CHAPTER 1
INTRODUCTION

1.1 Background

Mathematics is a universal science which very important in the aspects of technological progress and multidisciplinary. In Indonesia mathematics is regarded as one of disciplines which very important and has the most influence on the other multidisciplinary. The mathematics used as a compulsory subject and has been given early in the world of education in Indonesia. This is confirmed by Undang-Undang RI No. 20 Th. 2003 Tentang Sisdiknas (Sistem Pendidikan Nasional) Pasal 37 stated: "Mata pelajaran Matematika merupakan salah satu mata pelajaran wajib bagi siswa pada jenjang pendidikan dasar dan menengah."

From the explanation above it is said that learning and knowing about the mathematics is very important. Mathematics it's not only related with other multidisciplinary but also the development of modern technology and the power of human thought. So that it's very needed in dimensions of knowledge and skills which is supporting in learning mathematics deeply. One of dimension aspect of knowledge and skills that interesting to be studied more deeply, especially in learning mathematics is metacognition.

The importances of metacognition in learning mathematics supported by the statement of two mathematician expert in education who is well known from USA, Garofalo and Lester (Safitri, 2015 : 470): "There is also growing support for the view that purely cognitive analyses of mathematical performance are inadequate because they overlook metacognitive action." Furthermore Livingston (1997) also stated: "Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature."

From Brown (Hacker, 2009 : 7) that view the concept of metacognition as having four historical roots, each of which has provided foundation for approaches to strategies instruction, which we will take up in the next section. The first root is the issue of verbal reports as data—how reliable are people's reports of their thinking processes? What we can express about what we know, or how does what we can express relate to what we know? The second root is the notion of executive control, which is derived from information processing models. These models feature a central processor that can control its own operations, which include planning, evaluating, monitoring, and revising. The third root is self-regulation, processes by which active learners direct and continuously fine-tune their actions. The fourth root that Brown et al. see underlying metacognition is what they call other regulation, or the transfer of control from other to self. This kind of regulation is based on Vygotsky's theory that all psychological processes begin as social and then transformed through supportive experience to the intrapersonal, number of metacognition components that Brown et al. discuss within the four roots have relevance for reading. Actions such as self-regulating, planning, evaluating, and monitoring align well with what researchers have come to see as the processes in which readers need to engage in order to achieve successful comprehension. As Baker and Brown (Hacker, 2009 : 7) put it: "Since effective readers must have some awareness and control of the cognitive activities they engage in as they read, most characterizations of reading include skills and activities that involve metacognition".

And the Mevarech & Kramarski (1997 : 2) called IMPROVE, emphasizes the importance of providing each student with the opportunity to construct mathematical meaning by involving themselves in metacognitive discourse. The IMPROVE method is based on self-questioning via the use of metacognitive questions that focus on: (a) comprehending the problem (e.g.,"What is the problem all about"?); (b) constructing connections between previous and new knowledge (e.g., "What are the similarities/differences between the problem at hand and the problems you have solved in the past? and why?"; (c) using appropriate problem solving strategies (e.g., "What are the

strategies/tactics/principles appropriate for solving the problem and why?"; and in some studies, (d) reflecting on the processes and the solution (e.g., "What did I do wrong here?"; "Does the solution make sense?").

From the two expert it can be seen the importances of metacognitive and it's component. There are relation of thinking process and question in our mind to contruct the answer of problem. And other expert Keiichi (Mulbar, 2008 : 3) in his research on Metacognition in Mathematics Education produced some findings, namely:

> a). Metacognition plays an important role in resolving the conflict; b). Students are more skilled at solving problems if they have knowledge of metacognition; c). In the framework of solving problems, teachers often emphasize specific strategies to solve problems and lack of attention to important features activities solve other problems; d). The teacher expresses some achievement more impressive at the intermediate level in the elementary school where these things important in mathematical reasoning and problem posing strategies.

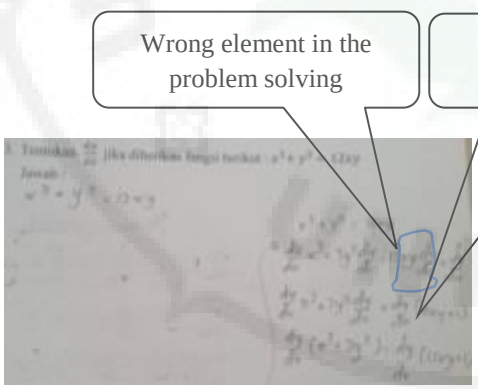
From the observations of researchers when conducted PFE (Practice Field Experience), researchers observed that the students' metacognition ability is still low. It is characterized by the existencies of students' who can not and difficult to explain the results of their work in front of the class and still confused with the question given by his friends. Another problem was found in research there are still many students who pay attention well, but when the test the students can not get maximum results. So the researchers concluded that the ability of learner metacognitive need to be further investigated. From some of the reviews mentioned the importance of metacognition in mathematics and problems in mathematics, it's necessary important to know the extent of stdents' metacognitive in solving mathematical problems.

Researchers choose undergraduated students as research subjects in importances of metacognition due to Baker statement cited from Dale (Safitri, 2015 : 471) : "Supervisory of activity more often used by the older children and adults compared with young children. However, older children and adults do not always monitor their understanding and often misjudged as to how well they understand the text." Reseacher choose the Calculus subject as a test observation

because Calculus is a compulsory subject for students' mathematics in the second semester and as general courses for several other major. Calculus II was selected because it is related to other subjects and is the foundation for further understanding of subjects, such as Differential Equations, Real Analysis, Algebra, also for the other subjects that are application. So it's important to see students in understanding and solving mathematical problems in Calculus II.

In the initial observations which was held on February, 2nd 2016, with correspondents Students of mathematics education regular class C in 2015 amounted to 40 people. There were many students who still difficulty to understand the mathematical problems, so that influent their mathematical problem solving ability. Also found from the initial observation that the ability of students mathematics regular class C 2015 , there was no oversight of thinking activities and monitoring the mathematical problem understanding.

Here is an overview the results of initial observations:



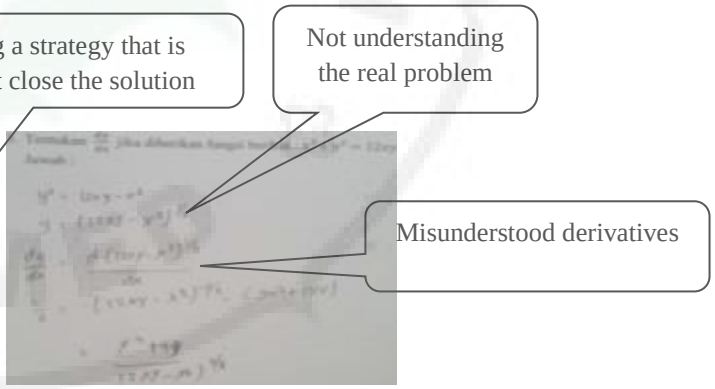


Figure 1.1 The Student I **Figure 1.2 The Student 2**

Figure 1.1 and 1.2 are Answer of Student in Initial Test no.3

From four questions provided by the material derivatives in Calculus I is still a lot of students who didn't understand and difficulty to solving the problems. Result of the initial observation test using problem solving rubric percentage yield obtained are:

1. The number of students who were in the top group, or high characteristic is 11 people
2. The number of students who were in the group of moderate or medium characteristic is 12 people
3. The number of students who were in the bottom group or low characteristic is 19 people

This percentage is 47,5% of students who are in the lower group shows the lack of students' ability to solve the problems and the lack of awareness of thinking, the lack above oversight of thinking activities and monitoring.Based on the results, the researchers are interested in knowing metacognitive level students and its characteristics in solving problems Calculus II.

1.2 Problem Identification

1. The mathematical problem solving ability is still low.
2. Not aware of the mistake that made in mathematical problem solving.
3. Students are not aware of their advantages and disadvantages in solving mathematical problems.
4. The use of students' thinking activity is still low in mathematical problem solving.
5. Students are not aware of what knowledge that can be used in mathematical problem solving.
6. Learning Process which not support for the using of metacognitive knowledge in mathematical problem solving
7. The metacognition in mathematical problem solving is still low

1.3 Problem limitation

Based on the identification problems above, there is a wide scope of issues, so this research is limited to know the following:

1. Grouping students based on characteristics of high, medium and low in mathematical problem solving at second semester State University of Medan.

2. The use of metacognition to know the mathematical problem solving
3. The components of metacognition to identify the level of student metacognition.

1.4 Problem Formulation

The problems formulation of this research are:

1. How is the students' characteristics in mathematical problem solving?
2. How is the level of student metacognition in mathematical problem solving?
3. How students' scaffolding question metacognitive if given mathematical problem solving at second semester at State University of Medan ?

1.5 Research Objective

Research objective in this research is to describe Mathematics Students characteristics and level of metacognition in mathematical problem solving and to know students' scaffolding question metacognitive in answer the question of problem solving at second semester State University of Medan.

1.6 Research Benefits

1. For the lecturer, to identify the difficulties of the students' mathematical problem solving and to know how the metacognitive level of students in problem solving and to improve the student learning outcomes using metacognition approach.
2. For students to know the thinkingt process in solving the problem, so that improve the students' mathematical problem solving ability.
3. For researchers, as reference to develop of the theory of metacognition.

1.7 Operational Definitions

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

1. Metacognition is the word that is related to what the learners known about him as individual and how he controls also consciousnees of awareness , consideration and controling or monitoring toward the strategy as well as cognitive processes themselves.
2. Problem solving is how to find alternative solutions to a problem as learners.
3. Level metacognitive is describing the metacognition to know learners steps in answered.