Learning Fraction With The Help Of Fractions Board Using Pmri Approach

Muhamad Saleh[1], Muhammad Isa[2], Murni[3]
{msalehginting@gmail.com}

[1,2] Serambi Mekkah University
[3]Abulyatama University

Abstract: Fractions are a part of mathematics that is provided to students in grade 4 (of elementary school) who are aged 9-11 years old on average and still engaged to concrete thinking. On contrary, mathematics is dominated by abstract material. It is necessary to create ways to represent fractions in concrete form. The purpose of this study was to find out the thinking flow of 4th grade students to understand the concept of fractions using a fractions board. Subjects of the study were 33 students. The result shows that students have been able to make simple discoveries about equivalent fractions and to sum two unlike simple fractions using "fractions board" without finding common denominators on prior.

Keywords: simple fractions, elementary school, fractions board

1 Introduction

Students often have to face problems, either inside or outside school. The problems are involved mathematical calculations or related to social interactions. Dealing with the problems, students are required to possess basic knowledge such as understanding the arguments and concepts of mathematics which served as a bridge for them to find solution. To this extent, a strategy is needed to help 4th grade students and teachers in understanding the concept, in this case are fractions and their operations, in accordance with the stage of intellectual development that is the concrete operation stage. Concepts of fraction can be learnt with the help of concrete objects so students can observe and represent their understanding of fractions using manipulative palpable objects. Basic knowledge about fractions will be more easily internalized by students when starting with understanding the concept and meaning of the fraction symbols. The curriculum 2013 contains subject about fraction as one of the materials studied by grade 4 students of elementary school whose are on average 9-11 years old and in the concrete operation stage of cognitive development [1] Yet, when students are in the guidance of teachers to learning the subject, they always deal with abstract matters. The abstractness of the subject may become obstacles or even difficulties for grade 4 students to understand it. Dealing with the situation, the learning process need to be performed actually, as well involving them mentally, through the use of discrete or continuous palpable objects (referral).

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Based on the results of interviews and preliminary test of mathematical ability conducted on selected 5th grader, it was revealed that the students were considerably weak in understanding some lessons while learning about fractions, especially about Least Common Multiple (LCM) and Greatest Common Divisor (GCD). Similar information was provided by teachers who served 4th grade at the school where the study was conducted. It was corroborated by information from teachers – experience in teaching mathematics since 1999 – that at large students have a low ability to understand mathematics including fractions.

Interviews and tests were also conducted on non-subject 4th grade students. The results conclude that they had not good enough ability to understand material about LCM and GCD. As a matter of fact, understanding the LCM and GCD is the initial ability needed in the learning process to comprehend fraction, for instance, when adding or subtracting unlike fractions it was required to find common denominator before running any of these operations.

Some of the findings that are considered as problems from the initial observations are: underutilized or lack of media that can be used in learning fraction due to it is considered time consuming which will reduce the time span available for teachers to carry out the learning process. Some reports showed that many students find it difficult to understand and solve fractions, and can even be a tormentor in learning. [2] mentioned that fractions are among the most difficult academic skills for studens to learn. A similar statement was made by [3] that was "The topic of fractions can be intimidating and difficult for children, even into the middle grades". Accordingly, [4]wrote "Fractions are often difficult for students to fully comprehend. Teachers must find a variety of strategies to use in the classroom for teaching fractions".

There are four important issues reported by [5] relating to difficulties with fractions, which are cited from various sources, including the difficulties experienced by teachers in carrying out fraction lessons that involving problems either with some conceptual requirements or with many steps (come with examples of the problems):

1. The division of fractions is difficult, not only for junior high school students but also for prospective teachers.
2. Teachers often experience several difficulties, for example, explaining procedures with different representations between fraction divisions and other mathematical theory such as the concepts of division, addition, subtraction, or multiplication of fractions. While students are also difficult in learning concepts such as a perception that smaller numbers cannot be divided by large ones or a division always generate smaller numbers. Illustration: find "how much $\frac{1}{2}$ are there in $\frac{1}{3}$?", Only 52% answered correctly. Many give "no" or "zero" as the answers.

Fractions are important to be understood by students as a proponent in learning other material. Laursen [6] reveals that: *'The inability to perform basic operations on common fractions has led to error patterns that emerge in learning algebra. Problems can arise when students attempt to apply misunderstood shortcuts, learned with fractions, to situations involving algebra'.*

Inability of students to understand fractions misled student in learning algebra. Accordingly, prior to learning algebra, students need to understand the concept of fractions so they are able to follow the process of learning along with the required initial knowledge.

The presence of the difficulties in understanding fractions requires accurate strategy in carrying out the teaching and learning process. Especially because of fraction lesson was the first material that is formally accepted by students in the 4th grade of elementary school or equivalent, even since first day. Students first impression of learning fractions greatly influences the success of the next process. Hence the arrangement of learning fractions needs to conduct with good strategy in order to increase their motivation in learning and understand

the lessons well. The learning process that works well is one that strive/guide the students to find concepts or solve problems based on their initial knowledge or flows of thinking.

The process of learning mathematics that is concerned with contextual problems is the Indonesian Realistic Mathematics Education (RME) or PMRI approach. *RME is viewed to be a potential approach in increasing pupils' understanding in mathematics. Inspired by the philosophy of RME, they developed an approach to improve mathematics learning in Indonesian schools. It is known as PMRI, stand for* Pendidikan Matematika Realistik Indonesia *or Indonesian version of* RME, (PMRI Team, 2010:18).

One of the five characteristics in PMRI is to use context. Using context in the learning process will worked to help students initiating their learning process on certain materials including fractions as it was a new concept for them to learn. The selected context should be adjusted into things that have been experienced or seen frequently by students in their daily lives as to the learning experiences either formally or informally.

Learning with PMRI approach encompasses students' senses through the use of concrete objects and alter gradually to abstract ones. Jitendra et al [7] conducted research on 3rd grade students and found that teaching them with special strategies was more effective in increasing problem solving abilities than with general ones, even though both of these strategies could improve students' numeracy.

The application of the PMRI approach followed through or accommodates the students' flows of thinking under guidance of the teacher. Consquently, prior to begin the learning process, teacher needs to plan and design the strategy that is hypothetically able to reflect the collaboration both between the teacher and students and between students and students in order to stimulate and to activate the flow of thinking of students. Strategies that consider the students' flow of thinking will make them feel learning is more meaningful as well as generate their self-confidence.

2 Methodology

It is difficult to imagine how the process and the results of learning of those without ability to hear as it aimed at knowing the mellifluous of the sound of birds [8] The objectives of *this* learning process will never be completed because the abstract sound of the singing birds was never be sensed by mind. Mathematics is dominated by abstract material. The abstractness needs to be staged, either in a concrete form or can be imagined by students, through contextual problems. The learning process begin with utilizing contextual problems or concrete matters can offer students profound impression since it is in accordance with their stages of cognitive development, which is convert from concrete operations to a more formal or abstract one. Activities of learning assisted by concrete objects can lead to an action and involve students' senses. One initiative to create processes of learning fractions in line with the students' flow of thinking is to use or to apply concrete objects to represent fraction. [9] said: "the abstractness of objects contained in mathematics needs to pursue to materialize concretely to help students to understand it easier. This is the vital key that should be known by mathematics teachers, and is expected to be used as a driver in planning the process more

In relation with students' cognition which is at a concrete level, [1] suggested: "a person believed to master concept at concrete level, if the person is able to recognize an object he has faced before". By involving concrete objects in the learning process, students will become more active both physically (sensory) and mentally.

A quality learning process contributes prominently to students in finding the expected mathematical concepts. For this reason the teachers are expected to act as a coaches and facilitators within the learning process. Teachers are expected to guide students whenever really needed or step-in when deemed necessary along the process. Teachers need the understand the flow of thinking of students such as how they think in planning steps to reveal and to solve a problem. A teacher's understanding of flow of thinking of students can help him to conduct the learning process correctly and suitably. Teachers can assist and direct students' minds so that they can themselves develop and find the concepts required. The findings they get from the process corroborate with their flow of thinking will be logically acceptable and make learning more meaningful for them. Mathematics is always there in human activities, either of young children or grownups. Ironically, the occurrence in human activities involving mathematics is often kept away of learning mathematics. Employing the occurrence, however, can be an entry point in the process of educating mathematics. Mathematical education that adopts some fragments of human activity will make the learning process fruitful due to the relation between mathematics and life. By utilizing their knowledge and experiences of out-school learning, it can be easier to them to understand the problems asked.

Initial ability of students played significant role in subsequent learning process especially the abilities needed to reveal problems they face. Students without adequate initial ability will have difficulties understanding the problems. This initial ability is strongly influenced by the learning process experiencing by students. The objectives of learning mathematics are to let students mastering abilities to: (1) comprehend mathematical concepts: explaining the relation among concepts and applying the concepts or algorithms in solving problems flexibly, accurately, efficiently and precisely; (2) use patterns and characters deliberately: manipulating mathematics either in making generalizations, compiling evidence, or explaining mathematical ideas and statements; (3) solve problems: that include the skills to understand problems, to design mathematical models, to resolve models, and to interpret solutions obtained (BSNP, 2006: 148). External and internal representation of a problem may vary from one student to another. Likewise when students face a similar problem. In this regard [10] said "when two people talk about mathematics problem solving, they may not be saying exactly the same thing".

2.1 Location of the Study

The study was took place in Class 4-A in SD Negeri 3 Banda Aceh in the odd semester of the school year 2018/2019. Prior to determining the location of the study, observations and interviews with the school member were conducted as an exploratory stage.

2.2 Study Instrument Test

The test instruments consist of initial math ability test, pretests, and posttests. The initial ability test is run to map students' abilities needed in learning fractions. The problems asked in the pre and posttest instruments were arranged and adapted to the context of the chocolate plate based on the learning process by using fractions boards and complemented with sum and subtract operation of simple fractions.

SWS. Student works sheets (SWS) are given to students right after completing every learning process. Work described in SAS is used as part of the learning process as well used to analyze the students' comprehension of the material they have learned. **Concrete media.** The concrete media used in this study consisted of a mortar, fractions boards, and cardboards.

Chocolate plate

Fractions Boards, mortar's fargments and cardboards

Fig. 1. Concrete Media

Fractions board. A rectangular-shaped boards are developed and divided into 24 equal parts to resemble chocolate plate. The chocolate-like board is then named as "fractions board". The board is divided into 24 portions (6x4 units). Non separated small portions should represent denominators which are 2, 3, 4, 6, 8, 12, and 24 as well as numerators which are whole numbers from 1 to 24. This fractions board is packed with cardboards of various shading sizes to represent fractions like: $\frac{1}{2}$ in size of 2x6 or 3x4 portions, $\frac{1}{3}$ in size of 2x4 portions, $\frac{1}{4}$ in size of 1x8 and 2x4 portions, $\frac{1}{6}$ in size of 1x4 portions, $\frac{1}{8}$ in size of 1x3 portions, $\frac{1}{12}$ in size of 1x2 portions, and $\frac{1}{24}$ in size of 1x1 portions and equipped with the size of a 4x6 portions chocolate plate.

3 Results and Discussion

Fractions boards can be used in learning processes to assist on: value of fractions, simple and equivalent fractions, operations for addition and subtraction of fraction.

Assisted with a fractions board in the learning process allowed any student to take different action relative to others on solving the available problem. It could injected positive impression on students as well as amplified their enthusiasm in learning fractions. Fractions boards are used when deemed necessary as to gradually reduce students' craving on concrete objects assistance. Reducing the use of concrete objects in learning should shaped students into the formal/semi-formal stage of intellectual development.

The learning session utilized a fractions board that represents chocolate plate consisting of 24 small portions. Later, the fractions board would only be depicted by students and at the end it only be conceived. The results portray that students have been able to use the "fractions board" to develop solution for the suggested problem with regard to comparing two simple fractions. Based on the learning process that run, it was conveyed hereby that students have confirmed their ability to use fractions boards in order to solve problems related to values of fractions, comparing fractions and simplify fractions to lowest term. At the beginning of the process, students considered every blocked area as n portions (which are not necessarily to be in the same size/portions) as they understood that each portion represents fractions equal to $\frac{1}{n}$. The ability of students to understand simple fractions with one as numerator and whole

numbers less than five as denominator was still low. The following figure is a part/excerpt from the students' answers about the values of fractions represented by the shaded area.

Fig. 2. Excerpts from Student's answer (Fractions Representation)

In other cases, when asked which one is greater between $\frac{1}{3}$ and $\frac{2}{4}$? Most of the students responded spontaneously by saying that $\frac{1}{3}$ is greater than $\frac{2}{4}$ on the grounds that $\frac{1}{3}$ represented a whole shape cut into three portions whereas $\frac{2}{4}$ was into four portions so that the portion generated for $\frac{2}{4}$ are smaller seeing they come from the similar chocolate plates. When students have given such respond, the teacher does not directly clarify whether it was correct or wrong answer otherwise encouraged students to examine the answers in their own way.

Few minutes after using the fractions board, students come out with clarification to the answer that it was incorrect following with a new answer which was the value of $\frac{2}{4}$ is greater than $\frac{1}{3}$ by seeing that the area representing the $\frac{2}{4}$ is wider than those representing $\frac{1}{3}$ fractions.

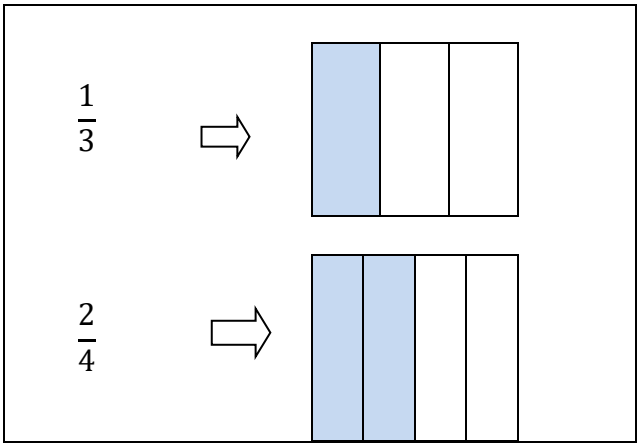
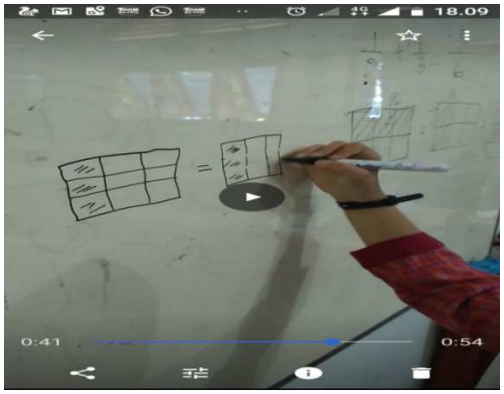
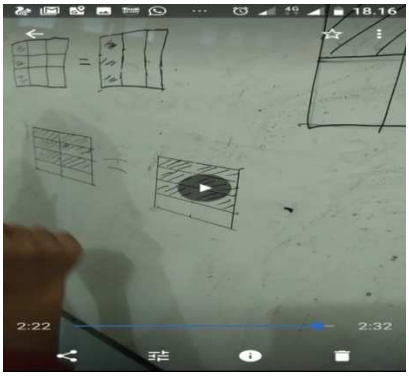


Fig. 3. Comparing Values of Fractions



A



B

C

Using Fractions Board modelling, students were able to reveal equivalent fractions or simplify the fractions as shown in these figures:

A. $\frac{3}{9} = \frac{1}{3}$

B. $\frac{6}{8} = \frac{3}{4}$

C. $\frac{4}{8} = \frac{6}{12}$

Fig. 4 Snippet Information of Student Actions

Assisted by a fractions board drawings, students have been able to make simple (guided) discoveries following limited guidance provided by the teacher. Depicting a fraction value which has $\frac{3}{9}$ shaded portion and later some lines were removed so that the shaded portion represented a $\frac{1}{3}$ fraction without reducing any of shaded portion.

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