# SUPPORTING THE STUDENTS' UNDERSTANDING OF PERCENT BY USING GRID 10 X 10

**SISKA NINGSIH[1)], RATU ILMA INDRA PUTRI[2)], & ELY SUSANTI[3)]**

*Department of Mathematics Education*
*Sriwijaya University*
*e-mail: 1) siska_ningsih92@yahoo.co.id, 2) ratu.ilma@yahoo.com,*
*3) ely_pasca@yahoo.com*

**Abstract**

Percent is often used in a variety of media in everyday life. Percent begins to be studied at the elementary level. Students are more or less know about percent, but they are often difficulties in percent problems. This study aims to support students' understanding in learning percent using a grid 10 x 10 and Indonesian Realistic Mathematics Education (PMRI) approach. The method used is design research of type validation studies. Design research consisted of three stages: preliminary, design experiments and retrospective analysis. This research was conducted in SD Negeri 23 OKU by involving students of class V. The data were collected through video recordings, students' work, interviews and then analyzed the data mostly in qualitative ways. The results of this study are learning trajectory that consists of 3 activities and shows that the grid of 10 x 10 with PMRI approach can help students understand the learning percent.

**Keywords**: Percent, *Design Research*, Grid 10x 10, PMRI

## 1. Introduction

The term "percent" derives from the latin meaning "per hundred", and percent provides another way to represent fractional or decimal hundredths (Fobringer dan Fuchs, 2014). Some conceptual understanding of percents is also essential for comprehension of messages in the media, such as statistical information about economic or social trends (Gingsburg *et al*, 1995). Percentages are a useful way of making comparisons, apart from being used to calculate the many taxes that we pay such as VAT, income tax, domestic fuel tax and insurance tax, to name but a few (*Mathcentre*, 2009).

Students are more of less know about percent, but they are often difficulties in percent problems (van Galen & van Eerde, 2013). Results of NAEP showed that students had difficulty with problems involving percent (Wearne & Kouba, 2000).

According to Van den Heuvel-Panhuizen (2003), to make students understand percentages, began with the introduction where students are confronted with stories of daily life in which the percentage of plays. De Corte et al (2005) also say the same thing, start a percentage of teaching, teachers can use many everyday situations are understandable for students. Additionally, Mulyani (2013) claimed to be able to help clarify what will be presented a teacher and easily perceived and understood by the students, then the required media. According to Fobringer and Fuchs (2014) using different types of model representation of a concept depends on students' conceptual understanding. Therefore we do not have to restrict representation percent using a 100-square grid, but also including models using pattern blocks, geoboards, meter sticks, line numbers, and other concrete objects and visual image, as we did when introducing fractions and decimals.

The approach can be used in this study, namely Indonesian Realistic Mathematics Education (PMRI). PMRI an adaptation of Realistic Mathematics Education (RME) where mathematics is the human activity and mathematics should be attributed significantly to the context of an everyday life of students as a source of development and as an area of application through the process of mathematization both horizontal and vertical (Zulkardi, 2002). Learning educational paradigm change from teacher-centered to student-centered learning is expected to provide a pleasant atmosphere and the creation of activity and creativity of learners, which in turn support the effective achievement of learning objectives (Putri, 2009)

## 2. Theoretical Background

*Percent*

Percent is a ratio expressed as a fraction whose denominator is equal to 100 (Sessu, 2014; Bird,J., 2002). Percent denoted by%. For example, 25 percent is 25/100 and written as 25%. To resolve the problem percent, Rosenberg (1975) argues that before you can add, subtract, multiply, or divide using percents, the percent must be changed to either a decimal or a fraction.

*PMRI*

Realistic Mathematics Education is a learning theory developed specifically mathematics. RME Freudenthal rooted in the theoretical view that mathematics as a human activity (Gravemeijer, 1994). Gravemeijer (1994) states that there are three important principles in the approach RME, namely: Guided reinvention and progressive mathematization (guided discovery and mathematics Continuous), didactical phenomenology (phenomenon educate), and Self-developed models (models developed by the students themselves ).

Characteristics of Indonesian Realistic Mathematics Education consists of five, which is a combination of three levels of Van hiele, the phenomenon of continuous learning and mathematics Freudenthal Treffer. Here is a characteristic of realistic (Gravemeijer, 1994):

1. *Phenomenological exploration uses of context*

Context is the real students' everyday environment. In PMR, the real world is used as a starting point for the development of ideas and mathematical concepts. By using the context, in addition to the student can be involved actively to explore issues (de Lange, 1987) but also can motivate and interest students in learning math and reduce math anxiety (Wijaya, 2012).

2. *Bridging by vertical instruments/ use of model*

The model is directed at increasing concrete models to abstract or model of the real situation to the direction of the abstract.

3. *Student contribution*

A big contribution to the learning process of students' construction itself is expected to bridge them from informal methods towards more formal.

4. *Interactivity*

In the process of learning, students undertake discussions to resolve the issue. In the discussion of students interacting with other students or the teacher. Interactivity emphasis on social interaction among students to support each individual student (Wijaya, 2012). The social norm is a common pattern of social interaction

that is not tied to the topic or subject matter, for example, respect the opinions of others.

5. *Intertwining*

In learning to use a holistic approach, meaning that the topics of learning can be linked and integrated to bring an understanding of a concept or an integrated operation.

## 3. Method

This research was conducted in SD Negeri 23 OKU by involving students of class V. The method used is the method of design research, the type used is a type of validation studies that aim to prove the theories of learning (Nieveen, McKenney, & van den Akker, 2006) , Design research aims to develop a Local Instructional Theory (LIT) with the cooperation of researchers and teachers to improve the quality of learning (Gravemeijer & Van Eerde, 2009). According to Gravemeijer and Cobb (2006), Design research consists of several stages, namely: (1) Preparing for the experiment / Preliminary Design, (2) Design Experiment, and (3) Retrospective Analysis.

The first step is Preparing for the experiment / Preliminary Design (preparation for research). At this stage, a literature review regarding the learning material is about percent, PMRI approaches, and methods of design research as a basis for the formulation of alleged initial strategy into learning or as a foundation in designing the learning trajectory. Furthermore, it would be designed hypothetical learning trajectory (HLT) is a series of learning activities percent material that contains learning objectives, learning activities, and allegations of students' thinking (Simon, 1995). HLT was developed based on the literature and adapted to the actual learning during the experiment teaching.

The second phase, Design Experiment consisted of two cycles, the pilot experiment and experiment teaching. The pilot experiment aims to pilot HLT has been designed in small groups in order to determine the extent of conjecture and

instruments that have been made so that the researchers can be accomplished. There are six students involved in the pilot experiment, with three different levels of academic ability. The sixth student academic levels were obtained from teachers who teach in class V. The results of the pilot experiment is used to correct the HLT that will be used for teaching experiment.

The third stage, Retrospective Analysis. Data have been obtained in the second stage is analyzed and the analysis results are used to plan activities and develop a learning activity design on the next. The purpose of retrospective analysis, in general is to develop local instructional theory. Data collected through video recordings, student activity sheets and interview then analyzed to improve HLT has been designed. Data were analyzed retrospectively with HLT as a reference. For data analysis, the researchers conducted a discussion with counselors and teachers model for improving the reliability and validity in this study.

## 4. Result and Discussion

This result in a learning trajectory on learning about the material learned in class V. percent of learning materials using a grid of 10 x 10 with the approach of Indonesian Realistic Mathematics Education (PMRI) can help students understand the material percent. Students can change the common fraction to form percent and remodel percent to shape common fraction. There are three activities that can help students understand the material percent.

All activities are conducted in groups with each group consisting of 3 students. Learning begins by giving apperception about fractions and motivation to students that percent is often used in everyday life. Students are required to discuss with each group to finalize and undertake appropriate activities that have been shared LAS. Each group has a heterogeneous academic ability. The first activity the students did after reading the student activity sheet (LAS), which divides the flat square form into 25 equal parts according to the problem was given to the student activity sheet (LAS). Furthermore, some parts in the wake of the shaded square to order at LAS.

From the square which has been shaded, students determine common fraction as much a part which has been shaded.

Figure 1. Students divide and square shading

During the discussion of students, researchers observed and provided guidance to students who are experiencing difficulties. One of the difficulties of students in this activity was to determine fractions of problems. With a little help students can determine the fractions of the problem given as the following conversation:

1. Teacher: What share of seats filled?
2. Yana: the first table ...
3. Teacher: Let's see, lots of chairs available there ...?
4. Ayu & Astrid: 25
5. Teacher: Yes, 25. Keep the number of seats filled?
6. Ayu: 22
7. Teacher: Yes, 22. So, what portion of seats filled?
8. Students: mmmm....
9. Teacher: How many seats are filled?
10. Ayu: 22
11. Teacher: na, of how much is available?
12. Ayu: 25
13. Teacher: So wrote it....
14. Ayu: 22 of 25 (22/25)

Transcription 1

Activities undertaken subsequently, the student uses a grid of 10 x 10 to change the common fraction to form percent. Students gluing 10 x 10 grid of

transparent plastic that has been created by researchers in a square image that has been divided and hatched before. Students compute grid that covered hatches and writes in LAS and noticed that every box has been divided on a square filled with 4 grid.

Figure 2. Students use a grid of 10 x 10

After calculating the affected grid shading, students deduce how to change a common fraction to form percent. Students hesitated to write the conclusions, so that teachers help students to excel in group discussions about writing, as in the following conversation:

15. *Students: (students have to write common fraction is 22/25, but hesitated to write back)*
16. *Teacher: So what now? What percent earlier?*
17. *Astrid: 88*
18. *Teacher: fractions?*
19. *Astrid: 88 per 100*
20. *Teacher: na, how 22 per 25 is made in 88 per 100?*
21. *Ayu: uy tiaaa ... multiplied (while talking on astrid or tia)*
22. *Teacher: write ...*
23. *Ayu: Eeeee ... ..22 multiplied by 4*
24. *Yana: yes, 2 x 4, 8*

Transcription 2

The third activity, to change to a common fraction percent of students shading grid of 10 x 10 which has been printed in the paper as much information obtained from the problems in the LAS. Students cut out the grid and classifying pieces of the

grid with each group of pieces of the grid as much as the shaded grid groups. Then students write up the results of grouping pieces of the grid at the LAS as shown below.

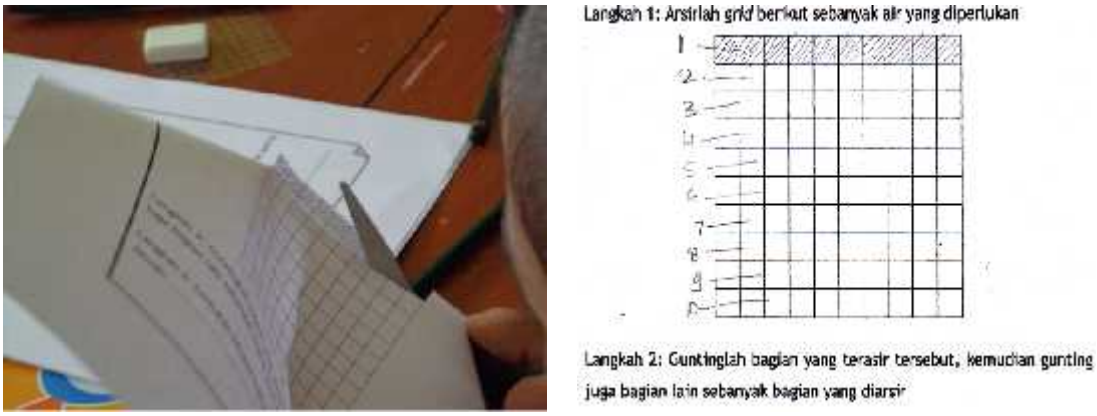


Figure 3. The students cut out a copy of a 10x10 grid in groups

Furthermore, students observe grid pieces that have been cut into sections and determine the number of parts of the grid that has been shaded.

*25. Yana: specify how the shaded part? (Read about at LAS), ... .One.*
*26. Teacher: Na, one...*
*27. Yana: one line.*
*28. Teacher: one line of ... ..?*
*29. Yana: ten columns...*
*30. Ayu: ten boxes ...*
*31. Teacher: ten....*
*32. Ayu: ten boxes ...*
33. *Teacher: mmmm, write .. (student writes (1/10))*

Transcription 3

In group discussions, students are still not used to write the conclusion of the working group on the student activity sheet, so that teachers provide assistance so that students write the results of discussions as the following conversation:

*34. Students: (read a statement asking students to write a conclusion)*
*35. Teacher: Na was what percentage?*
*36. Student: ....*
*37. Teacher: The water?*
*38. Students: 10 percent*
*39. Teacher: Na, write. 10 percent ...*
*40. Students: 10 percent....*

*41. Teacher: Na, 10 percent is the same as what?*
*42. Students: 10 percent*
*43. Teacher: na simple fractions so how many of the cans of paint?*
*44. Ayu: divided ...*
*45. Teacher: divided by how much?*
*46. Yana: divided by 2 e, in the fourth?*
*47. Ayu: divided ... divided by 10*
48. *Yana: divided by 10, one means. (And then write on sheets 1/10 activity)*

Transcription 4

Learning implementation is in conformity with the HLT that has been designed. From a series of activities that have been done can be seen that students are able to change the common fraction to form percent is calculated by multiplying the numerator by a number equal to the number in the denominator so that the denominator multiplier turns into a hundred fragments. As for changing the shape percent to ordinary fractions, students divide the numerator by a number equal to the denominator in the denominator.

## 5. Conclusion and Remark

Based on the results of research and discussion that has been described, it can be concluded that the series of activities that have been carried out using a grid of 10 x 10 and PMRI approach can support students' understanding of the material per cent. Students can change the common fraction to form percent and remodel percent to a common fraction. Learning trajectory generated in this study consists of three activities, namely, the first activity, dividing and shading Flat (square) as in the application of the activity sheet. The second activity, students use a 10x10 grid to change the common fraction to form percent by gluing a plastic that has been molded into a grid to wake flat which has been divided and shaded. The third activity, students categorize and cutting a grid of 10 x 10 to determine a common fraction of shapes percent.

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