

## CHAPTER I

### INTRODUCTION

#### 1.1 Background

The rapid development of technology has brought new challenges to the education sector. New technologies have the ability to change education. In order to receive more education, many people are already using and exploring existing new technologies. The use of technology in education requires educators to be more creative and innovative in order to use technology to improve the quality of education to achieve learning goals. Almost all components of education involve technology. According to Oktaviyanthi (2015), the use of technology in education can greatly improve learning effects and is superior to traditional learning methods. Through the use of technology, students can connect the school to the wider world and dynamically link displays through multiple representations, interactive models and learning material simulations.

Technology must be used to improve the efficiency and effectiveness of education. NCTM (Oktaviyanthi, 2015) technology is essential for mathematics teaching. It affects the mathematics taught and enhances the learning ability of students. In the use of technology to teach mathematics, the teacher's attitude plays an important role. Porter advocated the use of technology for math teachers. Most recently in 2017, they explained real teachers and their views on the availability of teaching technology, while Hatlevik, Throndsen, Loi, and Gudmundsdottir explained students' beliefs and actual achievements in ICT experience (Nisiyatussani, 2018).

The role of learning media in the process of learning and teaching is an indispensable part of the education sector. Learning media is anything that can be used to convey the sender's information to the receiver. It can stimulate students' thoughts, feelings, attention and interest in learning (Tafonao, 2018). According to Arsyad (Artasari, 2017), learning media is an intermediary or introduction to the source of the message recipient. Learning media plays an

important role in the learning process and can improve the quality of education. In addition, the use of teaching media in the teaching and learning of mathematics can independently stimulate students' learning motivation and interest.

For everyone, learning mathematics is essential, because mathematics is always closely related to daily life. According to Daut (2016), mathematics is a branch of science and plays an important role in the development of science and technology. It can be used as an application tool for other disciplines as well as the development of mathematics itself. James (Suherman, 2011) said that mathematics is the logical science of shapes, arrangements, numbers, and concepts. They are largely related to each other and are divided into three fields, namely, algebra, analysis and geometry. Mathematics is not a science for its own purposes, but a science that is very useful for most other sciences. In essence, mathematics is a science that is always closely related to human life. Mathematics also discusses facts, relationships, forms and spaces.

The problem that we often encounter in education, especially mathematics, is the negative reaction to mathematics. Students still believe that mathematics is a terrifying subject compared to other subjects. Indirectly, students become lazy to understand the concepts contained in mathematics. As stated by Irwanto (Azriati, 2018), in his research, eighth grade students encountered difficulties in learning mathematics, especially materials related to diversity or geometry, because students can only pass through schools that are not attractive. Of books and learning media to learn the material' interest.

The reality shows that teachers have not implemented the use of information and communication technology properly. Researchers at SMP Negeri 1 Labuhan Deli proved this through observations made through interviews with a school teacher. He said the school's facilities and infrastructure were adequate, such as projectors, laptops, and computer laboratories. School computer laboratories are rarely used in the teaching process. School laboratories are only used in ICT subjects and have never been integrated into other subjects, especially mathematics. Learning in schools only uses reading textbooks, but also mediocre and traditional media. Teachers

rarely use teaching media based on the development of computer technology. What's more with the current situation is being hit by the COVID-19 pandemic which is changing all human activities and habits, especially in the field of education. Learning that used to be face-to-face has now become distance learning (online).

With the rapid development of technology and communication in the field of education, technology has given birth to education, which will help us advance the education sector. The use of media in the form of software can help improve the efficiency of the learning process and convey information in the early stages of learning. Visually, students will be more active in the learning process, because students can directly develop material on the media through software in the form of the material being taught. Learning media can also be used in making virtual classes. One of the learning media resulting from the development of technology, information and communication is GeoGebra. *GeoGebra* is a free non-commercial software for mathematics educators (teachers and lecturers) in Indonesia. GeoGebra is an excellent choice for embodying various mathematical objects because GeoGebra is a dynamic geometry software that can help shape all shapes of points, lines and curves. GeoGebra is dynamic math software suitable for all levels of education. It integrates geometry, algebra, spreadsheets, graphs, statistics, and calculus in an easy-to-use package.

According to Riyana (Azriati, 2018) through media reports, the learning process may become more interesting and interesting. Asyhar's point of view confirms this point, which points out that learning media as a learning resource is an integral part of the learning system, including news and information that will affect the learning outcomes of students.

The use of learning media in learning mathematics will of course also help to improve students' mathematics ability, one of which is students' spatial ability. Spatial thinking is a collection of cognitive skills, composed of three elements, namely spatial concepts, representation tools, and reasoning processes (NCTM, 2006).

Spatial ability is a type of reasoning based on imagination. According to the research of Yuliardi (2017), the spatial ability is a cognitive aspect. Spatial ability is one of the eight multiple intelligences developed by Howard Gardner. Spatial ability refers to the ability to solve problems by managing, changing, and analyzing data, especially those with more complex and large collections, which can show the process and results to oneself and others (Asryana, 2017). Generally, everyone has the spatial ability, but what can be distinguished is that when someone's spatial ability is low, they will encounter difficulties in certain things. The Academy of Sciences (Japa, 2017) believes that every student should strive to develop abilities and a sense of space. These abilities and sense of space are very useful in understanding the relationships and properties of geometry to solve mathematical problems and problems in daily life. This refers to Barke's view (Syahputra, 2013), which states that spatial ability is the main intellectual factor, important not only for mathematics and science but also for success in many professional fields. Gardner (Syahputra, 2013) writes that children need spatial abilities in exploration activities, such as when children draw, color, paste, and play with folded paper. Pilots also need high spatial skills to know where the ground is during the exercise.

It can be concluded that spatial ability is the ability to visualize images, which includes the ability to accurately recognize shapes and objects, change objects in their minds and recognize changes in their true forms, and display data in balanced sensitivity graphs, relationships, and colors, lines, shapes, and spaces.

Learning geometry is very important because geometry has become the main tool for teaching the art of thinking. Hoherwater and Jones (2007) said that it is important to study geometry and algebraic geometry. Since receiving education in elementary school, the concept and thought of geometry have been introduced into the hands of students. The five reasons why geometry is very important to research are: (1) Geometry can help people have a complete aspiration for their world; (2) Geometry exploration can help develop spatial skills; (3) Geometry is in other mathematics Play an important role, (4)

geometric shapes are used by many people in daily life, (5) confusing and interesting geometric shapes (Khoiru, 2014). Geometry is the basic knowledge learned in early childhood. According to NCTM (Siswanto, 2017), the Indonesian curriculum requires children to master the materials of field geometry and space geometry, which also have spatial abilities.

Geometry is a branch of mathematics that studies visual patterns and connects mathematics with the real world. By studying geometric shapes, you can develop logical thinking, problem-solving, and reasoning skills, and can support many other topics in mathematics.

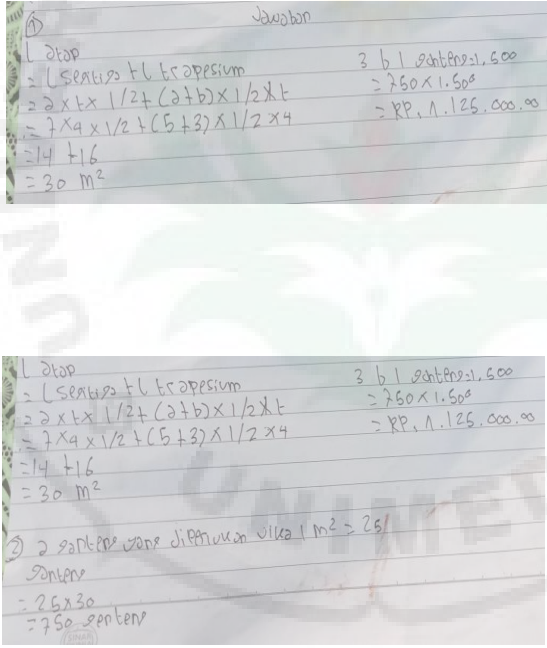
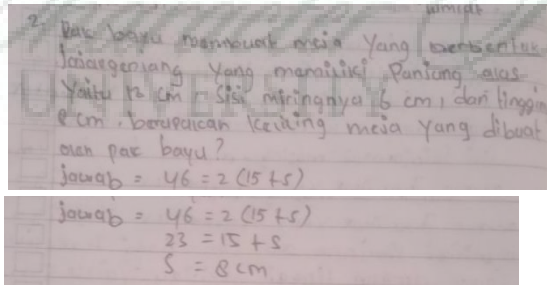
Budiarto (in Nasution, 2017) pointed out that the purpose of learning geometry is to develop spatial intuition skills, impart knowledge to support other materials, and be able to read and interpret mathematical arguments. Geometry has a greater chance of being understood by students than other branches of mathematics. However, the evidence in this field shows that the results of learning geometry and teaching have not been adjusted, which will lead to a decrease in the success rate of geometry teaching. To learn mathematics, students must not only master the concept of spatial relations but also master various other basic concepts.

Students find it difficult to imagine solving geometric problems visually. SMP Negeri 1 Labuhan Deli, Mrs. Endang Triwahyuni, S.Pd, researcher interview results confirmed this. The teacher said that he encountered some difficulties in the learning process, including (1) Students often regard mathematics as a difficult and boring subject for students. (2) It is difficult for students to recognize and understand geometric objects included in two-dimensional objects and their elements. (3) Some students do not understand the relationship of queue attributes, so it is difficult to define the concept of a quadrilateral. (4) There are still many students who do not meet the predetermined minimum integrity standards.

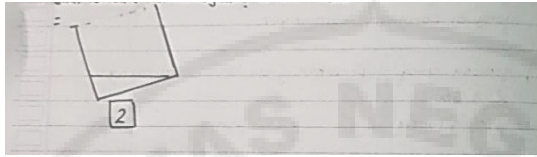
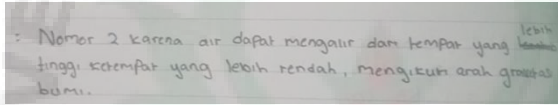
The next major problem is that students have poor spatial abilities. In these aspects, students still have difficulty visualizing images and cannot correctly understand images in their minds. Facts show that the students' mathematical spatial ability in maintaining the positional relationship of

objects is still very low. This is based on a diagnostic test conducted by researchers on SMP Negeri 1 Labuhan Deli students in grades VIII-1. The diagnostic test was completed by the researcher and asked three questions to 37 students. Three questions are designed to complete the indicators that can show the ability of mathematical spatial. This is the result of a student's answer based on a given diagnostic test question.

**Table 1. 1 Student Work Results**

No	Student Work Results	Error Analysis
1.	 <p> <math>L \text{ trap} = \frac{1}{2} (a+b) \times t</math>  <math>= \frac{1}{2} (4+5) \times 7</math>  <math>= \frac{1}{2} \times 9 \times 7</math>  <math>= \frac{1}{2} \times 63</math>  <math>= 31,5 \text{ m}^2</math> </p> <p> <math>P = 7 + 4 + 5 + 7</math>  <math>= 23 \text{ m}</math> </p>	<p>Students cannot understand the problem by writing down the content of the question</p> <p>The student is wrong in solving the problem. Students also cannot check completed work. Students cannot imagine or provide a two-dimensional overview of changes in some parts.</p>
2.	 <p> <math>L = \pi r^2</math>  <math>46 = \pi r^2</math>  <math>23 = \frac{1}{2} r^2</math>  <math>r = 8 \text{ cm}</math> </p>	<p>Students cannot write down what is known and all that is required.</p> <p>The student failed to solve problems related to spatial relations. Students cannot understand the relationship between one</p>



		part and another. Students cannot check completed work
3.	 	<p>When viewed from various angles and certain situations, students cannot see or state the shape of objects.</p> <p>Students cannot accurately find excuses from what they see. This means that the student's ability to target problem characters is very low.</p>

The equivalent results derived from the observation results also show that the students' answers vary little and tend to be the same. It can be seen that out of 16 students, only 2 students answered the question, or the percentage of students who answered the question was equal to 12.5%. The proportion of students who did not complete the answer to the question was 14, which is equivalent to 87.5%. This should not be ignored by the teacher, and the student's spatial ability should be improved again.

From the initial test, it was found that the level of students' spatial ability is still very low. It can also be seen that there are still many errors in the process of completing the students' answers to the given questions. This is caused by students who are unable to understand the problem, so the students are wrong in planning the solution to the problem and drawing conclusions. Students find it difficult to imagine and imagine, because so far, in the learning process, the development of students' spatial ability has not been paid attention to. Therefore, it can be concluded that the students have not mastered the

geometric materials, and the students' spatial ability is still very low, and they cannot solve the problems raised correctly.

The research conducted by Silfanus Jelatu, Sariyasa and I Made Ardana (2018) also showed that the spatial ability of eighth graders of SMP Santu Stanislaus Borong is still very low. It is difficult for students to solve math problems. And the learning applied in schools is still traditional. One of the indicators of traditional learning is that geometry is still being learned through paper and pen. This also coincides with the research conducted by Rizki Dwi Siswanto and Yaya Kusumah (2017), which also shows that students have lower spatial geometry skills when studying in Jakarta junior high schools. The observation results show that students lack imagination to visualize the components of spatial shapes, which makes it difficult for students to construct geometric shapes and solve problems.

When viewed from the perspective of daily life, it is necessary to improve spatial ability. This is the view of Barke (2001). He believes that spatial ability not only plays an important role in the success of mathematics and other disciplines, but also greatly influences spatial ability. The development of mathematics. Various occupations. Therefore, spatial capabilities are very important in the study of geometry.

Through the use of learning media, students will be able to better understand the concepts of various aspects of spatial competence. The media can visualize abstract shapes from geometric shapes into images that students can see. Students will find it easier to see how shapes rotate without having to imagine. Therefore, we need to carry out appropriate learning activities to improve students' spatial ability, including the use of GeoGebra-assisted learning media to describe geometric shapes in the real environment, so that students can find it easier to understand, rather than just understanding only regular problems.

Similarly, Ristontowi (2013) pointed out that the spatial ability of students who use learning media for teaching is better than that of students who do not use learning media for teaching. Another study conducted by Pranawestu (2012) also pointed out that the spatial ability of students assisted



by learning media reached the lowest completeness value, and was better than the spatial ability of students without the assistance of teaching media.

The above explanation shows that it is necessary to develop a media with computer software to improve students' mathematical spatial abilities properly. Therefore, researchers feel interested in conducting a research entitled **“Development of Learning Media Assisted by *GeoGebra* to Improve Student’s Spatial Ability on Two-dimensional Shaped Topic”**.

### **1.2 Problem Identification**

Based on the background of the problems that have been described, the problems of this research can be identified, namely:

1. Students still believe that mathematics is a terrifying subject compared to other subjects.
2. The use of information and communication technology has not been implemented by the teacher properly.
3. Learning carried out in schools only uses reading textbooks and also mediocre and conventional media.
4. Students are still difficulties in visualizing the image and give the right perception of the image in students mind.
5. The student's answer process is still incomplete and there are still many errors.

### **1.3 Problem Limitation**

Based on the identification of the problem, there is broad coverage, so the researcher defines the problem so that this research is clearer and more focused. The limitations of the problem in this study are:

1. Mathematical spatial ability of the eighth grade students of SMP Negeri 1 Labuhan Deli is still low.
2. The media used in this research is *GeoGebra* software on two-dimensional shape material in class VIII SMP Negeri 1 Labuhan Deli.
3. The process of students' answers in solving spatial ability
4. questions.

#### 1.4 Problem Formulation

Based on the limitation of the problem above, the formulation of the problem is as follows:

1. How to develop GeoGebra-assisted learning media that are valid, practical, and effective to improve students' mathematical spatial abilities in two-dimensional shapes?
2. How is the student's answer process after using GeoGebra-assisted learning media?

#### 1.5 Research Objective

Based on the problem formulation that has been made, the objectives to be achieved in this study are:

1. To know the develop of GeoGebra-assisted learning media that is valid, practical, and effective to improve students' mathematical spatial abilities in two-dimensional form.
2. To describe the student's answer process after using GeoGebra-assisted learning media.

#### 1.6 Resarch Benefits

The research benefits of the problems that have been stated above are as follows:

- a. For Teachers

GeoGebra learning media can help teachers overcome difficulties in the learning process, especially during this pandemic. In addition, the development of this learning media can be a reference for media innovation and create an active and fun learning atmosphere in the classroom, especially virtual classrooms.

- b. For Students

Media development like this is useful to assist students in developing and improving spatial abilities. In addition, students can also develop other skills.

c. For School

This media development can be used as a learning facility for SMP Negeri 1 Labuhan Deli students. In addition, the results of the research can be used as inputs to develop alternative policies to implement innovative learning media in schools.

d. For Researchers

This research becomes experience, increasing the researchers' knowledge and skills in developing various creative learning media. In addition, this research also reflects the fact that when researchers become teachers, they continue to conduct some research before writing learning designs and being sensitive to the school environment.

e. For Other Researchers

As input and comparison for research on the same problem in the future.

### 1.7 Operational Definitions

1. Learning media is a vehicle and delivery of information or messages of learning to students. With the media in the teaching and learning process, it is expected that it can help teachers to improve student learning achievement.
2. Based on the explanation of previous experts, the conclusion is that spatial ability refers to the ability to capture the world of visual space accurately, which includes the ability to Imagination, Conception, Problem Solving, and Determining patterns.
3. The answer process of students' spatial ability is a series of completion steps that students complete correctly and in more detail according to the spatial ability indicators. These indicators are: Imagination, Conception, Problem Solving, and Determining patterns.

4. *GeoGebra* is dynamic math software, which is a combination of geometry, algebra and calculus, and was developed as a tool for learning mathematics.



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