

CHAPTER I

INTRODUCTION

1.1. Background of the Study

It is undeniable that higher-order thinking skills have become the center of attention and essential skills needed, especially in mathematics today. Therefore, the significant influence of higher order thinking skills on student learning outcomes becomes a significant consideration in adapting HOTS in the learning process. However, some students, especially in Indonesia, still have lower-order thinking skills in mathematics. Commonly researchers found this situation happens because of inappropriate teaching materials. Therefore, students need suitable teaching materials to improve their higher-order thinking skills.

According to Anderson and Krathwohl (2001), there are three main cognitive process dimensions in HOTS, C4 (Analyze), C5 (Evaluate), and C6 (Create). In Analyze, students are stimulated to observe, examine and divide the material until the basic parts. In Evaluate, students are stimulated to make decisions based on quality, effectiveness, and consistency criteria. Finally, in Create, students are stimulated to compile various information to develop new functional ideas, products, strategies or methods. Therefore, the indicators in HOTS can be formulated as (1) Students can group relevant, important, and needed information in problem-solving, (2) Students can attribute the main problem with the suitable material in problem-solving, (3) Students can design strategies to solve problems, (4) Students can examine the suitability of created problem-solving strategies.

Besides the importance of HOTS in students' success in learning mathematics, there are still many research results showing students' low mathematics thinking skills. For example, the Program for International Student Assessment (PISA) 2018 results show that only 1% of Indonesian students can reach level five or higher in mathematics, and some 28% of students still attain level two or higher. Level two means students only can interpret and recognize a simple

situation in mathematics, while level five means students can select, compare and evaluate appropriate problem-solving strategies conducted in the HOTS indicator. The result of PISA is also supported by Widana et al. (2018), who found that the students of senior high schools in Indonesia tend to have low thinking skills, especially in mathematics learning.

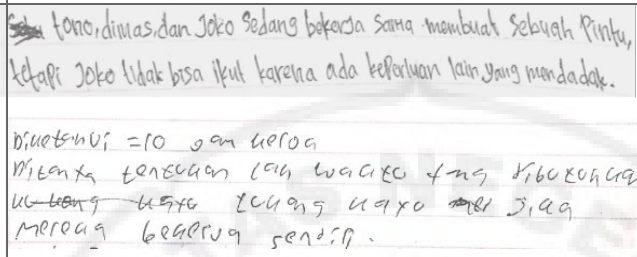
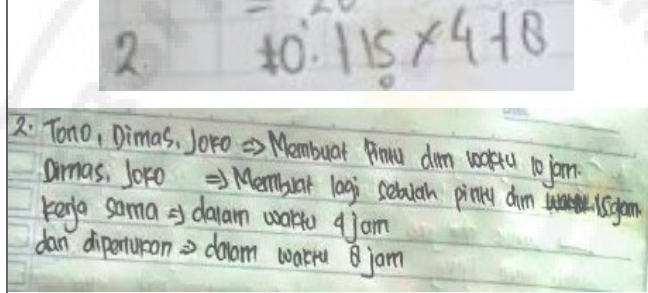
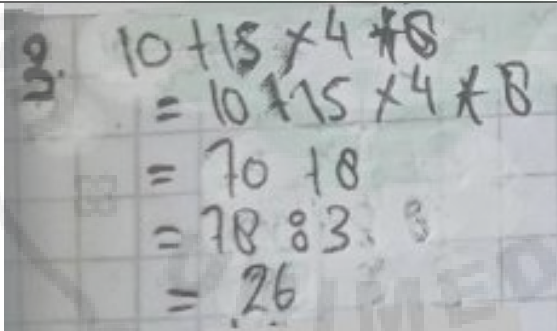
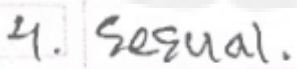
Based on the results of the literacy study that has been carried out, the researcher then conducted a diagnostic test on 25 students from various thinking skills levels in the tenth grade of SMA Negeri 1 Laubaleng to measure students' mathematical higher-order thinking skills. The tests given are shown in Table 1.1

Table 1.1. Mathematical higher-order thinking skills diagnostic test grid

Question	Measured Indicator
Three carpenters named Tono, Dimas, and Joko used to work together to make a door in 10 hours. Dimas and Joko once together made a similar door in 15 hours. One day these three carpenters worked to make a similar door, but after 4 hours working together, Joko suddenly came home because he had other business. Finally, Tono and Dimas needed an additional 8 hours of work to complete the door. Determine the time each carpenter would take if they worked alone to make a similar door!	-
1. From this situation, what information is known and asked in the question?	Analyze (C4)
2. Create a mathematical model based on the information you get in the problems above!	Creating (C6)
3. Calculate the time it takes each carpenter to work alone in a similar door!	Evaluate (C5)
4. Check the suitability of your result with the mathematical model you have formed in problem no. b!	Evaluate (C5)

Based on the answers given by students, there were still many errors whether in analyzing, creating, and evaluating indicators. The Table 1.2. shows the error made by students when answering diagnostic test questions:

Table 1.2. Errors in student answer through the diagnostics test

Num	Student's Answer	Analysis of Errors
1.		Students were not able to analyze the main information from the question.
2.		Students were not able to generate the known information into a mathematical model. In addition, some students made a wrong model.
3.		Students weren't able to examine the model, and made the inconsistency when using the model.
4.		Students weren't able to show the suitability of the result and formed model.

From 25 students, only six students (24%) have high mathematical HOTS, there are nine students (36%) have extremely low HOTS, and 10 other students (60%) have low HOTS. Most students made errors in the analysis (C4) indicators for 42.85%, followed by the evaluation (C5) indicators with 30.95% and the least from creating (C6) indicators with 26.2%. From the results of the students' error answer analysis and also from Table 1.2, it can conclude that students' mathematical higher-order thinking skills, especially in SMA Negeri 1 Laubaleng, are still low.

One of the causes of the low students' mathematical HOTS is the lack of learning resources and sample questions. Widana et al. (2018) argues that generally in Indonesia, the assessment of mathematics only tends to test the ability to remember, to calculate the formula, and to apply the mathematical concept to a particular problem that is routine which are still in low-order thinking skills categories. If this condition continues, it will be very difficult for students to activate their high-level thinking skills in mathematics. The activation of HOTS can be done in various ways, according to Tanujaya et al. (2017) one of the ways to activate the HOTS is by revising textbooks used in mathematics learning because it should provide examples and practice tests that can promote students thinking skills. Therefore every school needs to facilitate students with textbooks or other teaching materials that contain the HOTS example and assessment to improve their higher-order thinking skills, especially in mathematics.

Students' worksheet is one of the teaching materials that can be used to facilitate learning process. Teachers have the opportunity to provoke students to be actively involved in the learning process, so the discussion through the topic will be more active by using student worksheets (Rahayu & Budiyo, 2018). The activeness of students in learning through the student worksheets which contains HOTS questions will certainly help students to develop their mathematical HOTS with direct experience. However, some schools in Indonesia still didn't facilitate students with the student's worksheets that contain the HOTS example and assessment. From the early observation of the researcher in SMA N 1 Laubaleng, it found that students didn't have the worksheets for almost four years since 2017. Schools only facilitate students with a textbook that contains material, and ordinary questions which weren't able to activate students' HOTS. Based on interviews with Mrs. Dinnaria Sihombing, S.Pd as a mathematics teacher at SMA N 1 Laubaleng, the learning resources used are still dominated by remembering (C1), understanding (C2), and application (C3) indicators.

In addition to teaching materials, the learning model is also an important element that needs to be considered in improving students' HOTS. There are many types of learning models in this modern era such as Problem Based Learning (PBL),

inquiry, contextual, expository, and so on. Problem Based Learning is a student-centered learning model that makes problems or questions triggers for learning. There are five syntaxes for PBL according to Arends (2015), (1) Orient students to the problem, (2) Organize students for study, (3) Assist independent and group investigation, (4) Develop and present artifacts and exhibits and (5) Analyze and evaluate the problem-solving process. All of the syntax in the PBL model might facilitate students to improve their HOTS. Jailani et al. (2017) argue the implementation of PBL model is more effective than the expository especially in improving the students' HOTS, also the PBL is proven to activate students in performing analyzing, evaluating, and creating ideas. Therefore Problem Based Learning (PBL) can be used as the right choice in improving students' HOTS.

The method of presenting teaching materials also has a big influence on increasing students' HOTS. Currently, Indonesia is starting to implement limited face-to-face learning in several regions in Indonesia as a result of the Covid-19 pandemic. In SMA N 1 Laubaleng, face-to-face education has begun in a short time and students enter alternately. The short study time then becomes an obstacle for students to be actively involved in learning. This student's inactivity will certainly affect students' thinking abilities as well. Therefore, we need an innovation such as interactive learning media. Interactive learning media is multimedia that can describe the message from teacher to student in a two-way communication process (Sahronih et al., 2019) which allows students to improve their HOTS wherever, whenever even without a teacher. One of the interactive multimedia applications that can be used by teachers or students is the articulate storyline. The articulate storyline can be a good choice for teachers in developing interactive teaching materials such as student worksheets since it's easy to use, also easy to publish and access because it can be accessed via the internet, and can be accessed either on a computer or smartphones (Nabilah et al., 2020).

Besides all the descriptions above, the research result conducted by Yennita et al. (2018) also showed that the average of students HOTS who use the HOTS worksheet is higher than the students who are not using the worksheet. Apino and Retnawati (2017) in their research also showed that the instructional design using

the HOTS approach in creating the problem and question is effective for improving students' HOTS. Nabila et al. (2020) also argue that interactive media can be used as a suitable and feasible medium in the learning process. From all the literature study and observation results above, it is known that the development of a student's worksheets that can improve mathematical HOTS is necessary. Based on the various descriptions explained, the researcher had developed and conducted research with the title "The Development of Interactive Student's Worksheets to Improve Mathematical Higher Order Thinking Skills of Tenth Grade Students".

1.2. Problem Identification

Based on the background of study, the following problems can be identified:

1. Some of students' mathematical higher-order thinking skills in SMA Negeri 1 Laubaleng are still low,
2. Textbooks and exercises used in learning mathematics still contain LOTS-based questions,
3. The school does not facilitate students with worksheets that can activate student's higher order thinking skills,
4. Limited face-to-face learning time reduced students' activity and involvement in the learning process,
5. Reduced interaction between teachers and students during the pandemic.
6. Teachers at SMA Negeri 1 Laubaleng rarely use technology in learning due to limited ability to use technology.
7. Students at SMA Negeri 1 Laubaleng rarely use technology to support learning and rather to play games.

1.3. Scope of Problem

Based on the identification of the problem above, the researcher limits the scope of the problem to maintain the research focus as follows:

1. Develop the interactive students' worksheets to improve mathematical Higher Order Thinking Skills and limited in trigonometry topic of tenth-grade students.

2. The product is designed to activate students' involvement in learning process both in online or offline method.

1.4. Research Question

Based on the identification and scope of the problem above, the research question is how is the validity, practicality, and effectiveness of interactive student worksheets to improve mathematical Higher Order Thinking Skills of tenth-grade students in trigonometry topics?

1.5. Study Objective

The objective of the study is to develop valid, practical, and effective interactive student worksheets to improve mathematical Higher Order Thinking Skills of tenth-grade students in trigonometry topic.

1.6. Research Benefits

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

1. Theoretical Benefits

This research is expected to add insight to readers and provide additional references to develop interactive worksheets to improve Mathematical Higher Order Thinking Skills in Trigonometry material for tenth grade.

2. Practical Benefits

- a. For researchers, this research is expected to increase insight and creativity in developing student's worksheets which are needed by students during the pandemic
- b. For students, the product of this research is expected to be used to improve students' higher-order thinking skills on trigonometry material.
- c. For mathematics teachers, this research is expected to be a reference to become a technology-based student's worksheets, and hope that the product of this research can be used in the learning process.

- d. For future researchers, this research is expected to be a reference for similar research.

1.7. Operational Definitions

To avoid a debate over the understanding of the terms used as well as to make it easier for researchers to be more focused, some of the terms used in this research are:

1. Student Activity Sheet is a teaching material that contains an introduction to the material, and instructions for implementing learning tasks that must be done by students, which refers to the basic competencies that must be achieved.
2. Higher Order Thinking Skills (HOTS) is the ability to examine information critically and creatively, also able to solve problems that involve analyze (C4), evaluate (C5), and create (C6) skills.
3. Validation is a standard measure that shows the accuracy and validity of an instrument and involves the ongoing collection of evidence for the interpretation, evaluation, and use of the instrument.
4. Practical is a standard measure that shows the ease of use of a product.
5. Effectiveness is the level of success in achieving the goals set by using a certain method.