CHAPTER I
INTRODUCTION

1.1. Background of Research

Education is a key to achieve better advancement and development in all aspects of human life. Through education, students will be able to find out and improve all of their potential both as their-self and as a citizen of a country. Education, in essence, is a process of human empowerment that is expected to allow students to become brilliant, educated, and knowledgeable beings (Hamzah, 2007). One of the subjects that is important in formal education is mathematics learning. It matches UU RI No. 20 tahun 2003, which claims mathematics as a required subject in elementary and high school.

Mathematics is basic science that holds a significant role in other science and technology. Mathematics has great contributions in solving problems in human's life, for example, solving problems in our daily life, working world, and supporting the development of science and technology. This show us that learning mathematics is really important, which as we can see mathematics is taught in every stage of learning process, whatever stage is. Kusumaningrum & Saefudin (2012:571) said,

> "Mathematics is a science which can underlie the other science. Mathematics is the queen and servant of science. As queen, mathematics has a role as basic science and plays a significant role in the development of another science. Mathematics also is a servant that has the role as an instrument to advance another science in the future."

Based on the vision of mathematics education, learning mathematics has two (2) aims of development, namely, fulfilling today's needs and for the future one (Sumarmo, 2002). It's expected that by learning mathematics, students can solve problems that happen in another science and our daily life. On another vision, students are expected to have the ability in logical, systematic, critical, accurate

reasoning ability and ability to think objectively, which is needed to face problems in the future that will constantly change.

One of the skills that are expected to be mastered by students is critical thinking. Talking about critical thinking, Soeprapto (2001) said, "Critical thinking skill is an essential skill in our life, work-life, and offer many advantages in all aspects of life. Critical thinking skill has been one of the main goals in the education world since 1942. Research and opinions gathering about it have been a hot issue in last ten (10) years." In a world that will change constantly, critical thinking skills play a role as the main key in taking higher education (Rear, 2017). By mastering this skill, students are expected to be able to check all points of view about problems, evaluate them and finally take the right action to solve them.

Critical thinking is a process that aims to conclude an issue with the self-confidence we have in what we have done. Critical thinking is one of the most remarkable skills which students will need. Facione (1990) identified that critical thinking skills allow students to analyze and unify information to solve problems. The sharper their critical thinking skills, the better students can solve problems and formulate arguments by drawing on a base of knowledge (Huang,2016). That means improving critical skills can help students improve their ability in solving problems, especially mathematics problems, which leads them to improve their results in learning. Besides, Judge (2009) state that if students can challenge others' ideas and make their judgments, it can improve their self-confidence in exploring any evidence or literature and its implications. Ennis (1996) identified six (6) indicators of critical thinking, namely, focus, reason, inference, situation, clarity and overview.
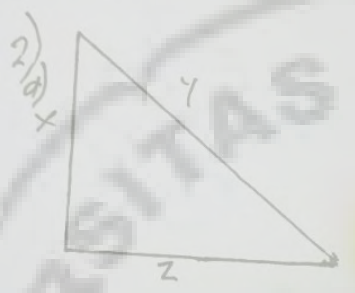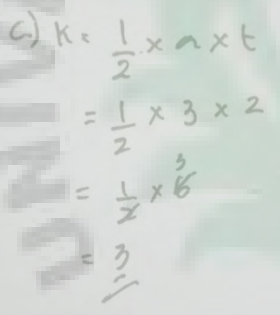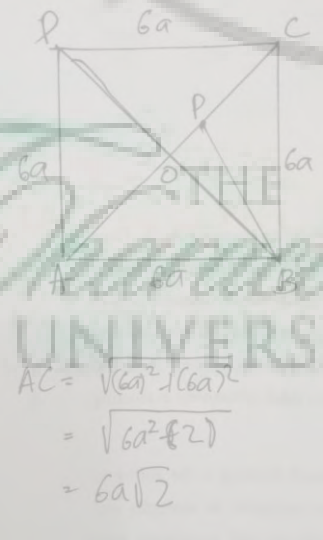
As we know, mathematics is a subject that requires solving problem skills. But on another side, solving problem skills involve high thinking ability, which contains critical thinking skills. So, by developing critical thinking skills, students will be able to solve problems that will be faced, in real life, which will constantly change. Critical thinking and mathematics are connected. To learn mathematics, we have to think critically, and we can practice our critical thinking ability in learning mathematics.

Ironically, these days, critical thinking skills in learning mathematics are still low. Based on interpretation from OECD (Schleicher, 2019), in the study of PISA 2018, Indonesia's rank is 72nd of 78 countries in the mathematics section and is still on level 1. This study explains that students have difficulties in solving mathematics problems, especially project problems. Students used to solve mathematics problems with simple formulas that they have been memorized. Students have no skills to elaborate their high thinking skill and apply it to solve the questions. This situation can be caused by how low their ability to critical thinking is.

In terms to investigate the truth of this problem, the researcher conducts an observation of SMKN 14 Medan in class X Multimedia 2 to find out students' critical thinking skills. The researcher makes an essay that contains questions based on critical thinking indicators, namely below,

1) Sebuah segitiga siku-siku XYZ memiliki sudut siku-siku di Y. Segitiga tersebut memiliki sisi YZ dengan panjang $\sqrt{80}$ cm, dengan $\sin X = {}^2/_3$.

   a) Gambarlah segitiga XYZ berdasarkan pernyataan di atas!

   b) Tentukan Keliling dari segitiga XYZ tersebut! Jelaskan secara rinci alasan penyelesaianmu!

   c) Tuliskan kesimpulan dari jawaban yang sebelumnya atelah anda jabarkan!

2) Diketahui persegi ABCD mempunyai panjang sisi $6a$ satuan. Kedua diagonalnya berpotongan di titik O. Jika titik P terletak pada diagonal AC dengan perbandingan $OP : PC = 1 : 2$, gambarlah sketsa gambar untuk soal ini dan kemudian tentukan nilai $\sin \angle PBO$!

Table 1.1 Students' Answers for the Question

No.	Students' Answer	Analysis of Error
1	a)	Students didn't understand the statement in the question. They didn't know the concept of drawing triangle XYZ and then answered it with the wrong figure.
	b)	Students didn't know the concept of the circumference of a triangle. They also can't get what they have to do based on the statement in the question to solve the main problem and only guess the final solution.
	c). -	Students are not able to write down the conclusion of what they did.
2.		There are not students who answer this question with right solution. Some of them already understand how to sketch the answer, but are not able to get the solution.

Students' answers to the question (a) on first question show that there are students who still didn't understand the basic concept of how to draw a triangle,

especially the right triangle. There are still 52,94% of students that make the wrong figure. For question (b), there is also no correct answer. Some students didn't even know the concept of circumference, and some of them could not explain the reason and steps of how they got their answers. And for the last question, no one answered it. They found it hard to write down the conclusion of the whole calculation. For the second question, about 54% of students are able to sketch figures based on the problem, based on that, we can see that most of them already know how to interpret a problem into a figure and understand facts and problem in the question. But even when they can interpret the problem into figure, they still can't use the information from the question to solve the solution, they are not able to clarify the concept that will be used to solve that. This observation tells us that students can not apply their high order skills to solve the problem, which means their critical thinking skills are still low, with the highest score of students in this essay being 20.

Besides the test, the researcher also interviewed a mathematics teacher of SMKN 14 Medan. In that interview, the teacher told that because students have to learn from home for almost two years, the interest of students to learn is decreasing. It is shown with how many students join the online class and how many students do their assignments and send them to their teacher. On the other side, there are some times this school conducts offline learning, but it seems that students are not ready yet for that. It is shown with how much students attend face-to-face learning and their score on their test for the subject they learn in the online class. The researcher also asked about the learning model they use in teaching mathematics. For the online learning, they stated that they just send the material's summary and assignments to the students. And for the face-to-face learning, they said that they still use the traditional model, namely the teacher-centered model.

A learning model is a learning design illustrated from the beginning until the end of the learning process, which is presented specifically by the teacher (Helmiati,2012). Designing a learning process by choosing the suitable learning model is an essential task for teachers since the model they choose will affect students' way of receiving the material. Helmiati (2012:10) said that the fact is many teachers interpret teaching as just delivering a material. Those teachers teach

students with only an explanation and expect students understand that. This kind of model can't develop students' critical thinking skills optimally.

Some researchs have proven that there are learning models that can help increase this ability. Novitasari (2015) stated that to improve critical thinking skills, we can apply a learning model called Creative Problem Solving (CPS). She claimed in her research that there is a difference between students' critical thinking skills when they learn with and without the Creative Problem Solving method. The research's result shows us that the improvement in critical thinking skills of students that learn with the CPS approach is better than learn conventionally. Maharani (2021:56), in their research, found that the effect of the Creative Problem Solving (CPS) model in the learning process is classified as big on students' critical thinking skills. Based on the result, there is a difference in mean scores between the class that used CPS and not. The effect size of the Creative Problem Solving is 1,269.

Based on Isrok'atun (2018), the Creative Problem Solving learning model is a learning model that emphasizes the creativity of students in problem-solving through divergent and convergent thinking. Retnawati (2017) said that Creative Problem Solving is a learning model that actively involves students in solving problems to make them capable develop their thinking skills. Novitasari (2015) stated that learning with this model allows students to associate questions in mathematics with situations in real life.

On the other side, the world's reality this day is pandemic Covid-19. The pandemic affects a lot of sectors in our life. The education sector is one sector that gets major effects from this pandemic. Based on Surat Mendikbud No. 46962/MPK.A/HK/2020 and Surat Edaran Mendikbud No. 4 2020, Covid-19 pandemic forces us to do physical distancing, so we can't make the learning process by meeting directly. This condition makes it harder to conduct all of the procedures of Creative Problem Solving if students only learn with an ordinary online meeting. This era makes us aware how important media is to help students and teacher conduct an efficient and suitable learning model in learning process. So to make the learning process easier and more beneficial, technology plays a big part. Choosing the right media-based technology will significantly help apply this model in the online learning process.

Media-based technology that can help in this problem is Desmos. Desmos is a web-based graphing utility that requires no special hardware. It works on any computer, tablet, or phone (Ebert,2015). There are two mainstays products of Desmos, namely graphing calculator and classroom activities. The product that we use to assist the Creative Problem Solving is the classroom activities product. In this product, Desmos provides digital activities so that teachers can directly supervise students online. Desmos provides a lot of animations and graphs that can show the visualization of mathematics concepts. By using some features, Desmos presents classroom activities that contain problems that can be used to conduct the Creative Problem Solving model in the learning process.

Based on that background, the researcher wants to do research that will focus on improving students' critical thinking skills by applying the Creative Problem Solving learning model and using Desmos as media in learning mathematics. The researcher wishes that this research will be helpful as a consideration to repair and improve the quality of education in Indonesia, especially in mathematics. Related to that, the researcher conducts research with the title: **"Application of Mathematics Learning Model Creative Problem Solving that Assisted with Desmos to Improve Students' Critical Thinking Skills of SMKN 14 Medan."**

1.2.   Problem Identification

Based on the background of the study, so we can identify problems in this study, namely:

1) The critical thinking skills of students of class X SMKN 14 MEDAN in learning mathematics are still low.
2) The learning model that the teachers use in class X SMKN 14 MEDAN is still the traditional model, which is a teacher-centered model and
3) The teachers of SMKN 14 Medan have never acknowledged the Creative Problem Solving learning model yet in learning process.
4) Teachers in SMKN 14 Medan had not utilized media in teaching mathematics, especially technology-based media in offline and online learning

1.3. Scope of the Problems

Based on the problem identifications above and the limitation of this research, this research is restricted to the application of Creative Problem Solving that assisted with website Desmos in improving Critical Thinking Skills of students of SMKN 14 Medan grade X with material Linear Equation System of Two Variables (SPLDV).

1.4. Research Question

Based on the scope of the study, we formulate the problem,

1) How does implementing Creative Problem Solving (CPS) assist Desmos in improving students of SMKN 14 Medan grade X's critical thinking skills in learning the Linear Equation System of Two Variables?

2) Can applying Creative Problem Solving (CPS) assisted by Desmos improve students of SMKN 14 Medan grade X's critical thinking skills in learning the Linear Equation System of Two Variables?

1.5. Research Objection

Based on the research questions, this research aims to

1) Know what actions are taken to improve students of SMKN 14 Medan's critical thinking skills grade X with material Linear Equation System of Two Variables (SPLDV) by applying Creative Problem Solving (CPS) that assisted with Desmos.

2) Know the improvement of students of SMKN 14 Medan's critical thinking skills grade X with material Linear Equation System of Two Variables (SPLDV) by using the Creative Problem Solving learning model assisted by Website Desmos.

1.6. Research Benefits

This research is expected present benefits such as,

1) For Teachers

This research result is expected to be a reference for teachers in using the Creative Problem Solving learning model in improving students' critical thinking skills.

2) For Students

Using Creative Problem Solving learning model in class give students new experience in learning process and help them improve their critical thinking skills in learning mathematics.

3) For School

This research result is expected can be a reference for the school in using the Creative Problem Solving learning model to improve the critical thinking skills of students of the school

4) For Researcher

By doing this research, the researcher gains new experience in applying the Creative Problem Solving learning model in teaching mathematics and in improving students' critical thinking.

1.7.   Operational Definitions

Some terms in this research are defined operationally like below,

1) Critical Thinking Skills are skills to gather their own knowledge and information to recognize the strengths and weaknesses of information they receive and reconstruct and improve the new information to solve problems they face. Indicators that are used in this research, namely, identifying, basic support, reason, inference, and strategy and tactic.

2) Creative Problem Solving (CPS) is a learning model that emphasizes students' creativity and actively involves students in solving problems with the aim to develop their thinking skills

3) Website Desmos is web-based graphing that contain in-class calculators, digital math activities, and curriculum for online classrooms. There are two mainstays products of Desmos, namely graphing calculator and classroom activities, but in this research we only use the classroom activities product.