CHAPTER 1
INTRODUCTION

1.1. Background

The National Education which based on Pancasila and the 1945 Constitution of the Republic of Indonesia was explained in Law Number 20 year 2003 about National Education System. The National Education functions is to develop the capability, character, and civilization of the nation for enhancing its intellectual capacity, and *is* aimed at developing learners' potentials so that they become persons imbued with human values who are faithful and pious to one and only God; who process morals and noble character; who are healthy, knowledgeable, competent, creative, independent; and as citizens, are democratic and responsible (Seameo, 2015).

Education gives knowledge, good thinking patterns, and a more systematic framework. Education need logical thinking to connect the abstract part in the mind to applied in solving problem of reality life. To construct this logical thinking, it needs mathematics.

Mathematics subject is one of the principal subjects taught begin during elementary school until to the university. Mathematics subject is also one of the subjects tested in the national examination both at the elementary school, junior high schools, as well as in senior high school.

Mathematics is a foundation and framework of the development of science and technology. In everyday life we use and need mathematical concepts and principles, as a tool in applications other disciplines as well as in the development of mathematics itself. Seeing the importance of the role of mathematics in everyday life, mastery of the subject areas of mathematics is a must.

Mathematics is one of the most important subjects that provide several vital skills to the learners. The characteristics of math abilities also as principle and process standards in mathematics that will be developed in the National Council of Teachers of Mathematics (NCTM, 2000) are problem solving, reasoning, communication, connection, and representation. The five of characteristics are the goal to be achieved in mathematics learning. So

mathematics is a learning that has final result more than a score in the final report, but Cockroft (1982) said that ―Mathematics can improve the ability of logical thinking, accuracy, and spatial awareness, also gives effort the ability to solve challenging problems".

Hudojo (2005: 64) said in his book that ―*hakekat matematika berkenaan dengan ide-ide, struktur-struktur dan hubungan-hubungannya yang diatur menurut urutan yang logis. Jadi matematika berkenaan dengan konsep-konsep abstrak".* So it can be conclude that mathematics is a lesson that can improve the way to think in life.

―A representation is a configuration that can *represent* something else in some manner" (Goldin, 2002: 208).

> People develop representations in order to interpret and remember their experiences in an effort to understand the world. Bruner (1966) found three distinct ways in which people represent the world: (a) through action, (b) through visual images, and (c) through words and language. He called these kinds of representations enactive, iconic, and symbolic, respectively. Most researchers agree that these three types of representations are important in human understanding. (Salkind, 2007: 3)

Based on the explanation above, can be concluded that representation is a term to make connection between abstract idea with logical thinking to understanding mathematics, it needs representation.

Goldin and Shteingold (2001) wrote of two *systems* of representation. ―External systems of representation include conventional representations that are usually symbolic in nature. Internal systems of representation are created within a person's mind and used to assign mathematical meaning". Our numeration system, mathematical equations, algebraic expressions, graphs, geometric figures, and number lines are examples of external representations. These representations have been developed over time and are widely used. External representations also include written and spoken language. Examples of internal representations include personal notation systems, natural language, visual imagery, and problem solving strategies. Low ability of representation showing a lack of skilled students in generating ideas, ask questions and respond to questions or opinions of others.

Based on explanation above, can be concluded that representation is one of the important thing in understanding mathematics. Mathematics can be understood if the students have good representation. So they able to describe, interpret, express, symbolize or even modeling ideas, mathematical concepts and the coherence among them and contained in a configuration, construction or certain situations that appear in various forms in order to obtain clarity of meaning, show understanding or looking for a solution of the problems.

In fact, our students in Indonesia has low quality in understanding mathematics. It shows from the result of the survey of Program for International Study Assessment (PISA) in 2012 showed that from 65 survey countries for mathematics, reading and science skills, Indonesia was in 64th level with the mean score of mathematics skill was 375 while the average of OECD (Organization for Economic Co-Operation and Development) was 494 (http://www.theguardian.com/news/datablog/2013/dec/03/pisa-results-country-best-reading-maths-science accessed on 7th of April, 2015).

Based on the observation of researcher did on January, 25th 2015 by doing interview to the vice principle and giving questions and questionnaire to the students, this problem also happened in SMA Negeri 1 Percut Sei Tuan. there are many students who failed the examinations. Their grade is lower than KKM that required by the school, it is about 65%, while the KKM in this school is 2.88 in scale of 4,00 or 72 in scale of 100. By giving the questions about statistics to the 37 students of grade X at SMA Negeri 1 Percut Sei Tuan as follows:

1. The scores of 35 students on a mathematical quiz are as follows:

    75 60 41 77 89 90 65 70 100 55 60 76 80 60 75 90 55 90 100 95 91 50 60 75 80 100 90 55 85 89 70 75 70 100 60

    a. Prepare a frequency table for the grouped data.

    b. How many students passed the science quiz if the standard score > 70?

    c. Determine the value of mean

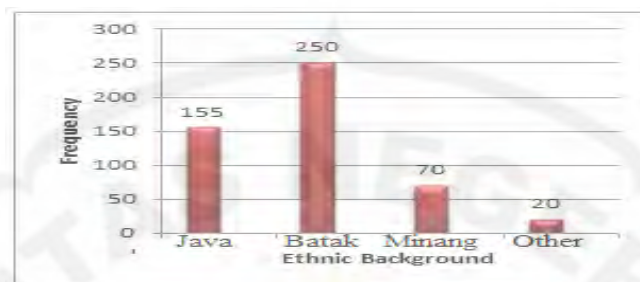2. Bar chart for the number of students based on their ethnic background in School A

Figure 1.1 The Question of Observation Question no.2

Describe in brief, the overall pattern the number of students based on their ethnic background ?
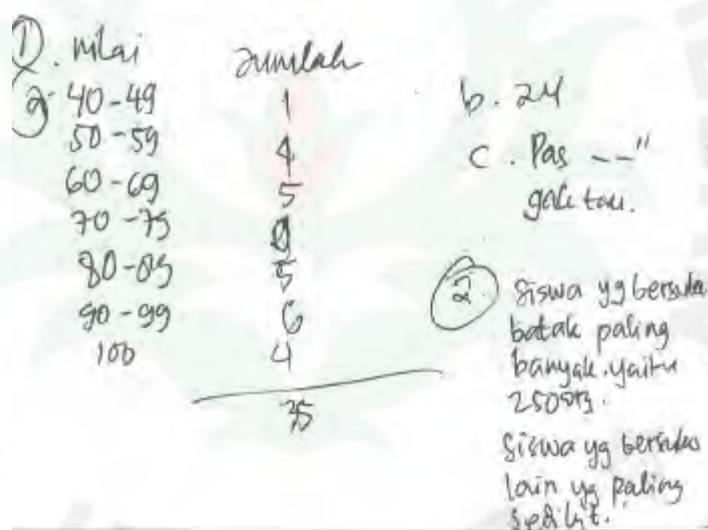

Figure 1.2 The Student's Answer of Observation Question

From 37 students who answer the question, can be seen that 66.67% of them have not been able yet to build their visual representations in making table exactly, while 70.27% of students also have not been able yet to build their mathematical representations ability in equation or mathematical expression aspects especially in making the equation. Mathematical model from initial representation is also given and 65,49% of students have not been able yet to represent their ideas or knowledge in writing the text form.

The mathematical representation ability of students has not satisfied yet according to the observed results. This situation is caused by the lack of their understanding in statistics and the lack of representing something from abstract to concrete.

Based on the observation that did on January 22th, 2015 through questionnaires were distributed randomly to 100 foreign students of SMA Negeri 1 Percut Sei Tuan, only 39% of students learn mathematics more than equal to 3 hours every week outside the school activity, For the example at house or course place. 38% of students learn mathematics less than 3 hours every week, and 33% never learn mathematics outside the school activity.

ANGKET PENDAPAT SISWA

1. Berapa jam waktu yang Anda gunakan dalam 1 minggu untuk belajar Matematika (di luar jam sekolah) dan dimana saja Anda melakukan aktivitas belajar tersebut?
   belajar dirumah sekedar liat PR minimal 10 menit

2. Apakah ada manfaat yang secara langsung bisa Anda rasakan setelah belajar Matematika? Jelaskan.
   ada dong biar tambah pintar

3. Dari skala 1 – 3 (1: mudah, 2: sedang, 3: sulit), berapa skala yang cocok untuk menggambarkan pendapat Anda tentang pelajaran Matematika? Berikan alasannya.
   2 karena kadang ngeribetin /sulit kadang Mudah

Figure 1.3 The Student's Answer of questionnaire

Actually, 86% of students know mathematics is important and they need mathematics in their daily life. But it doesn't enough to motivate them in learning mathematics. Based on observation, 55% students said that mathematics is difficult, 45% said it is not so difficult if they learn it seriously and none said mathematics is easy. 10% of students said it can be happen because they hate mathematics, while 38% of students give explanation that they have difficulty in understanding mathematics. 19% of students the difficulty of mathematics is depend on the matter and 33% explain it because of teacher doesn't explain clearly.

It can be concluded that mathematical representation in SMA Negeri 1 Percut Sei Tuan is still low. There are many factors can lead to low mathematics student learning achievements. Prasad (2008) said:

> There are three dimensions – school environment, teacher-student relations and value orientation among teachers' influence the whole educational process in the classroom situation. School environment is an external factor and teacher-student relation is an internal factor. We know that values among teacher decide and control both the factors.

It means, not only the students it self that can influence the student's ability in understanding mathematics, but also teacher and its environment. Teacher can reduce this problem by giving innovative learning strategies that are considered the development of students' cognitive abilities and independence. One of them is by giving ―learning by doing" in teaching and learning process. Stalheim and Smith (1998) said:

> People have known for hundreds of years that they remember what they see and do. A 2000 year old proverb states: ―I hear and I forget. I see and I remember. I do and I understand." Experience has taught me the wisdom of this proverb. Data given by Stice (1987) also supports this proverb. He indicates that learners remember 10% of what they read, 26% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say and 90% of what they say as they do something.

One model that provides learning by doing is Project based Learning. Project Based Learning is a teaching that is designed for complex problems in which students conduct an investigation to understand, emphasizing long learning activities, assignments given to students multidisciplinary, oriented products (artifacts). According Mahanal (2009) PBL learning in general have guidelines steps: planning, creating and processing.

> In fact, a growing body of research suggests that students learn more deeply and perform better on complex tasks if they have the opportunity to engage in more ―authentic" learning—projects and activities that require them to employ subject knowledge to solve real-world problems. Studies have shown a positive impact on learning when students participate in lessons that require them to construct and organize knowledge, consider alternatives, engage in detailed research, inquiry, writing, and analysis, and to communicate effectively to audiences. (Newmann, 1996)

A project-based learning lesson provides students with the opportunity to learn in an authentic, challenging, multidisciplinary environment, to learn how to design, carry out, and evaluate a project that requires sustained effort over a significant period of time, to learn to work with minimal external guidance, both individually and in groups, to gain in self-reliance and personal accountability. (Özdemir in Bas 2011: 10)

In this study, student will be guided to make project as data processing and will be and these data will be presented in the form of a report in the form of board and packaged as attractive as possible which will then be exhibited in a mini exhibition to be presented to the visitors. This activity is expected to improve the mathematical representation of students through activities that stimulate the representation ability by presentation to the visitors. Giving their opinion about their project orally, in writing in the form of words, symbols, or expressions of mathematical notation, making graph, diagrams, tables or physical objects such as report board.

In this observation, the observer will compare the learning model of project-based learning with problem based learning model. PBL is one of model that make active learning is occurred. Arends (2012: 396) said ―the essence of problem-based learning consists of presenting students with authentic and meaningful problem situations that can serve as springboards for investigations and inquiry".

PBL makes students work with classmates to solve complex and authentic problems that help develop content knowledge as well as problem – solving, reasoning, communication, and self-assessment skills. These problems also help to maintain student interest in course material because students realize that they are learning the skills needed to be successful in the field (White, 2011: 1).

Montague (in Sajadi, Amiripour and Malkhalifeh, 2013: 2) defined mathematical word problem solving as a process involving two stages: problem "representation" and "problem execution". Both of them are necessary for problem solving successfully. Successful problem solving is not possible without first representing the problem appropriately. Appropriate problem representation

indicates that the problem solver has perceived the problem and serves to guide the student toward the solution plan.

Based on the general description above, then the researcher has interested to do research entitled ―**The Difference of Students' Mathematical Representation Ability By Using Project Based Learning And Direct Instructional Learning Model on the Topic of Statistics in Grade X SMA Negeri 1 Percut Sei Tuan**‖.

1.2. Problem Identification

Based on the explanation in the background, the problem identification:

a. Student's mathematical learning in SMA Negeri 1 Percut Sei Tuan outcomes is still low.

b. Mathematical representation ability of students in SMA Negeri 1 Percut Sei Tuan is still low.

c. Students of in SMA Negeri 1 Percut Sei Tuan still have difficulties in solving mathematical represetation tests.

d. Teacher learning model used is still less variation and the learning process is still conventional.

1.3. Problem limitation

For more directing this research so focused and specific to the problem in this study in limited to the students' mathematical representation ability on the topic of statistics grade X in SMA Negeri 1 Percut Sei Tuan A. Y. 2014/2015 as well as the learning model is applied in the model limit by Project Based Learning and Problem Based Learning.

1.4. Problem Formulation

Based on the above problem limitation, then the problem formulation in this research: is there any difference students' mathematical representation ability taught by Project Based Learning with Problem Based Learning on the topic of statistics in grade X SMA Negeri 1 Percut Sei Tuan A. Y. 2014/2015?

1.5. Research Objective

The purpose of this research: to know any difference students' mathematical representation ability taught by Project Based Learning with Problem Based Learning on the topic of statistics in grade X SMA Negeri 1 Percut Sei Tuan A. Y. 2014/2015?

1.6. Research Benefits

The benefits of this research are:

1. Being incoming material for researchers as mathematics teacher candidates to apply Project Based Learning as mathematics' alternative learning model in school.
2. For teachers and prospective teachers, this study could be a reference in planning learning of statistics subject.
3. For students, is expected to use Project Based Learning and can be used to improve the students' mathematical representation ability.
4. For school, is expected to be a source of information or contribute ideas for improvement of mathematics teaching, especially in school where the researcher conducted and the school in general.

1.7. Operational Definitions

In order to avoid the differences of clarity meaning about important terms contained in this research, the operational definitions will be noted as following :

1. Mathematical representation ability is students' ability to express mathematical ideas (problem, statement, definition, and so on) into form: (1) Picture, diagram, graph, or table; (2) Mathematical notation, numerical/algebra symbol; (3) Written texts/words the interpretation of their mind.
2. Project Based Learning is Project based learning is a model that organizes learning around projects.

3. Projects are complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations.

4. PBL is one of model that make active learning is occurred. Arends (2010) said that PBL is a student centered approach that organizes curriculum and instruction around carefully crafted ―ill-structured‖ and real-world problems situations. Learning is active rather than passive, integrated rather than fragmented, and connected rather than disjointed.