CHAPTER I
INTRODUCTION

1.1 Background

The world nowadays is continually developing almost in whole aspects of life and it indicates that people, especially the young generation, has to be ready to thrive in today's digitally and globally interconnected world. According to the statement of National Education Association (NEA) of America, people living in the 21st century will have a high demand to increase their personal quality as 21st century opportunities will challenge everyone to be more competitive in each aspect of life, work, and citizenship. NEA (2015) stated clearly that there are four most important specific skills required by everyone to prepare the future. They are known as the "Four Cs" which includes critical thinking, creativity, collaboration, and also communication.

Science is actually one of fundamental subject that facilitate students to fulfill the requirement of the 21st century readiness. It occasionally will serve students an educational platform in promoting their learning and innovation skill which focuses on 4Cs such as creativity, critical thinking, collaboration, and communication (Dilley, Fishlock, Plucker, 2011). Education is actually like a bridge providing ways for people to achieve their aims in life. It means, science education will be a facility to support the development of 4Cs ability. Toward this case, teacher then will have a crucial role to achieve that. Teacher has their authority in which model, approach, or method they will teach their students and deliver the content or material.

One of learning approach that has been revealed as an effective way to initiate the development of 4Cs skill is STEM-Based Approach. In Indonesia, the ministry of education expecting that instruction should implement technology through science (Indonesia Ministry of Education and Culture, 2013). Through Republika Online in 2015, Amal, a researcher of Lembaga Ilmu Pengetahuan Indonesia (LIPI), argued that Indonesia should implement STEM-Based Approach to the young generation if they want to involve more in technology development nowadays. STEM-Based approach will challenge students to be more critical in seeking solution based on social problem in their surroundings. Reeve (2013) stated that

STEM-Based Approach is used in a learning process and integrates science, technology, engineering, and mathematics in a real context of school, work-life, and global world. The integration of those aspects is really connected with 4Cs skill that is improved through teaching learning process.

Some experts agree that STEM-Based Learning Approach is identically represented by Project-Based Learning. Its application is supported by some learning methods and models, such as problem-based learning or project-based learning. Capraro & Jones (2013) stated that Project-Based Learning is kind of an interdisciplinary instruction, as well as STEM-Based Approach which integrates four disciplines into a new knowledge. It facilitates a content integration of science, technology, engineering, and mathematics to broaden not only concept mastery of students but also 4Cs skill which is critical thinking, creativity, collaboration, and communication. Holubova (2008) and Hubbard (2012) stated that project-based learning is able to guide students to solve the problem and emphasizes their product. This product is either ideas or devices. It may indicate students' contribution in increasing the quality of life. In making this product, they could utilize science and technology and it is obviously related to STEM itself.

In accordance to Thomas (2000) and Doppelt (2000), in project-based learning, students will be working as a group and they are going to have a problem given by their teacher and they are expected to analyze that problem which lead them to think critically, plan and design the most effective solution which enactive their creativity, do an investigation with others, make a decision, report an investigation result in the form of a product, have a reflection toward their product, which surely involve collaboration and communication of theirs (Thomas, 2000 and Doppelt, 2000).

Brainstorming about 4Cs skill, many research related to creativity and critical thinking have been done by many academic researchers, while collaboration and communication, though it is two of the key components of 21st century skills, yet it has not attracted the same research attention as those related concepts, creativity and critical thinking (Dilley, Fishlock, and Plucker, 2011). Meanwhile, collaboration is increasingly mentioned as an important educational outcome, and most models of 21st century skills include collaboration as a key skill (Fadel &

Trilling, 2012; Trilling & Fadel, 2009; Wagner, 2008, 2010) and communication skill is assumed as the supportive competence towards collaboration.

Collaboration and communication is related to each other. Communication must be conducted in a collaborative work done by people. It means that collaboration without communication is impossible. Both of them will be running consecutively. In an ideal condition, students have a good collaboration when they are coordinated and having a synchronous activity to construct and maintain a shared conception of a problem (Roshelle and Teasley, 1995). Similarly, Hesse, Care, Buder, Sassenberg, & Griffin et al. (2015) define collaboration as the activity of working together towards a common goal. Doing a good collaborative work, students tend to have a good communication too. The ability to communicate well is a cornerstone for promoting and enabling critical thinking and active learning (Bean, 2011). A collaborative learning which usually expects students to solve any cases will support and facilitate students to develop and to improve their communication.

As stated before that collaboration and communication are two aspects of 4Cs that is not given the similar attention as well as critical thinking and creativity. A good science teacher should have an intention to provide and to facilitate students in developing those aspects. As our society evolves, we can no longer assume that collaborative and communicative competence is something that the students will learn "on their own", that is why an educator is expected to teach their students how to collaborate and to communicate effectively (Dilley, Fishlock, Plucker, 2011). This statement indicates that subject in school should be able to held an instruction that stimulate students to build their collaboration and communication skill.

Talking about collaboration works, Barron (2003) stated that students do not always collaborate themselves when fostering learning. It is possible that collaboration of students may not result in equivalent learning gains for each student (Teasley & Fischer, 2008; Gnesdilow, Bopardikar, Sullivan, & Puntambekar, 2010). In current situation nowadays, the researcher even found a phenomenon, when students work collaboratively in a group. As a science teacher in one of private school in Bandung, it is often observed by researcher how students interact and work together in group. Teacher actually can arrange students in different

group. It can be a group with single-gender member or a group with mix-gender member. Somehow, it is obviously observed that a group consists of students with different gender act and discuss very noisy. It seems that there are so many things they argue on and finally they lost their focus in learning process. On the other hand, another group may be very silent because of something unclear. An intimate communication among them is not occurred. Other cases, for example, students in mixed-gender group put no care to everyone with different gender and just have a talk with similar gender member.

Several factors that may influence teamwork are group size, context, gender, prior knowledge, and individual abilities (Hawkins & Power, 1999). Gender, actually, will be an aspect that can affect the collaboration work among people or students. As everyone knows, there are some possible ways to create a group with various compositions either a group consisted of single-gender group or mixed-gender group. Leman in 2010 said that there are differences between how boys and girls learn, converse, and interact, including when they both work in mixed-gender group. Girls, when work together with boys, will not perform as well as they work together with girls as they got lower post-test score (Light, Littleton, Bale, Joyner, & Messer, 2000). Similar to Leman, Modi, Schunberg, and Salmond (2012) argued, it is correctly predicted that girls will perceive higher gender barriers than boys, especially in some fields like science, mathematics, engineering, and technology. It seems that they will not put higher enthusiasm and attention on it as boys will take it over better than them.

Other research revealed that students who work in a single-gender group is more purposeful that mixed-gender group (Benneth, Hogarth, Lubben, Campbell, and Robinson, 2010). Yet, the contradiction appear when a research result stated by Goldstein and Puntambekar in 2004 said girls worked in mixed-gender group participated more actively and persistently on collaborative learning activities. In the other hand, research held by Condes and Bradford in 2010, argued that females from single gender groups also appeared to be more confident in their understanding the concept of physics through laboratory activities than females from mixed gender groups.

Looking at those research results, none of them indicate which one is the best way to build a strong student' collaboration and communication in group, whether it should be a single gender group or a mixed gender group. It means that the further research about this should be considered to conduct. The contradictions and non-conducive situations in the classroom when collaborative working held indicate that the evidence about gender composition in grouping is still actually needed to strengthen those statements, either it gives effect or not in the end of instruction. Moreover, some research about collaboration and communication is mostly conducted in laboratory activities, while in STEM Learning, this research has not been found as many as laboratory activities.

Considering all current situations and reasons above, so it is essential to have a research on how gender composition in grouping affects students' collaboration and communication, including its relation with concept mastery especially in STEM learning. Firman (2018) argued strongly that the 21st century skills have been main orientation of education practice globally which comprises three core components and one of them is actions skills and it could be expressed by practicing collaboration and communication. Toward this statement, in learning process, one of the efforts to support those aims that teacher should confidently construct the best group when having students to work collaboratively. So, this research will explore and elaborate the effect of gender grouping composition on collaboration and communication skill and pressure concept mastery when STEM learning is implemented in middle school.

1.2 Research Problem

According to the importance of having research on enhancing collaboration and communication skill through STEM learning, so the research problem is "How is the effect of gender grouping composition on collaboration and communication skill and pressure concept mastery in STEM learning for junior high school students?"

1.3 Research Question

Elaborating the research problem, the research attempts to explain the following questions:

1. What is the effect of gender composition in grouping on collaboration skill of junior high school students in STEM learning on pressure concept?
2. What is the effect of gender composition in grouping on communication skill of junior high school students in STEM learning on pressure concept?
3. What is the effect of gender composition in grouping on concept mastery of junior high school students in STEM learning on pressure concept?

1.4 Research Objectives

According to the problem proposed, then this research has objectives as follow:

1. To explore the effect of gender composition in grouping on collaboration skill of junior high school students in STEM learning on pressure concept;
2. To explore the effect of gender composition in grouping on communication skill of junior high school students in STEM learning on pressure concept;
3. To explore the effect of gender composition in grouping on concept mastery of junior high school students in STEM learning on pressure concept.

1.5 Limitation of Problem

In order to make the research become more focused, the problem is limited as follow:

1. Learning activity that is conducted in this research will be STEM-Based Learning that includes project-based learning implementation. The topic delivered through the learning process is focused on solid pressure and Pascal Law.
2. Gender composition in grouping will be divided into two kinds of grouping such as single gender grouping and mixed gender grouping.
3. Collaboration skill that is described in this research is based on Valente (2016) in CO-LAB Guidelines for Assessing Collaborative Learning in the Classroom. The measurement of this skill is just focused on five aspect, such

as engagement in teamwork, motivation to do the task, relationship in teamwork, team reporter performance, and team leader performance. This skill is measured quantitatively through peer assessment. The instrument used has been elaborated in order to fit the need of research.

4. Communication skill that is described in this research is based on Murdock, who developed an instrument called 'Assessing Public Communication by Scientist' in 2017. The measurement of this skill is just focused on six aspect, such as clarity of message, giving response or feedback, questioning and answering, arranging non verbal and voice, introduction, and emphasis. This skill is measured quantitatively through peer assessment. The instrument used has been elaborated in order to fit the need of research.

1.6 Research Benefits

This research is not only aimed to explore the effect of gender composition in grouping, but also it is actually expected to give some significances for:

1. Teachers

Teacher will gain a new sight of STEM-Based Learning, which could inspire them to the way of improving the quality of learning process in the classroom. STEM-Based Learning is expected to greet teachers a new way of meaningful influential science learning by pursuing students to another experience of gaining new knowledge independently.

2. Students

Students exactly gain a new experience learning process which is different to what they usually do in science class. STEM-Based Approach will contribute to the increment of their abilities of critical thinking, creativity, collaboration, and communication. Through this approach, the students will be pursued to have more independency in gaining new knowledge in school.

3. Other researchers

Result of this research hopefully can be used as the reference to develop another study regarding to STEM-Based Approach especially in Indonesia, which is still developing this to be applied in its education system.

1.7 Thesis Organization

Overall, this thesis consists of five chapters and several appendices. Each chapter consists of sub-chapters. The systematic of this thesis is as follows:

1. Chapter I: Introduction

This chapter outlines the background, research problem, research questions, research objectives, limitation of problem, research benefit, and thesis organization. All discussion is based on the research problem and questions stated in this chapter.

2. Chapter II: Literature Review

This chapter describes all the detail information regarding STEM-based learning, 2Cs (collaboration and communication skill), gender composition in grouping, and other things correlated to the science issue under the study.

3. Chapter III: Research Methodology

This chapter describes about methodology used during the research. It consists of research method and design, population and sample of research, assumption, hypothesis, operational definition, research instruments, instrument analysis result, data processing and analyzing technique, and research procedure.

4. Chapter IV: Result and Discussion

This chapter concern with the data gathered in this research. The author analyzes and interpreted it based on the needs of answering research questions determined in chapter one. The data are presented in the form of tables and figures.

5. Chapter V: Conclusion, Implication, and Recommendation

This chapter explains the conclusion, implication, and recommendation of the researchbased on the research result and analysis.