CHAPTER I
INTRODUCTION

1.1. Background

Education is a conscious effort carried out in a structured manner in the learning process to gain knowledge, skills and insights in order to develop self potential. Education can be said to be successful if the quality of education can be achieved properly, can create quality human resources (HR) that have the potential, and can deal with challenges that will come in the future. This does not happen by itself but is a process in achieving better education in the future.

In the current era of globalization, the quality of education has become a concern from various circles. The quality of education in Indonesian at the global level has not shown satisfactory results. According to the Organization for Economic Co-Operation and Development, Indonesia is placed 69th out of 76 nations in the PISA (Program for International Student Assessment) rankings (OECD, 2012). Indonesia students on average still experience problems in cognitive aspects (knowledge), namely knowing, applying, and reasoning (Herpiana and Rosidin, 2018).

Education faces very complex problems, where in the era of the industrial revolution 4.0 emphasizing the digital economy, artificial intelligence, big data, and robotics, demanding that the world of education constructs creativity, critical thinking, mastery of technology, and digital literacy skills (Wahyuni, 2018). Students are required to be capable of Higher Order Thinking Skills called HOTS. The main purpose of HOTS is how to improve students higher order thinking skills, especially in critical thinking skills to receive various types of information, think critically in solving a problem using knowledge possessed, able to make conclusions, and decisions in complex situations (Saputra, 2016).

Higher order thinking skills can be accommodated through the curriculum contained in education which is used as a guide in the implementation of learning activities. The revised 2013 curriculum (K-13 revision) has actually prioritized HOTS based learning. There are four things that are discussed in the revised 2013 curriculum, namely: Strengthening Character Education (PPK), literacy, 4C (Creative, Critical Thinking, Communicative, and Collaborative), and HOTS (Higher Order Thinking skills).

HOTS as critical thinking and creative thinking requires students to have the ability to reason, be critical in investigating problems or things that are found, and compare, relate and be critical of the problems they face, be creative in drawing conclusions, and solve problems in actual conditions. Assessment is needed to measure students higher order thinking skills. Assessment is an evaluation of student achievement in learning to see student learning outcomes carried out by educators. The evaluation has been designed and contained in the curriculum. The instrument in cognitive assessment is a test. Tests are used to measure learning. The test developed is the HOTS test which involves higher order thinking, cognitive and complex problems.

The process of creating test questions or instruments based on HOTS standards is known as HOTS-based test instrument development. With HOTS students are not only limited to memorizing or understanding existing concepts, but are able to analyze the state of the information obtained, be able to relate one information to another, solve existing problems, and be able to create new ideas. Referring to Anderson & Krathwohl's (2001) improved version of Bloom's taxonomy, the dimensions of the thinking process consist of the ability to: know (C1), understand (C2), apply (C3), analyze (C4), evaluate (C5), and create (C6).

Dimensions of thinking C1 and C2 are grouped into cognitive level 1 (Low Order Thinking Skills/LOTS), C3 at cognitive level 2 (Middle Order Thinking Skills/MOTS), and C4 to C6 at cognitive level 3 (Higher Order Thinking Skills/HOTS). Analyzing (C4) is the ability to separate concepts into several components and connect them to each other to gain an understanding of the concept as a whole, evaluating (C5) is the ability to determine the degree of

something based on certain norms, criteria or benchmarks, and creating (C6) is the ability to integrate elements into a new whole and broad form, or to make something original.

The problem that is often faced in schools is that the questions given to students tend to test aspects of memory such as questions that tend to be about memorizing formulas and the lack of questions that test students thinking and analytical skills in solving problems. Lack of instruction in answering HOTS-based questions is one of the factors contributing to student's low thinking abilities. Teachers also face challenges in developing HOTS-based test instruments and in finding tools that are specifically made to help students practice answering HOTS-based questions.

According to findings from observations and interviews with SMA Swasta PAB-8 Saentis Percut Sei Tuan physics teachers, the majority of student's science literacy is still rated as low. Students interest in learning is very low compared to hours using gadgets. Empty hours are filled with playing gadgets.

There are some students who score high above the KKM (Minimum Completeness Criteria) and there are still many students who score below the KKM. Suppose there are 30 students in one class, then of these 30 only 10 people are complete. The learning model used is often problem solving. Students still depend on the teacher and on friends.

Teachers have not applied HOTS questions because students have not been able to accept and have not been motivated to learn Physics. Cognitive assessment instruments used by teachers tend to test aspects of memory or recall, because calculation questions are still something that students are afraid of. Students responses to learning in class, some are enthusiastic, and some are lazy.

When students are given physics problems, there are about 30% of students who can solve them smoothly, in detail, in their own way, and in various ways. Teachers always involve students or demand active students in learning, by often holding impromptu quizzes at the beginning of learning so that students can remember previous lessons. And again the priority is to motivate students not to be afraid to learn physics.

Higher order thinking skills have indicators, namely critical thinking skills and creative thinking skills (Dewi, Sriyono, & Ashari, 2015). Sani *at al.*, (2019) said that HOTS is different from higher order thinking (HOT). Higher order thinking (HOT) refers to cognitive abilities in analyzing (C4), evaluating (C5) and creating (C6), while higher order thinking skills (HOTS) relates to the ability to solve problems, think critically, think creatively and make decisions.

Sugrue (1995) in Sani (2019) collects information from several studies in problem solving model studies and identified three formats used to measure HOTS, namely: choosing answers such as multiple choice questions and matching questions, generating (short answer questions, essays and performances), and explaining (giving reasons for a choice or answer to a question). The development of students higher order thinking skills will result in students ability to solve problems to be better, students self confidence to be higher, and student achievement in improving their thinking skills to increase.

Based on the background description that has been described by the researcher, the researcher must conduct research regarding **"The Development of Test Instrument Based on Higher Order Thinking Skills (HOTS) of Translational Dynamics Topic"** as a solution to the problems faced by students of class XI IPA SMA Swasta PAB-8 Saentis. To teach, acquaint, and enhance student's critical and creative thinking skills, a test instrument developed on the HOTS model is essential.

1.2. Problem Identification

Based on the background stated above, the problems that can be identified are as follows:

1. Test instrument based on Higher Order Thinking Skills (HOTS) are still limited.
2. The teacher presents questions that tend to measure students cognitive abilities more, namely C1, C2, and C3.

3. Students are not trained in doing physics quetions based on HOTS (Higher Order Thinking Skills).

1.3. Scope

Based on the background of the problem above, the scope of this research are:

1. Develop of test instrument based on Higher Order Thinking Skills (HOTS) of translational dynamics topic.
2. The test instrument in the form of multiple choice to measure the students higher order thinking skills of translational dynamics topic.

1.4. Problem Formulation

Based on the background stated above, the problems that can be formulated are as follows:

1. How is the validity of test instrument based on Higher Order Thinking Skills (HOTS) on the developed translational dynamics topic?
2. How is the reliability of test instrument based on Higher Order Thinking Skills (HOTS) on the developed translational dynamics topic?
3. How is the discriminating power of test instrument based on Higher Order Thinking Skills (HOTS) on the developed translational dynamics topic?
4. How is the level of difficulty of test instrument based on Higher Order Thinking Skills (HOTS) on the developed translational dynamics topic?
5. How is the effectiveness of the distractors of test instrument based on Higher Order Thinking Skills (HOTS) on the developed translational dynamics topic?

1.5. Problem Limitation

Based on the description of the background and identification of the problem above, many problems were found, so the author made a problem definition. The limitations of the problem in this study are:

1. The test instrument based on HOTS (Higher Order Thinking Skills) was developed in the form of multiple choice questions.
2. The subject matter in this research is only limited to the subject matter of Translational Dynamics.
3. The research subjects were students of class XI in the first semester of SMA Swasta PAB-8 Saentis.

1.6. Research Objectives

Based on the formulation of the research problem, the objectives of the research are to:

1. Analyze the validity of the HOTS based test instrument on the developed translational dynamics topic.
2. Analyze the reliability of the HOTS based test instrument on the developed translational dynamics topic.
3. Analyze the discriminating power of the HOTS based test instrument on the developed translational dynamics topic.
4. Analyze the level of difficulty of the HOTS based test instrument on the developed translational dynamics topic.
5. Analyze the effectiveness of the distractors of the HOTS based test instrument on the developed translational dynamics topic.

1.7. Research Benefits

After this research is conducted, it is expected to provide benefits to:

1. For School

   It is anticipated that this research will benefit the school by helping the students learn.

2. For Teachers

   Served as learning to develop learning outcomes test instruments with different and interesting test instruments to determine student learning outcomes.

3. For Students

   Can help students in solving physics problems of translational dynamics topic.

4. For Other Researchers

   This research can be used as a reference in developing test instruments based on HOTS (Higher Order Thinking Skills) to measure students critical thinking skills of translational dynamics topic.

5. For Scientific Development

   This research can provide information that can develop knowledge in education specifically of test instrument based on Higher Order Thinking Skills (HOTS) of translational dynamics topic.

1.8. Operational Definition

Based on the above explanation, the operational definition of this research is:

1. Critical thinking is a skilled and active process of interpretation and evaluation of observation and communication, information and argumentation (Fisher, 2008).
2. The process of coming up with a fresh idea is called creative thinking. (Yuliantaningrum & Sunarti, 2020).
3. A test instrument is a tool or procedure used to find out or measure something, in a way and with predetermined rules (Arikunto, 2008).
4. The HOTS (Higher Order Thinking Skill) based test instrument is a measuring tool that demands answers with analytical, synthetic, evaluative thinking, and produces many productive solutions through higher order thinking processes that involve mental activity in an effort to explore complex, reflective, creative experiences, and innovative (Sani, 2019).
5. HOTS can be said to be learning communication skills, reasoning skills, problem solving and learning systematically by connecting existing ideas, and connecting positive attitudes towards a goal (Nadhiro, 2018).

6. Validity is the degree that indicates the category in which a test measures what it is intended to measure (Sukardi, 2008).
7. Reliability is the level or degree of consistency of measurement results with the same test at different times (Widiyanto, 2018).
8. Discriminating power is the ability on each test item to distinguish between students with high and low abilities (Widiyanto, 2018).
9. The effectiveness of distractor is an answer choice (option) that is different from the correct answer, each options given has the same probability of being chosen. An option is said to be effective if it fulfills the function or objective presented the option is achieved (Widiyanto, 2018).
10. The level of difficulty is a number that indicates the level of difficulty of a question. A good question is a question that is not too easy and a question that is not too difficult (Widiyanto, 2018).