CHAPTER I
INTRODUCTION

1.1 Background of Study

Mathematics has a role as symbolic language may appear communication correctly and accurately. It is not only as a thinking aid tool but also as a communication tool to peers, teachers and others. Furthermore, mathematics is an aid tool which can clarify and simplify a condition or situation which is abstract to concrete through language, mathematical idea and generalization to simplify problem solving (Ansari, 2012: 1).

As Qohar (2011: 1) said “mathematics is the language of symbol so that everyone who studied mathematics required having the ability to communicate using the language of these symbol”.

An essential aspect of mathematical education is providing sufficient opportunities for students to communicate. According to Ministry of Education (MOE) in Singapore (in Kaur, 2012: 142), “Communication refers to the ability to use the mathematical language to express mathematical ideas and arguments precisely, concisely, and logically”. In addition, The National Council of Teachers of Mathematics (NCTM) (in Kadir, 2013: 77) stated "Communication is an essential part of mathematics and mathematics education". In fact, communication is one of the five process standards emphasized by NCTM.

Mathematical communication is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment. When students are challenged to communicate the results of their thinking to others orally or in writing, they learn to be clear, convincing, and precise in their use of mathematical language (NCTM, 2000: 4).

Therefore, mathematical communication takes a significant role in mathematics education. As argued by Lindquist and Elliot (in Lim and Chew, 2007: 1), "We all need to communicate mathematically opportunities for all, and an informed electorate".

The purposes of learning mathematics are mentioned in *Badan Standar Nasional Pendidikan* (BSNP, 2006: 146) that though mathematics expected the student has ability: "(1) memahami konsep matematika, menjelaskan keterkaitan antarkonsep dan mengaplikasikan konsep atau algoritma, secara luwes, akurat, efisien, dan tepat, dalam pemecahan masalah, (2) menggunakan penalaran pada pola dan sifat, melakukan manipulasi matematika dalam membuat generalisasi, menyusun bukti atau menjelaskan gagasan dan pernyataan matematika, (3) memecahkan masalah yang meliputi kemampuan memahami masalah, merancang model matematika, menyeesaikan model dan menafsirkan solusi yang diperoleh, (4) mengkomunikasikan gagasan dengan simbol, tabel, digram, atau media lain untuk memperjelas keadaan atau masalah, (5) memiliki sikap menghargai kegunaan matematika dalam kehidupan, yaitu memiliki rasa ingin tahu, perhatian, dan minat dalam mempelajari matematika, serta sikap ulet dan percaya diri dalam pemecahan masalah".

Baroody (in Tandililing, 2011: 917) described that at least there are two main reasons for focusing on mathematical communication. *First*, mathematics is essentially a language by itself. It means mathematics is not only a tool aiding students to find patterns, solving problems and drawing conclusions, but also a tool communicating a variety of ideas clearly, precisely and succinctly.

Second, mathematics teaching and learning are social activities that involve at least two parties, teachers and pupils. It means that as social activities in mathematics learning, also as means of interaction among students, and also communication between teacher and students. It is an essential that thought and ideas are communicated to others by using language.

The activities classified as indicators of mathematical communication and focused in this study, namely (Ansari, 2012: 11):

1. Stating mathematical problem in writing into figure
2. Explaining mathematical problem by own words.
3. Stating mathematical problem in writing into mathematical model and solving it.

In fact, the mathematical communication of Indonesian students is still low. It stated by Suryadi (in Marlina, et al, 2014: 85) that the mathematical communication ability of Indonesian students is considerably more than the other countries, an illustration of this is mathematical problem in respect to mathematical communication ability; Indonesian students answering the correct solution accounting for around 5 % compared to 50 % more in Singapore, Korea, and Taiwan.

Similar with Suryadi, Survey done by Trends in International Mathematics and Science Study (TIMSS) adduced that mathematics learning Indonesia is more emphasized on basic skill assignments, it is slightly focused attention on mathematical application on daily activities, mathematical communication, and mathematical reasoning. Furthermore, the research of *Tim Pusat Pengembangan Penataran Guru Matematika* also declared that on some different districts of Indonesia, almost of students has difficulties in solving solutions, expressing solutions about daily activities to mathematical model (Agustyaningrum, 2011: 377). It shows that the mathematical communication ability of Indonesian students is still low.

The above statements are also supported by researcher's preliminary study of students in grade VII at SMP Negeri 3 Kisaran. In this observation, students are given some problems indicating the mathematical communication ability.

At the first sight, students are given a question indicating the ability of stating mathematical problem in writing into figure. For example of the first problem: State

the fractional $1\frac{1}{4}$ in figure. In this case students are expected can draw a fractional figure (see Figure 1.1).

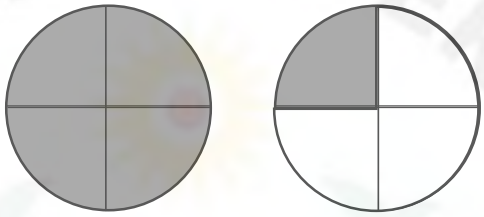


Figure 1.1. Expected answer for The First Problems

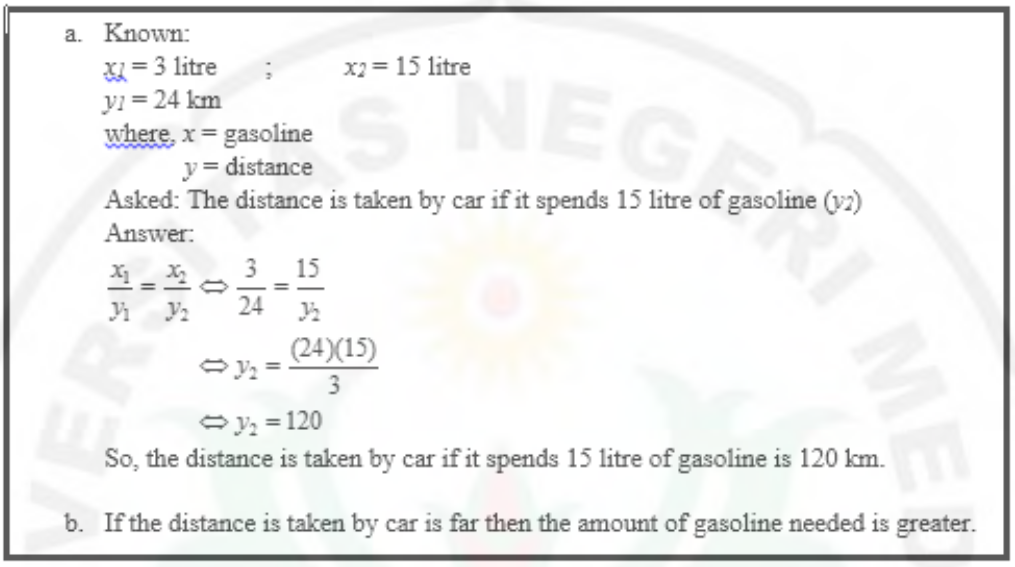
But, in reality the following figure 1.2 shows that the students' ability in stating mathematical problem into figure is low. They do not yet understand how to represent the fractional form in figure.

Figure 1.2. Student's answer sheet for The First Problem

Another indicator is explaining mathematical problem by own words. Provided several questions to indicate the third indicator. An example of this: A car need 3 litre of gasoline to cover a distance of 24 km.

a. How much the distance is taken by car if it spends 15 litre of gasoline ?
b. Explain the relationship between the distance is taken by car and the amount of gasoline is needed.

In these illustrations, students are expected can make and explain the mathematical model completely (see Figure 1.3).



a. Known:
$x_1 = 3$ litre ; $x_2 = 15$ litre
$y_1 = 24$ km
where, x = gasoline
y = distance
Asked: The distance is taken by car if it spends 15 litre of gasoline (y_2)
Answer:

$$\frac{x_1}{y_1} = \frac{x_2}{y_2} \Leftrightarrow \frac{3}{24} = \frac{15}{y_2}$$

$$\Leftrightarrow y_2 = \frac{(24)(15)}{3}$$

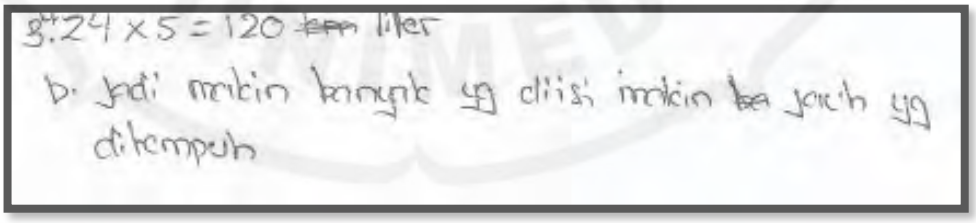
$$\Leftrightarrow y_2 = 120$$

So, the distance is taken by car if it spends 15 litre of gasoline is 120 km.

b. If the distance is taken by car is far then the amount of gasoline needed is greater.

Figure 1.3. Expected answer for The Second Problems

In contrast, based on the 1.4 figure, it indicates that students do not yet communicate problem exactly. They are not able to make and explain mathematical model based on the problem given. It shows that the students' ability in explaining mathematical problem by own words is still low.



g. 24 x 5 = 120 ~~km~~ liter
b. jadi makin banyak yg diisi makin bea yang yg dikempuh

Figure 1.4. Student's answer sheet for The Third Problems

The final indicator is students are able to state mathematical problem in writing into mathematical model and solving it. Given some problems indicating the second indicator. For instances are; Write down every sentence below in mathematical model by using variable x and y.

a. If a number is multiplied by 3, then added by 2 and next subtracted by 3, and finally obtains number 5.

b. Two times of Anwar's age and then added by Surya's age is 21 years old. The difference in age between their age if added by 2 is 6 years old
c. The perimeter of rectangle is 60 m in which its width is 4 m shorter than the length.

In these problems students are expected can make mathematical model of the questions above by stating every problem in variable x and y (see Figure 1.5).

a. $3x + 2 - 3 = 5$
b. Suppose,
   Anwar's age = x
   Surya's age = y
   Then,
   $2x + y = 21$
   $x - y + 2 = 6$
c. Suppose,
   x = length
   y = width
   Then,
   $2x + 2y = 60$
   $y = 4 + x$

Figure 1.5. Expected answer for The Second Problems

In fact, from the below figure 1.6 can be seen that students cannot make the mathematical model of questions which are given. They do not yet understand how to state variable given in mathematical model. It means the students' ability in stating problem into mathematical model is considerably low.

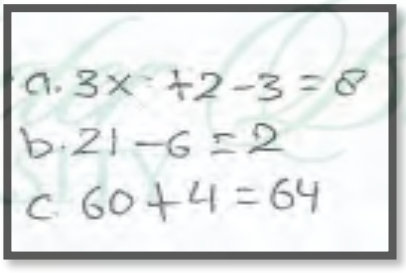


Figure 1.6. Student's answer sheet for The Second Problems

From the preliminary study, it is concluded that the students' ability in mathematical communication is still less. It can be happened because the lack of students' comprehension about fraction, algebra and ratio as well as their communication skill is less for the reason that the learning activities do not give a chance for them to be more active and participate during learning process. Consequently, they cannot construct their abstract insight to real form, an example is mathematical model.

One of the failure of pupils in learning depends on the use of methods or how teacher teaches. According to Abdurrahman (Marlina, et al, 2014: 86) said that one of factor causing low or lack of student comprehension about mathematical concept is learning method applied by teachers, an example of this is the learning process oriented on conventional approach settling pupils as a listener on learning process.

Similar with Marlina, Baroody (in Umar, 2012: 3) stated that on mathematics learning with conventional approach, students' communication is still limited only on short verbal answer toward questions asked by teacher. Moreover, according Cai (in Umar, 2012: 3) 'it is so rare for students to provide explanation in mathematics class, so strange to talk about mathematics, and so surprising to justify answer'.

In old paradigm, teachers are more dominant and only be transferring knowledge to students, while the students quietly and passively accept the transfer knowledge from the teacher. Instructional process taking place in class makes students being passive.

But in new paradigm of learning mathematics, teachers are leaders of community learning in the classroom, teachers guide students to actively communicate in the classroom. The role of teachers is not as a transferring of knowledge, but as a stimulation of learning in order to construct their own knowledge through some activities such as problem solving, reasoning, and communicating. Teachers assist students to understand ideas of mathematics, and set right the students' understanding if one is incorrect.

Mathematical communication skills of Indonesian students especially in junior high school are still considered low due to the using of instructional model is still less efficient in which learning activities are more focused on teacher.

Sabandar (in Komariyatiningsih, et al, 2013: 294) said mathematical communication skills cannot be appeared by itself, but needs to be drilled in the learning activities. Communication provides a forum for students to negotiate meaning and then reflect it on their solution strategies. Consequently, to enhance the mathematical communication skill required a class-room environment designed in a small-groups setting.

Brenner (in Qohar, 2011: 6) found that the formation of small groups facilitate the development of mathematical communication skills. Given the small groups, then the intensity of students in expressing their opinions will be higher. It will provide a great opportunity for students to develop mathematical communication skills.

According to Slavin (In Retno, et al, 2012: 458), cooperative learning is one kind of student-centered learning approach, has been documented throughout the literature as effective in helping students obtain practical learning skills, abilities for effective communication and proficiency in term of understanding knowledge, and it promotes positive student attitudes towards their own learning.

Based on the above definition, cooperative learning model is not same with common study groups. There are some basic unsure in cooperative learning making different with common study groups, they are; interdependence, responsibility, face to face, communication to peers, and evaluation the group process. For instance, types of cooperative learning model are Think-Pair-Share (TPS) and Numbered-Heads-Together (NHT) can give students much time to think, to respond, and to help each other.

Think-Pair-Share is a simple classic cooperative-learning strategy developed by Frank Lyman (1987). It involves all students and is quick and easy to implement in any class (Ulrich and Glendon, 2005: 39). Thinking: The teacher poses a question associated with the lesson and ask students thinking alone about the answer. Pairing:

Next, the teacher asks students to pair off and discuss what they have been thinking about. Sharing: in the final step, the teacher asks the pairs to share what they have been talking about with the whole class. It is effective to simply go around the from pair to pair and continue until about a fourth or a half of the pairs have had a chance to report (Arends, 2011: 370 - 371)..

Thus, Think-Pair-Share can aid students in communicating mathematically to share any information such as; expressing ideas, proposing questions, and giving respond about other people's answer.

Numbered-Heads-Together is one of the traditional whole class question-answer structure having goal to check for understanding, review, and create some active involvement (Brody and Davidson, 1998: 116). Teachers divide students into three to five member teams and have them number off so each student on the team has a number between 1 and 5. Teachers ask students a question. After that, students put their heads together to figure out and make sure everyone knows the answer. Finally, the teachers calls a number and students from each group with that number raise their hands and provide answer to the whole class (Arends, 2011: 371).

Accordingly, Numbered-Heads-Together gives opportunity for each student to reflect the subject material understanding studied through communicating. By explaining the subject material studied to fellow students, the ability of understanding and mathematical communication in NHT learning will be increasingly felt.

Based on the above background, the researcher intends to conduct a research entitled: "**The Difference of Student's Mathematical Communication Ability Taught by Cooperative Learning Think-Pair-Share and Numbered-Heads-Together Types at SMP Negeri 3 Kisaran**".

1.2 Problem Identification

Based on analysing the background, problem identification in this research are:

1. Student's mathematical communication ability is still low.
2. The involvement of students in the learning process is very less.
3. The teachers are more dominant than students in the learning process
4. The less of variation in the learning model which teachers do in the learning process.
5. The cooperative learning is rare to be applied in the learning process

1.3 Problem Formulation

Based on the background above, the writer formulates the problems of the study as follows:

Is student's mathematical communication ability taught by cooperative learning Think-Pair-Share type better than student's mathematical communication ability taught by cooperative learning Numbered-Heads-Together type?

1.4 Problem Limitation

This research needs to restrict to get targets as expected. The limitation of this research are:

1. The model used are cooperative learning model Think-Pair-Share and Numbered-Head-Together types.
2. The student's mathematical communication ability in this research is restricted in student's mathematical communication ability at Quadrilateral (especially Rectangle and Square) subject in grade VII semester II
3. This research is conducted at SMP Negeri 3 Kisaran.

1.5 Objective of Research

To know whether students' mathematical communication ability taught by cooperative learning Think-Pair-Share type is better than cooperative learning Numbered-Heads-Together type.

1.6 Benefit of Research

The expected benefits of this research are:

1. For teachers, especially for mathematics teachers, it can be used as consideration in selecting one of alternative mathematics learning model in learning activities at school.
2. For prospective teachers, it can be used as proper consideration for handle problem which often appears at school in order to be the next professional teacher.
3. For students, it can make students having enthusiasm to improve mathematical communication ability.
4. For the researcher, it can be used to enhance his knowledge and insight about problem occurred at school.
5. For the school, it can be used as consideration and suggestion to improve the quality of teachers and learning system at class.

1.7 Operational Definition

To avoid differences or lack of meaning clarity, the following operational definition are important terms in this research:

1. Mathematical communication refers to the ability to use the mathematical language to express mathematical ideas and arguments precisely, concisely, and logically.
2. The indicator of student's mathematical communication ability which will be measured are:
   a. The ability of stating mathematical problem in writing into figure.

b. The ability of explaining mathematical problem by own words, and
c. The ability of stating mathematical problem in writing into mathematical model and solving it.

3. The syntaxes of TPS that follows:
   a. Phase 1: Think

      The teacher poses a question associated with the lesson and ask students thinking alone about the answer
   b. Phase 2: Pair

      Next, the teacher asks students to pair off and discuss what they have been thinking about.
   c. Phase 3: Share

      In the final step, the teacher asks the pairs to share what they have been talking about with the whole class. It is effective to simply go around the from pair to pair and continue until about a fourth or a half of the pairs have had a chance to report
4. The syntaxes of NHT are:
   a. Phase 1: Numbering

      Teachers divide students into three to five member teams and have them number off so each student on the team has a number between 1 and 5.
   b. Phase 2: Questioning

      Teachers ask students a question.
   c. Phase 3: Heads Together

      Students put their heads together to figure out and make sure everyone knows the answer.
   d. Phase 4: Answering

      Teachers calls a number and students from each group with that number raise their hands and provide answer to the whole class.