

## CHAPTER I INTRODUCTION

### 1.1 Background

Student worksheet is a learning material that trains students' independence, creativity, critical thinking, and designed according to the competency in educational institutions. Student worksheets as one of the printed teaching materialize guides, complement or tools to support the learning activity (Mahmudah, 2017). According to Trianto (2012), student worksheet is an activity that must be carried by students to increase understanding in efforts to form basic abilities according to learning indicators that must be achieved. In this explanation, student worksheet is a learning resource and material that improve and establish student creativity, mastery, and responsibility also can be developing by educators as a facilitator in learning activities according to the conditions and learning situations.

Student worksheets generally consist of information, a problem, instructions and guiding questions (Majid, 2015). Structure of student worksheet settled by Depdiknas (2008) consists of (a) title; (b) learning guide; (c) competency that must achieve; (d) supporter information; (e) tasks and work steps; and (f) assessment. Therefore, it was concluded that student worksheets had components including book identity, student identity box, instructions to use, competencies, and indicators, information of subjects matter, tasks and activities, and last assessment. Moreover, the Student Worksheet consists of material summary, learning task instructions that students must do, including investigation activities and problem-solving through experiments and demonstrations.

Student worksheets as teaching materials useful to train student independence, literacy, creativity, and understanding. Student worksheet establishes students' literacy interest, allowed the student to make a feedback in the learning activity, accommodate student difficulty, and create flexible learning activity to student development(Widyantini, 2013). Activating

students in the learning process, assisting students in developing concepts, training students in finding and developing process skills, as a guide for educators and students in carrying out the learning process, and helping students obtaining the matter which learned through learning activities are the benefit provided by student worksheet.

An ideal student worksheet must have validity, practicality, and effectiveness requirements. The validity of a student worksheet if the worksheet designed in scientific and each component of the worksheet are interrelated. Practicality, if the worksheet is easy to use by students. And effectiveness, if the worksheet complying learning objectives. Darmodjo and Kaligis in Indriyani (2013) explain that the preparation of student worksheets must comply with dictates, construction, and technical requirements. Dictates requirements are student worksheet can be used according to varying levels of student ability, have a variety of stimuli through the media and learning activities also, develop students' social, emotional, moral and aesthetic communication skills. Construction requirements relating to language utilization according to children's maturity level. And technical requirements discuss the terms of letters, pictures and displays utilization. In consequence, refer to three requirement student worksheet need an approach or learning strategy in its arrangement complying learning indicators. Thus, variations in learning approaches in student worksheets can be a scientific approach, guided inquiry, STEM, and also STEAM accordance with the school condition.

Ordinarily, student worksheet that should be used in learning is a worksheet that is compiled directly by educators in educational institutions to synchronize learning conditions within the school. On the other hand, analysis of the student worksheet in SMA Negeri 1 Berastagi grade X namely, Irnaningtyas, S.A. (2016). *Mandiri: Biologi Untuk SMA/MA Kelas X*. Jakarta. Erlangga indicates that this worksheet consists of core competency and basic competency, a summary of learning matter and competency tests in multiple-choice and essays. The student worksheet compiled with 11th

chapters biology matter uses on odd and even semester. Activity that encourages students to conduct an investigation and understanding of learning matter based on scientific attitude, is the activity which not yet included in SMA Negeri 1 Berastagi student worksheet. Consequently, the student learns only based on theory. The analysis also conducted especially on ecosystem topic which is the matter learn through experiment or investigation, by basic competency 3.10 and 4.10. So thus the condition of SMA Negeri 1 Berastagi student worksheet, it needs to do the development of student worksheet which is complying learning indicators 3.10 and 4.10, also condition of the school. according to children's maturity level. And technical requirements discuss the terms of letters, pictures and displays utilization. In consequence, refer to three requirement student worksheet need an approach or learning strategy in its arrangement complying learning indicators. So, the variations on approaches in student worksheets it depend to school characteristic and curriculum, it can be a scientific approach, guided inquiry, STEM, or STEAM.

Analysis of learning indicators on basic competency 3.10 and 4.10, Ecosystems biology matter which require activities that directly related to the environment. Learning indicators basic competency 3.10 require students to analyze information/data from various sources including interactions between ecosystem components. Moreover, the skills demanded in basic competency 4.10 are students able to design a chart of interactions between ecosystem components in various forms of media. Through indicators in basic competency 3.10 and 4.10 on the ecosystem, indicate the involvement of students' scientific process skills in their learning. Which is the students' scientific skills aspect are observing, asking questions, experimenting, associating, and communicating are the skills required by the curriculum to appear in learning.

Scientific process skills are basic and special skill that students have and are adapted from scientific habit of scientists in understanding concepts in nature. According to Gagne in Dahar (1985), scientific process skills are

typical skills used by all scientists and can be applied to understand phenomena. Every scientific process skill is a scientific behavior of scientists that can be learned by students and transferred between the contents of the lessons and contribute to rational thinking in daily life. Science process skills are skills that students must have in learning which consist of observing, asking questions, experimenting, associating, and communicating (Permendikbud No. 54, 2013). So, scientific process skills are abilities that must be possessed by students as a result of the learning process based on indicators in basic competency of knowledge domain 3.10 and skill domain 4.10 in the ecosystem, which includes the ability to observe, asking questions, experimenting, associating, and communicating.

Accordance to learning indicator of ecosystem topic, STEAM one of learning approaches which is complying basic competency 3.10 and 4.10 in experimenting to analyze ecosystem components and its relation. STEAM is an approach in which envelope students' understanding and interest in related subjects such as science, technology, engineering, etc, foster thinking conversions and problem-solving based on science and technology (Baek and Yoon 2016). Principles of STEAM are similar to other learning approaches, such as the scientific approach. Makes science as a major component in learning that can implemented in everyday life is the goal both of STEAM and scientific approach. A different thing as a renewal, STEAM with 5 disciplines not only focuses on science, but followed by technology, engineering, art, and mathematical concepts. STEAM aims to encourage students experimenting, make models/music/films with their own hands, realize ideas into actions, and create final products, like problem-solving based on a project/PJBL (Project Based-Learning). The focus of STEAM ordinarily combine scientific approaches and project-based learning, invites students to work real and directly related to the environment.

STEAM student worksheet was the renewal concept carried by this research. Student worksheet based on STEAM included 5 disciplines (science, technology, engineering, arts, and mathematics) of STEAM, studies

the concept of biological matter into activities that real and directly related to the environment. Through *science*, students invited to train the ability to use scientific knowledge and processes to understand the world and the ability to participate in making decisions. *Technology* trains students on how to use new technology, understands how new technologies develop, and can analyze how new technologies affect individuals, and society. *Engineering*, trains students to use a systematic approach to design, process and produce objects or systems to meet human needs and desires. *Art* trains students' creativity in producing artful, meaningful and useful products. And *mathematics* sharpens students' ability to analyze, and communicate ideas effectively, how to formulate, solve, and interpret solutions to mathematical problems in their application (Yakman, 2012).

There are many studies with the theme of STEAM conducted in various countries, ordinarily developed countries. Discussed in each international scientific conference, STEAM to be a hot topic in education. It consequently encourages educators in Indonesia to examine the development of steam as an integrative approach. Moreover, one of the previous studies from Wandari *et al*(2018) examine the effects of STEAM learning on student mastery concept and creativity on the topic of light and optics. An increase in the mastery concept with a normalized gain score of 0.78 in the high improvement category. While for the creativity of students in every dimension gained different results: 1) Novelty categorized into good with 75.6%, 2) Resolution is categorized into good with 77.8%, and 3) Elaboration and synthesis categorized into enough with 65.3%.

Through the contents of student worksheet on SMA Negeri 1 Berastagi and curriculum analysis which is related to learning approaches, it is necessary to do the renewal in student worksheet arrangement. Student worksheet development conducted based on the actual goals of learning, especially in the demands of the 21<sup>st</sup> skill. The existence of a learning approach by the curriculum moreover, the development of education which is

a student worksheet is not burdening students and teachers, rather become fun and creative learning activities.

Based on this framework, the researcher does research entitled "Developing Student Worksheet Based on STEAM (Science, Technology, Engineering, Arts and Mathematics) on Ecosystem Topic at SMA Negeri 1 Berastagi". Moreover, this research used Research and Development method with the 4D model, *Define, Design, Development, and Disseminate*.

### **1.2 Problem Identification**

From the back ground of the research above, there are several problems that can be identified:

1. The student worksheet in SMA Negeri 1 Berastagi consists of subject matter summary and competency test.
2. SMA Negeri 1 Berastagi student worksheet Ecosystem topic didn't identical activity directly related to the environment.
3. Student worksheet in SMA Negeri 1 Berastagi has not yet using an learning approaches.
4. Student worksheet train students to memorize concepts based on theory.

### **1.3 Scope of Study**

The scope of this research is limited to:

1. The development of student worksheets carried with the 4D model (*Define, Design, Develop and Disseminate*).
2. The student Worksheet that develops is a student worksheet based on STEAM approaches on Ecosystem topic grade X.
3. Material Expert and Learning Expert validate Content Eligibility, Eligibility of Presentation, and STEAM Learning Component.
4. The product test of the Student Worksheet conducted in SMA Negeri 1 Berastagi.



#### 1.4 Research Question

Based on problem identification and scope of study, the research questions are formulated as follow:

1. How is the procedure of developing an student worksheet based on STEAM on Ecosystem topic?
2. How is the eligibility of student worksheet based on STEAM on Ecosystem topic according by matter expert?
3. How is the eligibility of student worksheet based on STEAM on Ecosystem topic according by learning expert?
4. How is the eligibility of student worksheet based on STEAM on Ecosystem topic according by teacher and student?
5. How is the scientific process skill of students grade X MIPA 7 on ecosystem topics using student worksheets based on STEAM?

#### 1.5 Research Objective

Based on research objective described above, this research is aimed to:

1. To know the procedure of developing student worksheet based on STEAM on Ecosystem topic.
2. To know the eligibility of student worksheet based on STEAM on Ecosystem topic according to matter expert.
3. To know the eligibility of student worksheet based on STEAM on Ecosystem topic according to learning expert.
4. To know the eligibility of student worksheet based on STEAM on Ecosystem topic according to teacher and students.
5. To know N-gain score of students' scientific process skills on Ecosystem through student worksheet based on STEAM.

#### 1.6 Research Benefical

By implementing research objectives, this research will significantly contribute for:

1. For Teacher: Student worksheet that produced from this development research can be a teacher guide to teach Biology with applied STEAM approaches.
2. For Students: Student worksheets that produced from this development research can be a learning resource, so it can motivate students to learn independently, creatively, and efficiently in the learning process.
3. For Researcher: Student worksheet that produced from this research can be as experience applying Student Worksheet based on STEAM approaches directly to students.

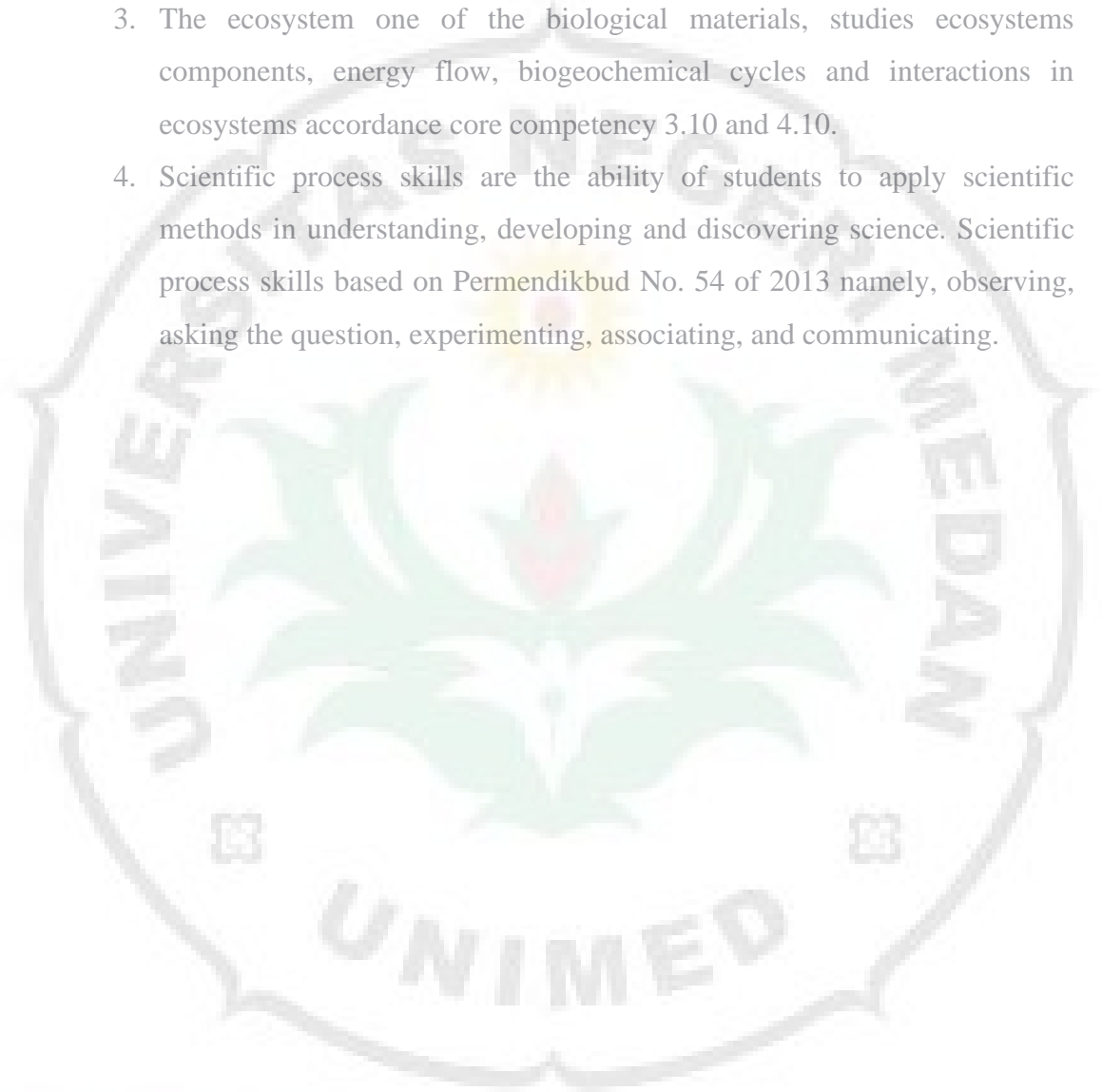
### 1.7 Operational Definition

The operational definitions in this study are as follows:

1. The development of this Student Worksheet uses the Research and Development (R & D) method with a 4-D model (*Define, Design, Develop and Disseminate*). Define, the first step to identify the needs in learning through curriculum analysis, students, and learning material. Design, namely designing an approach that will be used in learning, learning media selection, assessment, and learning activities. Develop, validating and evaluating teaching material through experts such as material expert, learning expert, or graphics expert, and field trial. Validity and evaluation from teachers and students also including in the developing stage. Last, disseminate stage to know the acceptance of the final product by the biology teacher.
2. STEAM (Science, technology, engineering, arts, and mathematics) is an interdisciplinary learning approach between science, technology, engineering, and mathematics. *Science* as processes to understand nature, *Technology* as tools to process science concepts, *Engineering* as recreating the concepts to be a product, *Arts* as creativity to communicate the concepts, and *Mathematics* as a process to find and use formula.



3. The ecosystem one of the biological materials, studies ecosystems components, energy flow, biogeochemical cycles and interactions in ecosystems accordance core competency 3.10 and 4.10.
4. Scientific process skills are the ability of students to apply scientific methods in understanding, developing and discovering science. Scientific process skills based on Permendikbud No. 54 of 2013 namely, observing, asking the question, experimenting, associating, and communicating.



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