

CHAPTER I

INTRODUCTION

1.1 Background

The industrial revolution continues to progress along with the times. Currently, the industrial revolution has reached the era of 4.0, which is marked by the presence of new technology. The industrial revolution 4.0 is shown by the collaboration between physical equipment and MT (mobile technology), IoT (internet of things), UV (unnamed vehicles), AI (artificial intelligence), big data, and production facilities to assist data collection and analysis. Also decisions are made manually as well as automatically (Putry et al., 2020: 6). At the same time, the educational revolution is also in the era of 4.0, marked by an independent and student-centered learning system. The educational revolution that has occurred provides opportunities as well as new challenges that must be faced.

Another challenge facing today is the COVID-19 pandemic. The impact of this pandemic affects all community activities, including the world of education. Since March 2020, all education units in Indonesia have implemented a study from home program. And in conditions of declining pandemic cases, learning takes place in a hybrid way. This encourages teaching and learning activities to experience system changes, namely online learning by utilizing the internet network. This situation becomes a serious problem in education, especially in learning mathematics. Learning mathematics continues to develop in line with the development of the revolution and the current pandemic situation. The implementation of mathematics learning is carried out online by applying digital technology. This development is expected to continue to encourage the implementation of good learning as well as the achievement of learning objectives in accordance with NCTM.

NCTM (National Council of Teachers of Mathematics) (Maulyda, 2019: 14), states that the objectives of learning mathematics are; mathematical understanding, mathematical reasoning, mathematical communication, mathematical connection, mathematical representation, and problem solving . From the learning objectives above, one of the competencies that students must possess, according to the learning objectives above, is the capacity to solve mathematical issues (*problem solving*).

Actually, Indonesia has a score of 379, or 72nd order , according to data from the Organization for Economic Co-operation and Development (OECD Program's for International Student Assessment (PISA) (OECD, 2019: 7), which includes 77 countries with an average score of 489. This implies that Indonesian students have a very low level of mathematical ability. Furthermore, the PISA 2018 interpretation results show that pupils' problem solving abilities are still very low.

Problem solving ability is one of the skills that students need in everyday life. However, the reality shows that students' problem solving abilities are still low. Rohmah & Sutiarmo (2018: 680) say that the low problem solving ability of students is because students have not been able to absorb information well, do not understand the transformation of the problem, do not understand the material completely, and have weak prerequisite concepts. There is a lack of experience of students in solving problems, and students are not careful and thorough in the work process. This is in line with Setiani et al. (2020: 129), which states that the cause of the low mathematical problem solving ability is that students are still not used to working on story questions that require them to understand the problem first. Furthermore, Yusri (2018: 53) illustrates that this student's lack of problem solving ability is evident when facing new math problems. Students tend to only be able to use existing formulas and, moreover, memorize examples of questions. Students are also less able to solve non-routine questions that require further thought (Suryani et al., 2020: 121). Self-regulated learning also causes low problem solving ability in students. Research conducted by Mayasari & Rosyana

(2019: 88) shows that student self-regulated learning with mathematical problem solving abilities has a linear relationship. The greater the student's self-regulated learning, the greater their problem solving ability. Reski et al. (2019: 52) also stated that students who have strong self-regulated learning will not give up easily. While Masri et al. (2018) state that the cause of students' not being able to show optimal learning outcomes is that students feel unsure that they are able to complete the tasks assigned to them. In addition, Simamora et al. (2019: 61) explain that the low problem solving ability is also influenced by students' disinterest or hatred for mathematics. The number of students who think that mathematics is difficult causes students to have difficulty understanding the formulas in mathematics, have difficulty answering questions in the form of story questions, feel ashamed to ask questions, and become lazy about learning mathematics (Ruhi et al., 2019: 146). Other than the above factors, another cause of the low problem solving ability of students is the selection of models and learning strategies used in the classroom. Rinaldi & Afriansyah (2019: 10), briefly stated that the teacher-centered learning model caused a lack of opportunities for students to construct their mathematical knowledge.

Based on the results of observations at SMK Negeri 14 Medan, which were held on February 8 and 15, 2022, it was discovered that students were sometimes able to solve routine problems where the solution was simply to repeat a mathematical procedure that had just been learned, but had difficulty solving problems in the form of problems. According to information from a mathematics teacher at SMK Negeri 14 Medan, this is further exacerbated during the pandemic because learning takes place online.

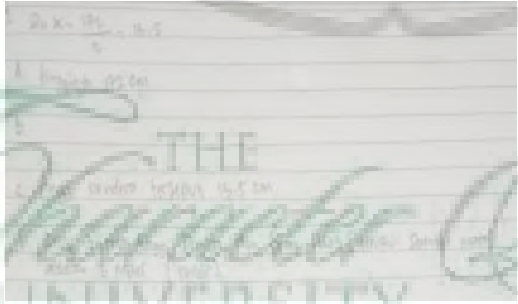
The researcher gave an initial test of students' problem solving abilities in the form of 2 essay questions on trigonometry material in class X TITL 1. The researcher also observed the work process of solving problems and the problem solving abilities of students. For example, the following is one of the questions used in the initial observation.

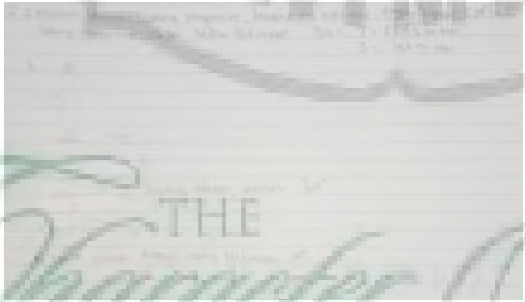
Lucas has a height of 172 cm (measured to the eye) standing at a distance of 12 meters from the flagpole. He saw the top of the flagpole with an elevation angle (angle of view up) of 45° . So

- What is known from this problem?
- Make a mathematical model of the problem and determine the formula or concept used to solve it.
- Count how tall the flag is.
- Which of the following statements is true?
 - The difference between the height of the flag and Lucas' height (measured to the eye) is 12 meters..
 - The difference between the height of the flag and Lucas' height (measured to the eye) is 13 meters.

The following are some of the results of student work in solving the given initial test.

Table 1. 1 Initial Test Results

No. (1)	Student Work (2)	Problem solving Indicators (3)
1.	 <p>Figure 1. 1 The Students' Answers to Question 1 Based on the results of the initial diagnostic test, of the 22 students who took the initial ability test, the result for</p>	<ul style="list-style-type: none"> Understanding: the ability of students is still very lacking in understanding the questions that are marked by incorrect answers. Devising a plan: students are still unable to plan and solve problems. This can be seen from the inability of students to

(1)	(2)	(3)
	<p>question number 1 was that all students were not able to solve the problem properly according to the indicators of mathematical problem-solving ability. In more detail, 16 of 22 students (73%) have not been able to understand the questions and make mathematical models of existing problems. 3 of 22 students, or 14 percent, provide answers to questions related to rechecking indicators but do not include how to calculate or how to get the answers. And all students have not been able to obtain the results of problem solving as a process carried out on the indicators of implementing the plan.</p>	<p>make mathematical models of the problems.</p> <ul style="list-style-type: none"> • Carrying out the plan: students have not been able to solve the problem indicated by the absence of answers or the calculation process to obtain a solution to the problem. • Looking Back: due to the previous process not being fulfilled, students have not been able to re-examine by giving the correct statement..
2.	 <p>Figure 1. 2 The Students' Answers to Question. 2 Note: Of the 22 students who took the initial ability test, the results for question number 2 were that 14 students, or 64%, could not understand the problem</p>	<ul style="list-style-type: none"> • Understanding: the students' ability to understand the problem is still very lacking. • Devising a plan: students are still unable to plan and solve problems. This can be seen from the inability of students to make mathematical models of the problems. • Carrying out the plan: students have not been

(1)	(2)	(3)
	<p>or make a mathematical model of it. Two of the 22 (9%) were able to solve the problem, but the mathematical model given does not exist. And all students have not been able to re-check correctly because the previous process has not been fulfilled.</p>	<p>able to solve the problem shown by the absence of a calculation process to obtain a solution to the problem.</p> <ul style="list-style-type: none"> • Looking Back: students have not been able to re-check correctly.

From the data obtained from the diagnostic test results, approximately 77% of students are experiencing problems with their problem solving abilities. So it can be concluded that the students' mathematical problem solving ability is still low. This condition is one of the problems that exist in the school where the observation is located.

Another problem obtained from the results of an interview with one of the mathematics teachers at SMK Negeri 14 Medan is the lack of interest in student learning during the COVID-19 pandemic, where online learning is more common. In the case of declining COVID-19 cases, face-to-face learning resumed, but students showed unpreparedness for the transition from online learning to offline learning. This condition is in line with the research of Cahyani et al. (2020: 138), which states that students' learning motivation has decreased during online learning, which has been in effect since the COVID-19 pandemic. This situation certainly affects student learning outcomes, including students' mathematical problem-solving abilities. According to Safithri et al. (2021:336), one of the strategies that can be used to optimize students' mathematical problem solving abilities is the application of a learning model.

One alternative learning model that can be used to help improve students' mathematical problem solving skills is the Problem-Based Learning (PBL) model. PBL is a learning model that confronts students with a problem so that students can develop their thinking skills and problem solving skills and gain new

knowledge related to existing problems (Lestari & Yudhanegara, 2019: 43). The application of the PBL model in the midst of pandemic problems and the development of existing technology is expected to be an effective solution. Of course, this can be supported by using methods or media in accordance with the latest trends.

In line with current educational developments, one of the learning trends is Video-Based Learning (Putry et al., 2020: 13). Video-Based Learning (VBL), is a learning method with media that can help achieve learning objectives that students can access anywhere and anytime. The results of research conducted by Octalia et al. (2020: 251) show that there are differences in students' knowledge before and after using VBL. This shows that VBL can also be effective in improving student learning outcomes. From a review of several sources conducted by researchers, there is still very little research on VBL especially in learning mathematics. And from the results of an interview with one of the mathematics teachers at SMK Negeri 14, it was obtained that learning nowadays sometimes uses video media. However, the videos provided are from common sources, such as videos from Youtube, and they do not focus on problem solving skills.

Based on the problems above, researchers interested in conducting research with the title **"The Effect of Problem-Based Learning (PBL) using Video-Based Learning (VBL) on Mathematics Students' Problem solving Ability in SMK Negeri 14 Medan"**.

1.2 Problem Identification

Based on the background of the problem that has been described, the following problems can be identified:

- a. The low of mathematical problem solving ability of class X students of SMK Negeri 14 Medan.
- b. The SMK Negeri 14 Medan students' low interest in learning mathematics.
- c. The decrease in students' abilities as a result of the implementation of hybrid learning during the COVID-19 pandemic.

- d. The lack of application of learning models and methods according to the latest trends.
- e. There is still little research related to VBL in mathematics learning.
- f. The lack of application of VBL, which focuses on improving students' mathematical problem solving abilities.

1.3 Scope of Problems

Based on the problem identification, researcher limited the problem to more specific problem. The scope of problem in this research are:

- a. The low of mathematical problem solving ability of class X students of SMK Negeri 14 Medan.
- b. There is still little research related to VBL in mathematics learning.
- c. The lack of application of VBL, which focuses on improving students' mathematical problem solving abilities.

1.4 Research Question

Based on the background that has been described previously, the authors formulate several issues as follows:

- a. Is there an effect of Problem-Based Learning (PBL) using Video-Based Learning (VBL) on the mathematical problem-solving ability of students in SMK Negeri 14 Medan in a two-variable linear equation system?
- b. How the effect size of Problem-Based Learning (PBL) using Video-Based Learning (VBL) on the mathematical problem-solving abilities in SMK Negeri 14 Medan students in a two-variable linear equation system?

1.5 Study Objectives

Based on the formulation of the problem above, the aims of this study are:

- a. To know the effect of Problem-Based Learning (PBL) using Video-Based Learning (VBL) on the mathematical problem solving abilities of students in SMK Negeri 14 Medan in a two-variable linear equation system.

- b. To know the effect size of Problem-Based Learning (PBL) using Video-Based Learning (VBL) on the mathematical problem solving abilities of students in SMK Negeri 14 Medan in a two-variable linear equation system.

1.6 Research Purposes

The results of this study are expected to provide the following benefits:

- a. For Teachers
The results of this research, hopefully can provide alternative learning strategy in mathematics and in order to able to improve student's ability in problem solving.
- b. For Students
Students might gain new learning experiences to boost their motivation and enthusiasm for mathematics.
- c. For Schools
Schools can utilize this research as a resource for establishing classroom teaching strategies and obtaining data from the analyses' findings to help students improve their problem solving abilities.
- d. For Researcher
Through analysis of the effect of Problem-Based Learning (PBL) using VBL, researchers get new experience in improving students' mathematical problem solving abilities.

1.7 Operational Definition

Some terms that used in this research are defined operationally as follows:

- a. The effect in this study is referred to the difference in mathematical problem solving abilities between the experimental class and the control class, where the mathematical problem solving ability of the experimental class students is higher than the control class. Cohen's Effect Size was used to calculate the magnitude of the influence between variables in this study.
- b. Problem-Based Learning (PBL) in this study consists of 5 stages or syntax. The syntax of PBL in this study is: 1) orient students to the problem, 2)

organize students for study, 3) assist independent and group investigation, 4) create and present artifacts and exhibits, and 5) analyze and evaluate problem-solving techniques.

- c. Video-Based Learning (VBL) is a method of learning that used video with audio-visual aspect and is intended to aid in the achievement of learning objectives and affect learning outcomes.
- d. Problem solving is a process of finding a solution or completion of a problem with certain steps.
- e. Mathematical problem solving ability is the ability of someone to: 1) understanding the problem, 2) devising a plan, 3) carrying out the plan, and 4) looking back after solve the problem.



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