

CHAPTER 1

INTRODUCTION

1.1. Research Background

Teaching materials is all the form of materials that can used in learning process (Abadi et al, 2015). Teaching materials has many of form such as textbooks, workbooks, tapes, CD-ROMs, videos, photocopies of handouts, newspapers, magazine, comic, paragraphs written on the blackboard or anything that presents or informs about the something being studied. In educational scope, the existence of teaching materials is very necessary and in general, the form of teaching materials that is most often encountered is in the form of books either in the form of textbooks or ebooks. The quality of teaching materials will be influence the quality of education system. This refers to Kalyani and Rajasekaran's thoughts on learning objectives which say that “the learning objective is not only to teach textbooks and make students understand more but also to add innovation. Innovation in education is often associated with renewal that comes from the results of creative and innovative thinking in an invention or modification containing ideas and methods used to solve a problem in education (Purba and Situmorang, 2015). Thus, that need the development and innovation of teaching materials continuously.

The innovation of teaching materials aims to increase students' high-level thinking skills so that it can encourage a learning shift system from conventional learning to structured and independent learning (Parulian and Situmorang, 2013). To create innovative teaching materials, it can be done with various models, one of which is project-based learning.

According to its mean, project-based learning (PjBL) is an approach to teaching in which students answer challenges or problem through an extended inquiry process (Chiang and Lee, 2016). Several previous studies on project-based teaching materials put forward by Hapsari and Airlanda (2018) concluded that the use of project-based teaching materials can improve student learning outcomes and student creativity. In addition, other positive things are being able to improve students' higher order thinking skills and student activity in doing and completing project assignments properly and appropriately. This is in line with the research of Insyasiska, et al (2015)

and Linda (2011) which states that project-based learning can motivate students to learn independently to find their own information from various sources, such as a team of experts, the environment, media and the internet so that it can produce generation who think innovative.

Chemistry is in the form of concepts that explain abstract things (Tsaparlis, 2016) that require a high level of concentration to be able to solve the problem. A person's level of concentration can be influenced by everything that is observed, for example from the surrounding environment or from the learning resources that are used. While viewed from its function, chemistry is an experimental science, meaning that studying chemistry is not enough just by listening and reading, but it is necessary to carry out practicum learning activities, which aim to help build students knowledge of the material being studied.

Chemistry consist of so many field there are organic chemistry, inorganic chemistry, biochemistry, physics of chemistry and analytical chemistry. Analytical Chemistry is defined as the field of chemistry that develops and delivers appropriate methods and tools to obtain information about the composition and structure of matter, especially regarding the type, quantity, energetic state and geometrical arrangement of atoms and molecules in general or in a specific sample volume. The analytical chemistry must be explained clearly in the principles of problem solving methods (Situmorang, et al., 2018). One of the analytical chemistry topic is Paper Chromatography. Paper chromatography is a method of separating of component compounds from a mixture where it consist of mainly two phase that stationary (usually in form liquid or solid) and mobile phase (usually in form gas) by using paper chromatography (Mandeep, 2018). Chromatography is a one of best technique separation which are studied in depth in analytical chemistry courses. This topic discuss about the separation concept and principle, where based on my observation the student still not understand clearly the separation concept of this technique. The lack of clarity of this concept is also caused by the lack of teaching materials on planar chromatography, especially paper chromatography. On this basis, chemical materials also are materials that are considered difficult by most people in general this can be caused by the less presentation material, unattractive and boring materials that makes it difficult for student to study chemistry and dominantly people always assume that

the subject matter is difficult to learn, so that learners feel less able to learn it (Yusfiani and Situmorang, 2011) . That is caused by the the applied learning materials not yet full the standards and not optimally innovated which would influence the learning outcome student, high order thinking skill and student ability in mastering the chemistry matter specially in paper chromatography matter.

At the Universitas Negeri Medan, Mathematics and Natural Science Faculty in Chemistry Department, students are still using the module as a learning media to do the experiment. Utilization of the module as a sources of learning is important to support the knowledge of learners follow the increasingly global technology (Situmorang, 2013). The use of good and appropriate learning resources can trigger a person's ability to solve problems. According to the expert, experiments and laboratory cannot separated from chemistry matter so that the development of project in laboratory is very needed. Because the project can helps the student to find a new thing as an innovative ideas in designing project to be done or solve the problem encountered while doing the laboratory experiments activity. This activity will be a stimulate in improving the high order thinking skill of student. By adding the project and some innovation in laboratory experiment in learning material trusted can create the interesting learning condition. This things will improving high order thinking skill, creative skill, communication and their collaborative where it can develop students skill work of a project and learning outcomes. Because the high order thinking skill trusted as a best alternative to answer the many trouble in education world which related to student ability.

To overcome these problems, it is necessary to develop an innovative learning materials with project based learning that can improve high order thinking skill of students, their activities and learning outcomes in the learning process at the experiment laboratory in teaching of paper chromatography. In addition it needs to be developed teaching materials that can improve the ability of students in solving problems, the ability student to reach high order thinking skill and the their activities in teaching Chemistry and it will be applied online to prevent the spread of *Corona* virus. Based on the explanation above, the researcher interested to develop innovative learning with Project Based Learning to increase student high order thinking skill and their activities with entitled "**The Development An Innovative Teaching Material**

With Project Based Learning To Increase High Order Thinking Skill (HOTS) In Teaching Of Paper Chromatography''

1.2. Problem Identification

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

1. The low concept of understanding students in paper chromatography material.
2. The lack of innovative teaching materials which exists on topic paper chromatography.
3. The conventional learning system without the existence of a project is not optimal, because the learning material is quite difficult, less attractive and causes boredom in learning.
4. Innovative project-based learning resources that are integrated into online learning are needed to support the change in traditional learning systems towards student-centered learning.
5. Project-based learning resource innovation on paper chromatography material is needed to support the increase in students' high order thinking skills in Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan.

1.3. Problem Formulation

The problems in this research are:

1. What is the strategy that will be carried out to develop innovative project-based teaching materials for teaching chromatography?
2. What are the mini-projects that can be developed to be integrated in the Chromatography Subject matter teaching material to make the Analytical Chemistry teaching of Separation easily learn?
3. What is the strategy that will be carried out to standardize innovative teaching materials in order to reach the eligibility criteria for teaching materials according to BSNP standards?
4. How do students' teaching and learning activities when using the developed innovative project-based teaching material for teaching chromatography?

5. How is the students learning outcomes that are taught by using an innovative project-based teaching materials in teaching Chromatography Subjects?

1.4. Problem Limitation

As for the limitations of the problem in this study are:

1. Innovating project-based learning for the teaching of Paper Chromatography through innovative teaching materials and given the questions in multiple choice form.
2. The learning model in this teaching material is a project based learning model.
3. Teaching materials will be reviewed and revised by chemistry lecturers and students in Universitas Negeri Medan until standard teaching materials are obtained according to BSNP standards.
4. In this study only reached the stage of development and preparation of teaching materials on Paper Chromatography as well as measuring the eligibility of teaching materials, students' high order thinking skill and students' activities.
5. This research only for Universitas Negeri Medan students of Regular Chemistry Education Study Program 2018.

1.5. Research Objectives

The objectives of this research are:

1. To develop an innovative project-based teaching materials for teaching chromatography.
2. To compile and develop mini projects that can be developed to be integrated in the Chromatography Subject matter teaching material to make the Analytical Chemistry teaching of Separation easily learn.
3. To standardize innovative teaching materials in order to reach the eligibility criteria for teaching materials according to BSNP standards
4. Knowing the level of students' teaching and learning activities when using the developed innovative project-based teaching material for teaching chromatography.
5. To improve student learning outcomes that are taught by using an innovative project-based teaching materials in teaching Chromatography Subjects.

1.6. Benefits of Research

The benefits of this research are:

1. For students, increase knowledge (high order thinking skill) and can stimulate the student activities by doing project-based learning.
2. For lecturers, it is a suggestion for students to use project-based teaching materials.
3. For researchers, this is a valuable experience in innovating project-based learning that can be used by students at Universitas Negeri Medan.
4. For other researchers, it is information in designing further research, to improve the quality of the learning process in general, and the chemistry learning process in general.

1.7. Operational Definition

1. Development is a method for developing or creating an innovation through a learning-based project that aims to improve the high order thinking skill of students.
2. Innovation is the renewal of a new result through project-based learning, development and research engineering that aims to develop or apply the results of an innovations such as innovative learning materials on paper chromatography and current knowledge contexts with applying existing science and technology, especially on paper chromatography material.
3. Eligibility is the criterion for determining whether an innovation teaching material is eligible to apply. An innovation teaching material is considered to fulfill the eligibility criteria if it has fulfilled the established BSNP standard criteria.
4. Project Based Learning is a learning method that uses projects / activities as a medium which aims to stimulate the work of the brain in solving problems so that it can improve learning outcomes.
5. Student learning activities are a series of activities carried out in the learning process that affect student success in the material being studied

6. High Order Thinking Skill (HOTS) is a conscious exploration of experiences in achieving a goal, namely in achieving and mastering learning material that has been received during the learning process.
7. Paper chromatography is a method of separating compounds by using chromatographic paper specifically designed as a stationary phase into only one compound (individual compounds).