

CHAPTER I

INTRODUCTION

1.1. Background

Curriculum in this era in Indonesia has undergone renewal to 21st century education. An innovation from the 2013 curriculum aims to increase the quality of quality education and be able to fulfil the needs of students. The 2013 curriculum had applied currently is a constructivist paradigm that guides students to find information independently from observing student interactions with the surrounding environment both inside and outside the school. The 2013 curriculum aims to prepare Indonesian to have life skills that can contribute to people's lives and careers. The 2013 curriculum is designed to increase the ability of students to think creatively and critically. Indirectly, the ability of students to think critically and creatively is part of the Higher Order Thinking Skill (HOTS).

High order thinking skills (HOTS) are needed by students to encounter he times in the era of education. In developing critical thinking skills, there are five ways that can be implemented, namely: (1) Determining learning objectives; (2) Teaching by inquiry; (3) Practice; (4) Review, refine and improve understanding; and (5) Practical feedback and assess learning (Kusuma at el., 2017: 1). In the HOTS category, there are cognitive domains of Bloom-Andersin's taxonomy (revised), namely analyzing (C4), evaluating (C5), and creating (C6). In the C4 category, students are guided to solve problems and find out how a problem is related between two or more things. In the C5 category, students give an assessment according to existing criteria and standards. In the C6 category, students are guided to generalize an idea and develop new ideas (Bakri et al., 2019: 2). HOTS can be improved and trained by instructional design where teachers can use appropriate raters to assess students in HOTS learning. In (Chandra & Hayati, 2021) the HOTS question according to Suprianto, (2018) is measuring the HOTS instrument that does not only measure based on recall,

restate, or recite. Meanwhile, according to Widana (2017) the HOTS question is an assessment based on the real world so that students are expected to solve problems by applying concepts or learning principles that have been obtained at school. Based on the views in the journal (Chandra & Hayati, 2021) the HOTS question is an instrument for measuring the HOTS ability of students in seeking to solve a problem by applying learning concepts or principles that do not only use memory, restate or refer without processing. Students must be able to solve problems, especially in senior high school learning in the scientific field. One is the physics learning process that requires higher order thinking skills (HOTS). Physics as a science that is closely related to various events and events in nature makes it very important for students to have critical level thinking skills because learning physics requires students to be able to recognize, solve problems, interfere, analyze, summarize and evaluate in physics (Astutik et al., 2017: 2).

Physics is one of the subjects of Natural Sciences that use the development of advanced technology and the concept of everyday life with natural phenomena. The learning process of high school physics must be properly formed and managed to realize meaningful learning so that teachers have the task of providing quality learning experiences in order to increase knowledge of cognitive abilities, competitiveness, and the quality of human resources to students. Knowledge in physics will overcome and solve problems from problems that arise and teachers have a role in efforts to build students' thinking skills and knowledge (Chandra & Hayati, 2021).

The physics learning process at SMA Negeri 3 Pematangsiantar has a low category in high-level critical thinking skills. Based on observations and interviews with physics teachers at SMA Negeri 3 Pematangsiantar, it was found that only 20% of students had HOTS in physics learning. This is due to the lack of maximum application of HOTS physics questions. According to the teacher, physics teaching and learning activities currently only use teaching materials in the form of text books with the lecture method via video conference. The teaching materials used in learning physics are only one and less varied. It was found that the teaching materials in the form of student worksheet had not been used since 4

years ago, this was because the circulating student worksheet could not be obtained for free so students had to buy them to use them. In fact, student worksheet are teaching materials that really help students in the learning process.

Student worksheet is a teaching material that can help students build their knowledge independently and encourage students to participate in classroom learning activities (Taslidere in Misbah et al., 2018: 20). The use of teaching materials according to Julian et al., (2020) makes it easier for students to understand the material more pleasantly and does not require a long time. The solution to improve educational skills in the 21st century is to develop teaching materials that can facilitate student learning activities and have an impact on forming active interactions between students and teachers. A teacher must make efforts to develop students' knowledge in varying media with models any learning that can improve students' higher order thinking skills (Ramadhan et al., in Chandra & Hayati, 2021). This student worksheet is one of the facilities that can help to learning activities and can effective interactions between students and teachers, so that they can increase student activities to affect the improvement of students' thinking skills. Researcher in channeling students to think skills, this development innovation uses the 4D model by Thiagarajan (Rosyidah et al., 2019). The ability to solve problems in 4D procedural models is packaged in development E-student worksheet based on HOTS. The ability to solve problems contained in the student worksheet will affect the students' HOTS. Therefore, the development of HOTS-based questions in student worksheet can be used as an instrument for teachers in measuring students' HOTS abilities (Chandra & Hayati, 2021).

The physics learning process in high school requires learning that can build higher order thinking skills so that a solution is found in the form of a student worksheet equipped with technology as a HOTS-based student media with 4D model (Bukit at el., 2018). Innovation 4D model in the development of E-student worksheet based on HOTS is a solution for teachers and students as interactive learning that can improve critical thinking skills. Based on the research of Bakri et al., (2020) the student worksheet based on HOTS has been validated to

be applied as teaching material in physics learning that can build students' HOTS abilities. The results of the validation with the development of a E-student worksheet based on HOTS that meet these requirements have gone through a feasibility test of media expert and material expert with very effective and good categories (Bakri et al., 2020).

The implications of research on E-student worksheet based on HOTS are an alternative in overcoming the problems of 21st century education in the era of the industrial revolution 4.0 which refers to the problem of low critical thinking skills, creative thinking skills and scientific creativity skills in physics learning (Daryanto & Suryanto, 2022). Therefore, it is very important to develop appropriate physics learning designs in overcoming low critical thinking and being able to improve students' thinking skills (Astutik et al., 2020). The results of the development of physics learning design in this study resulted in a product in the form of a E-student worksheet based on HOTS that was able to overcome the low level of higher-order thinking skills and improve students' higher-order thinking skills.

Based on the problems in the physics learning process at SMA Negeri 3 Pematangsiantar, researcher important to conduct research to provide solutions in the form of developing an electronic student worksheet containing for understanding that can build students' HOTS. By conducting e-student worksheet based on HOTS research on the Doppler effect material with 4D model, students will be able to improve critical thinking skills and be able to overcome low critical thinking skills with a more interesting physics learning process. Students are expected to have easier access to the student worksheet anytime and anywhere, making it easier for students to learn with the help of technology and making this teaching material in the form of an electronic student's worksheet. The researcher feels important to conduct research entitled **"The Development of E-student Worksheet based on High Order Thinking Skill (HOTS) with 4D Model on Doppler Effect Material in SMA Negeri 3 Pematangsiantar"**.

1.2. Scope

The scope of the e-student worksheet based HOTS research is:

1. Development of teaching materials in the e-student worksheet based HOTS to improve students' high-level critical thinking skills.
2. Research and development of this development e-student worksheet based HOTS uses a 4-D model.

1.3. Problem Identification

Based on the background of the researcher's problem, the identification of problems in the e-student worksheet based HOTS research is:

1. The teacher has not made a student worksheet independently according to the needs of the students.
2. Teachers only use text books and lecture methods with application of HOTS questions still minimal so that learning is less varied and less able to increase students' HOTS.
3. There is no development electronic student worksheet based HOTS at SMA N 3 Pematangsiantar.

1.4. Problem Formulation

Based on the background and problem identification, the e-student worksheet based HOTS research problem formulation is obtained, as follows:

1. Does the e-student worksheet by researcher get a validation category according to the criteria with material expert, learning expert, and learning practitioners?
2. Does the e-student worksheet by researcher get a practicality category according to the criteria with learning practitioners and student respondents?
3. Does the e-student worksheet by researcher get a student respondents?

1.5. Problem Limitation

Based on the formulation of the problem, the scope of problems was obtained. The researcher was conducted for Senior High School Students as follows:

1. The Researcher limit the development of e-student worksheet based on equipped with visual and audio-visual materials of Doppler effect as well as task sheets that are arranged in order to improve students' higher thinking skills.
2. Utilization of the e-student worksheet based on HOTS a teaching material that can be accessed in online learning.

1.6. Research Objective

The research objectives of the e-student worksheet are:

1. Knowing the level of validation of the e-student worksheet based on HOTS on the Doppler effect material developed by the researcher in accordance with the criteria by material expert, media expert and teacher.
2. Knowing the level of practicality of the e-student worksheet based on HOTS on the Doppler effect material developed by the researcher according to the criteria by teacher and students.
3. Knowing the level of student respondents of the e-student worksheet based HOTS on the Doppler effect material developed by the researcher.

1.7. Research Benefit

The benefits of e-student worksheet based on HOTS research with the 4-D Model are as follows:

1. For College Students

College students can add new knowledge, insights, and invaluable experience, especially in the development of e-student worksheet based on HOTS. Then, it can be used as a reference for further researcher who want to research the development of e-student worksheet based on HOTS.

2. For Teachers

The e-student worksheet produced from this development research can be used as independent teaching materials to facilitate the learning process, utilize technology more effectively or efficiently and can improve the quality of learning that is varied and innovative.

3. For Students

As an independent learning media that can be accessed for free, anytime and anywhere. Students can make product as an innovative learning media increasing interest in learning and higher order thinking skills (HOTS).

1.8. Operational Definition

Operational definitions in this research activity are:

1. Student worksheet is a teaching material that is used as a forum for developing student learning activities and developing creative thinking skills in solving a problem as well as evaluating for teachers (Susanti in Chandra, 2021: 18).
2. HOTS is a way of improving thinking that is used to transfer a problem in finding and finding solutions to problems using critical thinking processes that are implemented in the 2013 curriculum (Susanti in Chandra, 2021: 19).
3. The doppler effect is one of the sub-materials of waves and sound. The Doppler effect is something that can be known without seeing and observing the sound based on the frequency emitted by the sound source which is not necessarily the same as the listener's frequency. (Klinaku & Berisha, 2019).
4. The development model used leads to a modified and adapted 4-D model, this model was suggested by Thiagarajan. This development model consists of 4 stages, namely: define, design, develop and dissemination.