The Iceberg Approach of Learning Fractions in Junior High School: Teachers' Simulations of Prior to Lesson Study Activities

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The purpose of this paper is to provide teachers with realistic approach for teaching fractions in Junior High School with the schema of Lesson Study. Although it would be wonderful to be able to state that within this limited chance to share ideas and experiences, teachers will find an extensive and comprehensive empirical evidences of teaching practices of fractions. The reflections of teachers prior to Lesson Study activities concluded that: to get the concepts of fractions, the students need mathematical world orientation ; mathematical world orientation is needed to develop material model of the concepts of fractions; the students need to develop relationship among material model. Many more strategies and practices have been invented for fostering more formal notation of fraction. Concrete materials and contextual problems are perceived as more tangible for students to have experiences in developing horizontal aspects of fractions' concepts. The teachers found that horizontal problems have to make sense to the students in order to be able to construct vertical aspect of fractions' concepts. The specific content covered in this paper was selected due to these problems share a common mathematical method.

A. INTRODUCTION

The National Standard of Mathematics Teaching in Indonesia is the minimum competencies that should be performed by the students, covering affective, cognitive and psychomotor competencies. It means that the government encourages the teachers to develop students life skills by employing optimally the environment to support students' activities. Mathematics in Junior High School have its function to encourage the students to think logically, analytically, systematically, critically, creatively and be able to collaborate with others. Those competencies are needed for the students in order that they can get, access and employ information to preserve their live in which it involves the using of symbols, tables, diagrams and other sources in other that the students are able to solve their problems. The students need to develop problem solving skills covering both closed and open problems. In solving the problems, students need to creatively develop many ways and alternatives, to develop mathematical models, and to estimate the results. It was suggested that in teaching learning of primary mathematics, students have the chances to identify mathematical problems contextually and realistically. Contextual and realistic approaches are recommended to be developed by the teachers to encourage mathematical thinking in primary schools. With these approaches, there is a hope that the students step-by-step learn and master mathematics enthusiastically. To make their

teaching learning of primary mathematics more effective, teachers also need to develop resources such as information technology, teaching aids and other media.

The aims of teaching learning of mathematics in Junior High School covers:

1. to understand the concepts of mathematics, to explain the relationships among them and to apply them to solve the problems accurately and efficiently.
2. to develop thinking skills to learn patterns and characteristics of mathematics, to manipulate them in order to generalize, to proof and to explain ideas and mathematics propositions.
3. to develop problems solving skills which covers understanding the problems, outlining mathmatical models, solving them and estimating the outcomes.
4. to communicate mathematics ideas using symbols, tables, diagrams and other media.
5. to develop appreciations of the uses of mathematics in daily lifes, curiosity, consideration, and willingness to learn mathematics as well as tough and self-confidence.

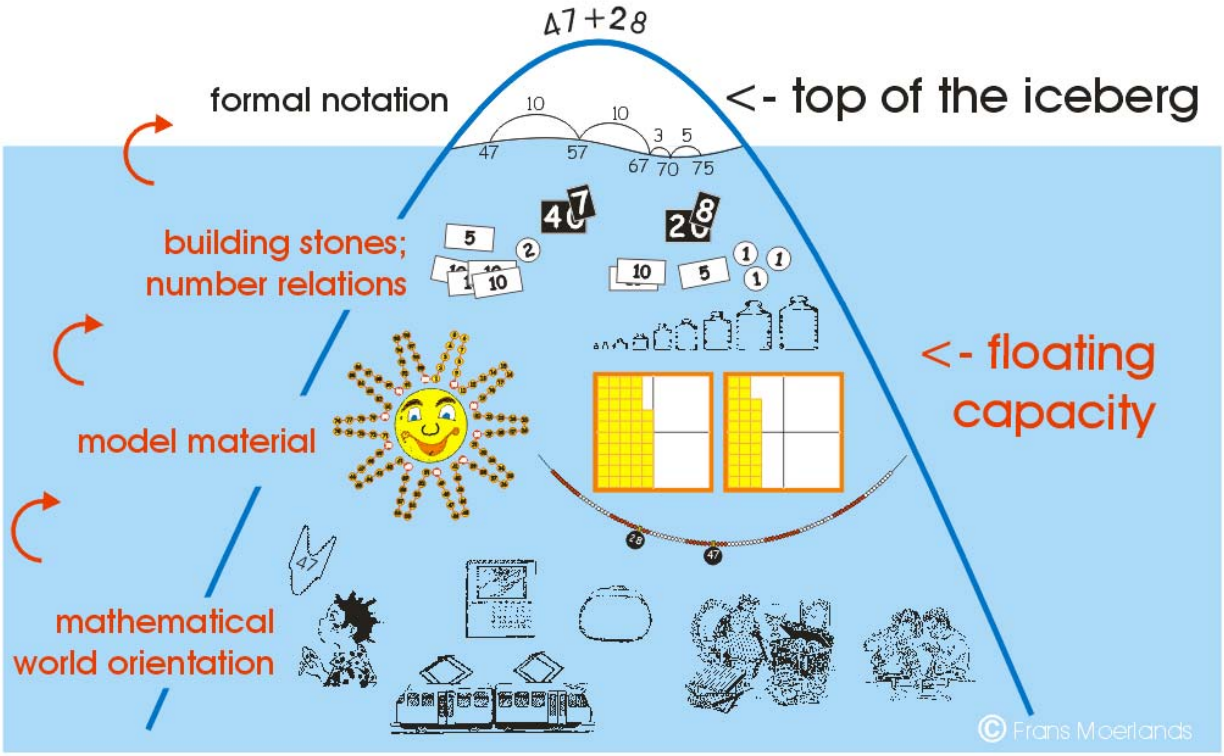
B. THEORETICAL FRAMEWORK

1. Realistic Mathematics

Mathematics must be close to children and be relevant to every day life situations. However, the word ‘realistic’, refers not just to the connection with the real-world, but also refers to problem situations which real in students' mind (Zulkardi, 2006). For the problems to be presented to the students this means that the context can be a real-world but this is not always necessary. De Lange (1996) stated that problem situations can also be seen as applications or modeling. The idea of mathematics as a human activity is stressed. Mathematics education organized as a process of *guided reinvention*, where students can experience a similar process compared to the process by which mathematics was invented. The meaning of invention is steps in learning processes while the meaning of guided is the instructional environment of the learning process. Moreover, the reinvention principle can also be inspired by informal solution procedures. Informal strategies of students can often be interpreted as anticipating more formal procedures.

Two types of mathematization which were formulated explicitly in an educational context by Treffers, 1987, in Zulkardi, 2006, are horizontal and vertical mathematization. In horizontal mathematization, the students come up with mathematical tools which can help to organize and solve a problem located in a real-life situation. The following activities are examples of horizontal mathematization: identifying or describing the specific mathematics in a general context,

schematizing, formulating and visualizing a problem in different ways, discovering relations, discovering regularities, recognizing isomorphic aspect in different problems, transferring a real world problem to a mathematical problem, and transferring a real world problem to a known mathematical problem (Zulkardi, 2006). On the other hand, vertical mathematization is the process of reorganization within the mathematical system itself.



Picture: Iceberg Approach in Realistics Mathematics
(Moerlands, 2004 in Sutarto, 2008)

Above is the Iceberg approach as a starting point of learning sequences give real experiences to students such that they involve immediately in a personal mathematical activities. In order to utilize students' mathematical knowledge, this approach should be employed through potential learning sequence.

2. Teaching Fraction

Emilie A. Naiser , et al. (2009) indicated that in teaching fractions the teacher need to :

1. Ensure that students have mastered the prerequisite skills for the tasks to be learned as part of your advance organizer presentation, demonstrate the “Big Idea” and interconnected relationships between division, fractions, decimals, and percents (e.g., physically divide a whole into five equal pieces)
2. Introduce skill instruction with succinct and unambiguous demonstration of the task to be learned (e.g., solve several problems while the student observes)
3. Introduce instruction using concrete materials (i.e., manipulatives) before proceeding to semi-concrete materials (e.g., pictorial representations) before proceeding to abstract problems (e.g., numerical representation)
4. Ensure that your teaching examples include sufficient practice opportunities to produce task mastery
5. Ensure that your teaching examples include variations of all problem types to avoid students making incorrect generalizations (e.g., that all fractions represent parts of a whole)
6. Provide systematic instruction on discriminating among different problem types that is designed to enable students to know which solution to employ (e.g., teach students to attend to the operation sign, perhaps by circling it, so that they will select the correct computational algorithm)
7. Provide guided practice (following teacher-led demonstrations) before assigning independent work (i.e., have teacher and student work several problems together)

Many students bring a great deal of informal understanding of fractions to their instruction in mathematics; however, it is often difficult for students to integrate formal instruction with their informal knowledge (Mack, 1990 in Emilie A. Naiser , et al.). Additional problems in representation of fractional numbers include lack of understanding that fractions can represent a part of a set as well as a part of a whole unit, and that fractions represent a certain number of equal sized parts. Teachers should also bear in mind that representation of fractions can be a very abstract and difficult task for students that is sometimes beyond the ability of even their teachers (Ball, 1990 in Emilie A. Naiser , et al.)

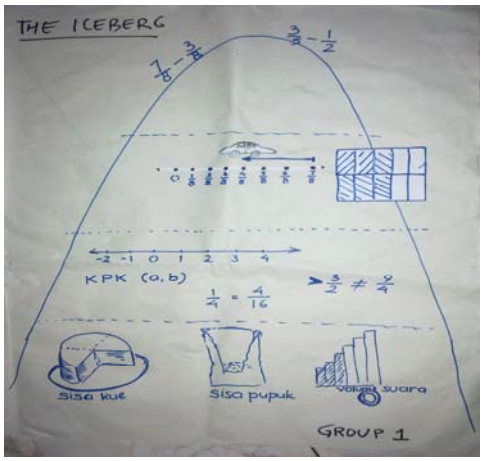
C. POSING THE PROBLEMS AND ITS ICEBERG APPROACH

There are 6 (six) group of teachers developed the Iceberg Model for teaching fraction in Junior High School. Each group consists of five teachers. Followings are their works:

Group 1: Subtraction of Fraction Number

Posed Problem :

Agus has bought Tart Cake. He cut it into eight similar parts. He and his three younger brothers will each take one part of it. And he will save the rest. How many parts of the Cake Agus will save?

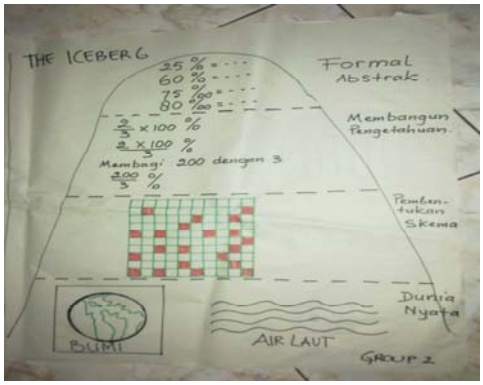


Group 2: Percentage and Permil

Posed Problem:

Two third of the Hemisphere consist of water.

State into the percentage the amount of water?



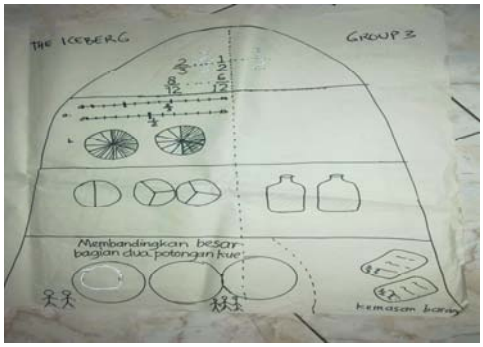
Group 3: Compare the Fractions

Posed Problem:

Compare the following fraction :

2/3 and ½

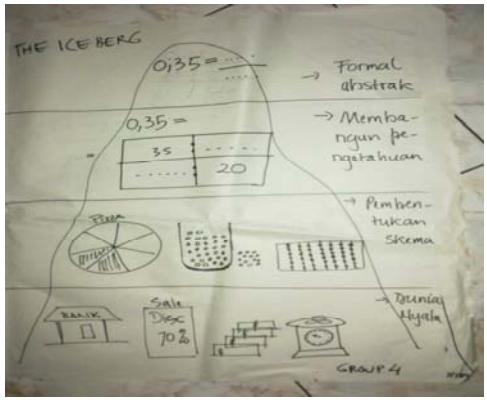
Which is the bigger?



Group 4: Desimal Fraction

Posed Problem:

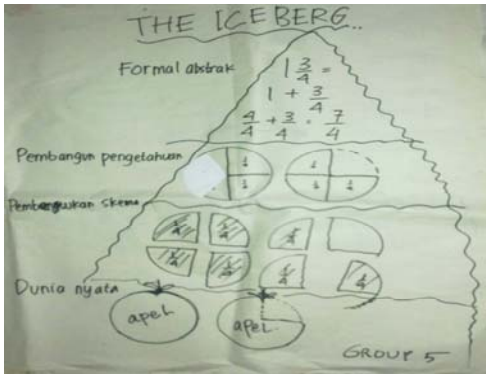
Write 0.35 into the simple form of fraction?



Group 5: Mix Number

Posed Problem:

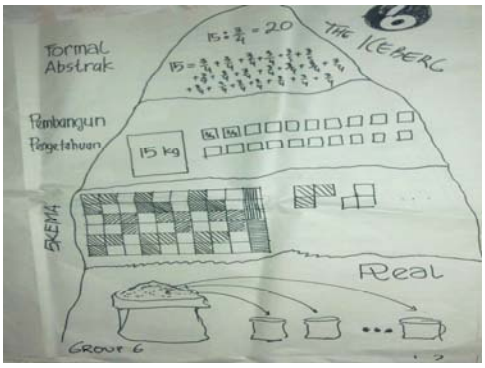
Write the following mix number 1 ¾ as simple fraction?



Group 6: Division of Fraction

Posed Problem:

Fifteen kilogram of rice will be put into some smaller containers size ¾ kg. How many containers does it need?



D. DISCUSSION

Mathematical World Orientation

In the first start, it is not so easy for the teacher to develop and manipulate the concrete material as a mathematical world orientation. It seemed that there are some gaps between teachers' habit in doing formal mathematics and informal mathematics. Some teachers seemed uncertain whether initiating to introduce concrete model to their students or waiting until their students find for themselves. However most of the teachers believed that mathematical world orientation is important step to offer the students a motive and a solution strategy.

Material Model

For the material models, the teacher tried to identify the role of visual representation in setting up the relationship among fraction concepts, its relations and operations. To some extent the teachers need to manipulate the concrete model in such a way that they represent their and the students' knowledge of fractions. However it seemed that it was not automatically that the teachers find the supporting aspects of transition toward sophisticated mathematics. Most of the teacher understood that there were problems of intertwining between informal activities and formal mathematics.

Building Mathematical Relationship

In building mathematical relationship, the teachers perceived that the students need to develop their mathematical attitude as well as mathematical method. It needed for the teacher to facilitate students' questions, students' interactions and students' activities. Uncovering the pattern from material model and trying to connect with mathematical concepts are important aspects. There were possibilities for the students to find out various mathematical methods. To compare some mathematical method lead the students have a clear picture of the problems they faced.

Formal Notation

The teachers perceived that the formal notions of fractions, its relations and operations come up in line with inclination of sharing ideas of fraction concepts through small group discussion. The students will find their interest when they get a clear understanding of formal

notions of fractions. The teachers believed that the ultimate achievement of students is that they feel to have the mathematical concepts they found. More than this, the students will have an important capacity to a more sophisticated solution for mathematical problems.

E. CONCLUSION

Many teachers bring a great deal of informal understanding of fractions to their effort in developing the iceberg model for teaching fractions. In developing the iceberg model of teaching, the teachers expected that there is a tendency that their students will consider fractions not only as a whole number but also a proportion or rational number. Although the iceberg model reinforces the students to construct their own concepts of fractions, there are still difficulties for the students to solve problems expressed symbolically. However, they were able to solve similar problems expressed in the context of real-world situations. Most of the teachers admitted that representation of fractions can be a very abstract and difficult task for students. Meanwhile, they also found that the iceberg model is very important and useful approach to teach fractions in Junior High School.

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