many students are still errors in solving problems on parallel lines of junior high school students and there are still many students who claim that rhomb is not a parallelogram. Soedjadi (in Fatma, 2013: 191) who studied the spatial abilities of students, found that students are still difficult to identify and understand the geometry object especially three-dimensional object and its elements. In addition to the students' hard mentioned geometrical elements. It can be seen from the fact that states the number of students perceived that pedestal of a cube is a rhombus.

In the initial observation, the researchers concluded there are several factors that cause students of SMP N 4 Balige have low spatial ability in geometry matter, such as teaching methods, and teaching techniques that are less relevant to the matter and instructional media, and so on. Therefore, researchers

distinguish these factors into two more complex things, namely the factor of teachers and the use of learning media in schools.

The first factor is teachers or educators. The success of the teaching and learning mathematics process can not be separated from the preparation of learners and the educators. So the role and attitude of teachers in the process of learning geometry also need to be considered. From the observation by researchers at SMPN 4 Balige, students' understanding in geometry is also caused by less effective, creative and appropriate instructional models and teaching techniques. Teachers still use conventional models and less relevant of teaching techniques. This can be seen during the learning process takes place, the teacher still acts as a learning center (teacher centered learning). As a result, students can not play an active role during the learning process. They are only accept the explanation given in the absence of an attempt to discover the concept of the geometry itself. Because of this, most students memorize the formula given by the teacher or those in the package book without being able to know and develop the concept of the initial knowledge it has. So many students consider that mathematics is a difficult and abstract subject.

In addition, mathematics learning is not enough just to hear and see what is taught by the teacher, because it will only survive temporarily in their memories, but it takes the process of material storage permanently, namely through the process of recording. The recording process will help students recall and repeat the material that has been taught when needed, especially in the workout of the exercise. Without the recording process, the information received will not be optimal and will not last long in memory. The problem that arises then is how to record how to improve the memory as well as the power of thought.

The second factor is the minimal use of visual aids and learning media. Adequate learning media will also help learners to understand the material they are learning. During this time teachers rarely use props as a tool to help students in understanding the concept of geometry. Then with the less preparation of

teachers to prepare the props. Usually teachers only use whiteboards as a means to draw a two-dimensional object. Many students are still difficult to understand the material geometry because the explanations given by teachers in the classroom is still abstract. Therefore, it is needed learning media that can improve students' spatial ability toward geometry learning.

Viewed in the context of mathematics, especially geometry, it is very important spatial ability to be upgraded. National of Science (2006: 33) suggests: "Spatial thinking serves three purposes. It has (1) a descriptive function, capturing, preserving, and conveying the appearances of and relations between objects, (2) an analytic function, enabling an understanding of the structure of objects and (3) an inferential function, generating answers to questions about the evolution and functions of objects ". This explains there are 3 purposes that is, describe the function, analyze the function and find the answer of an object function. Each student should try to develop spatial sensing abilities which is very useful in understanding the relationships and properties in geometry to solve mathematical problems and problems in the development of everyday life.

The importance of spatial abilities in mathematics is supported by several studies of validity. Hills (in Tambunan, 2006: 29) says that by examining the relationship between spatial ability tests involving visualization and orientation skills of Guilford and Zimmerman with mathematical values it was found that there was a high correlation between spatial abilities and math scores, when compared with verbal tests and reasoning. Research from Suherman (1980) on school-age children (in Tambunan, 2006: 29): "There was a positive relationship between mathematics learning achievement and spatial ability". So, it is expected that learning activities in schools are more meaningful and can make students able to apply their math knowledge in everyday life. So it takes a learning approach that makes students skilled in solving problems faced, especially in geometry.

Geometry and spatial abilities are two interrelated things, because spatial ability is very useful in understanding relationships and properties in geometry.

To have a more applicative learning experience, it is of course necessary that more learning provides opportunities for students to do, try, and experience themselves.

To overcome the problem low spatial ability of students in the learning of geometry, especially three-dimensional object, it is necessary an appropriate learning model and learning techniques. In addition, it is hoped that the expected model or teaching technique can easily help students understand the concept of the geometry.

One of the learning models that can be applied in overcoming the problem of difficulties in understanding geometry is the learning of geometry based on Van Hiele theory. In the learning of geometry based on Van Hiele theory, students can find their own geometry concept from their knowledge and can increase student's activity and learning outcomes. Several studies have been done to prove that learning plan and give satisfactory results.

Selection of Van Hiele theory learning as a learning model that can help students in understanding the geometry based on several reasons. The first reason, Van Hiele's theory focuses on the learning of geometry. In addition, Van Hiele's theory also provides hierarchical understanding of learning in geometry where each level shows the thinking process that one uses in learning geometric concepts. Thirdly, each level has its own symbol and language. The fourth reason is that Van Hiele's theory provides general descriptors at each level that are elaborated into more operational descriptors and each stage can be developed in the learning stages. Finally, Van Hiele's theory has accuracy in describing students' thinking in geometry.

One technique used by researchers to support the model of learning geometry based on Van Hiele theory is Mind Map technique. Researchers suggest that Mind Mapping technique is one of innovation in effective learning and can educate students. Mind mapping is a visual technique that can align the learning process with the natural workings of the brain. Mind map is said to be in

accordance with the natural workings of the brain because its manufacture using the principles of brain management. So it will be easy to put the information into the brain and retrieve that information when needed. Mind mapping can also increase students' creativity through the process of drawing mind mapping. Therefore, Mind Mapping technique is a very suitable learning technique to support the learning of geometry based on Van Hiele theory.

By applying geometry learning based on Van Hiele theory applied with mind technique expected to create more meaningful learning and more to explore the creativity and spatial ability of students in learning mathematics. Because students find their own rules, visualize the concepts learned, the students are free to discuss with friends of a group, students are free to ask the teacher, allowing students more easily remember the chronological material being studied. As a result students' understanding of mathematical concepts is better than understanding the concept of the results of the teachers given directly.

In a study conducted by Rusyda Amrina (2013: 42-51) showed that there is a better influence on the learning result of triangle and quadrilateral material geometry in grade VII students of SMPN 3 Banjarmasin. This is indicated by the average score of students' learning outcomes 70.84% higher than the average student learning outcomes that do not apply Van Hiele learning theory, so the application of this theory provides benefits for students to obtain optimal learning outcomes. In addition, Budiarti (2015: 1-5) in his research indicates that there is a significant influence between the results of third grade students of SDN Summersari 01 Jember who obtained the application using Van Hiele learning theory with those who did not apply Van Hiele learning theory. These results show that the application of Van Hiele learning theory is more effective around 93.39%. Therefore, the learning based on Van Hiele theory is one of the learning that can help the students in developing their spatial ability.

Based on the facts about the process and learning outcomes above, the teacher should be able to design a lesson in which the learning approach used by

the teacher is able to be accepted by a group of student abilities. So that students with high, medium, and low ability can feel the benefit of applying of learning approach done by teacher, especially in increasing spatial ability of student.

Every individual has different learning abilities. The student's initial ability is the ability that has been possessed by the student before he / she follows the learning. This initial ability illustrates the readiness of the students in accepting the lessons to be conveyed by the teacher. The student's initial ability is important for the teacher to know before starting the lesson, as it can be known: (a) whether the student has knowledge that is a prerequisite for following the lesson, (b) to extent which the student has understand the material. By knowing these two things, the teacher will be able to design the learning well. So there is a positive relationship between the student's initial ability and the learning outcomes, so that a student who has a better initial ability will more quickly understand the material than the students who do not have the initial ability in the learning process.

Based on the background of the problems mentioned above, to determine the effect of a learning-based on Van Hiele theory with the Mind Mapping technique to the spatial abilities of students, especially in geometry then conducted an experiment with the title "The Effect of Learning Geometry-Based on Van Hiele Theory with Mind Mapping Technique on Students' Spatial Ability on Flat Side Three- Dimensional Object in SMP N 4 BALIGE".

1.2 Problem Identification

Based on the background of the problem described above, it can be identified several problems as follows:

1. Students find many difficulties to understand the object of geometry
2. Lack of attention to the spatial abilities of students in teaching and learning.
3. Spatial ability of students is still relatively low.
4. Teacher-centered learning in classroom.

5. Learning process that does not relate the material to the student's experience.
6. Lack of attention to the difference of students' initial ability by the teacher.
7. Students tend to memorize concepts without understanding the concept itself.

1.3 Problem Limitation

The problems identified above are quite extensive and complex, and the scope of math material is too much. The limited time and ability of the authors, it is necessary to limit the problem so that research conducted more focused.

Researchers will conduct research on the problem as follows:

1. Spatial ability of students is still low, consequently they face some problem to understand the material flat side geometry.
2. Lack of teacher attention to differences in students' initial mathematics ability.
3. The use of learning geometry-based on van hiele theory with mind mapping technique has not been applied well.

1.4 Problem Formulation

Based on the description on the background, then the problem formulation is as follows

1. How is the influence of the learning geometry based on Van Hiele theory with Mind Mapping technique and direct instruction to students' spatial ability?
2. Is there any interaction between mathematics learning with students mathematical 'initial ability (high, medium, low) to students' spatial ability?

1.5 Purpose of Research

The objectives to be achieved in this research are:

1. To find out how the influence of learning geometry based on Van Hiele theory with Mind Mapping technique and direct instruction to students' spatial ability.
2. To find out whether there is interaction between mathematics learning with students' mathematical initial ability (high, medium, low) to students' spatial ability.

1.6 Research Advantages

With the achievement of the objectives of the research above, the advantages of research will be obtained as follows:

1. To add knowledge insight to improve the quality of learning especially related to the Learning of Geometry based on Van Hiele Theory with Mind Mapping Technique.
2. Give an alternative how to improve students' spatial skills
3. Contributing and reference materials of curriculum development, educational institution and its management in its application become one of alternative in the development of science.
4. As a source of information for schools the need to design the learning system as an effort to overcome the difficulties of students in visualizing their understanding in learning mathematics, especially on geometry.

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