

Learning Proportional by Comparing Costs in Secondary School

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Abstract: This study aims to determine students' understanding of proportional learning in comparing costs through the PMRI approach. The research participants consisted of 32 grade VII junior high school students using the Research design method which consisted of three stages: initial design, experimental design (pilot experiment and teaching experiment) and retrospective analysis. This study produced a Learning Trajectory (LT), which contains a series of learning processes that help students find cost comparison concepts that can be seen in everyday life. A Hypothetical Learning Project (HLT) was developed in activities using the Actual Learning Flow of students (ALT) during the teaching experiment. The results of the study indicate that the price comparison concept is the starting point in the comparison of values.

1 INTRODUCTION

Value comparison is the ratio of two values or more than a similar quantity. The use of comparative material can be applied and unwittingly often used in everyday life. Proportion is defined as the equality of two ratios, for example $a/b=c/d$ (Silvestre and da Ponte, 2012; Ellis, 2013). Value comparison is one of the subjects studied in grade VII which one of the basic competencies is to use comparisons to solve problems.

One way to make material can be done by exploring its contents from users which will help students learn more (Cramert and Post, 1993; Van de Walle, 2008). Comparison informal, students make a solid foundation on which they make their own approaches, which can be explored and cover situations that involve measuring prices, geometry or other visual contexts and varying degrees can be used to teach comparisons (Wijaya, 2013), that use context in explicit between context and mathematical ideas is also useful for students to support development of mathematical thinking.

Zulkardi (2002) explained that context leads students to understand mathematics from what can be used for something formal can be written with symbols through the mathematical process. In this study, using the context of *tekwan* as one of Palembang's special foods that can explore national and local culture into the concept of learning

mathematics through everyday life, so as to make a lesson more meaningful and interesting so as to motivate students to study harder (Retta *et al.*, 2013). In general, comparison problems are categorized into two types, namely missing value problems and comparison problems (Sumarto *et al.*, 2013).

PMRI has five characteristics that are in accordance with the characteristics of RME (Gravemeijer, 2006; Zulkardi, 2002; Putri, 2013), in the learning process with Realistic Mathematics Education that must be improved, namely: (a) using the context for exploration (use of contexts for phenomenon exploration), (b) using models to construct mathematical concepts (use of models for mathematics concept construction), (c) using student contributions (use of students' creations and contributions), (d) student activities and interactivity in the learning process (students activity and interactivity on the learning process), and (e) integrated with other learning topics (intertwining mathematics concepts, aspects, and units).

This study aims to produce a learning trajectory of proportional concept using the context of *tekwan* in seventh grader of junior high school. Through the identification stage, students can understand the ratio of a comparison value based on the conditions and situations obtained through the price of different technicians and what materials will be used.

Learning is designed using RME approach which can be related to other learning in the form of the context of *tekwan* food as one of the typical foods in Palembang.

2 METHOD

This study used design research method which is an appropriate way to answer researchers' questions and achieve the objectives of the research as those who will design comparative material with RME approach through the making of *tekwan* in grade VII of SMP Negeri 3 Rantau Bayur, Banyuasin.

According to Gravemeijer and Cobb (2006), there are three stages in the implementation of research as follows.

1. Preparing for the experiment and preliminary design. It is the preparation and preliminary stage in the form of literature studies in the form of understanding comparisons, RME approaches and analysis of mathematics curriculum materials through discussions with classroom teachers regarding the state of the classroom and the way in which research is carried out, research needs through observation in accordance with the schedule. Designing the suspected learning trajectory of this stage is learning trajectory and hypothetical learning trajectory (HLT). HLT is designed to be dynamic so that a cyclic process can be formed that can change and develop during the teaching process.

2. Designing experiment. At this stage the pilot experiment is carried out (cycle 1) through HLT trials which will have been designed for students in small groups to collect data in adjusting and revising the initial HLT to be used in the teaching experiment (cycle 2) later. Students taken from 9 students. based on 3 different low, medium and high abilities that the model teacher will choose. The results of the HLT pilot experiment phase that has been fixed are tested again in a class consisting of students as many as the number of classes as the subject of the study. Eye teacher students as model teachers and researchers conduct communication learning activities. The overall activities carried out by students will be used as data in the study.

3. Retrospective Analysis. At this stage, an analysis of the results of the study conducted by comparing Hypothetical Learning Trajectory (HLT) with the learning trajectory of students in the actual learning process so that the results were obtained in student learning activities to answer the problems in the study.

The data collection techniques in this study were carried out by comparing observations during the learning process with HLT which was designed in the preliminary design phase. The data obtained through observation, making video recordings of student activities, looking at students' abilities through Student Activity Sheets (LAS), giving initial tests and final tests and student interviews. Then compare HLT and ALT to find out if the active student is not active during the activity.

Analysis of the data based on the initial data validation of student' activity sheets and student' learning recordings so that the results of the research can be finally concluded.

3 RESULT AND DISCUSSION

3.1 Result

This research is used to produce learning trajectories about comparative material in solving problems in everyday life by using the context of *tekwan* through RME approaches in junior high school. Through various stages in the initial preparation, namely reviewing the literature and designing HLT by making direct observations on student learning activities

Where this stage the researcher prepares the activities of the literature in research through activities in the form of discussion about the comparison material of the comparison with the concept - the basic concept. In addition, students can find out that the context used is *tekwan* which is a typical food Palembang also provides knowledge that in every sale of *tekwan* the price sold is not all the same varies from the experiment students know what ingredients are the main subject and additions through size on basic materials during the making of *tekwan* and carried out in several activities before and after several tests.

Table 1. Name of student in pilot experiment

Student Name	Ability
Karnia	High
Yenita	High
Farida	Medium
Nunik	Medium
Wisma	Low
Winda	Low

The researcher himself will act as a model teacher along with 6 students with different abilities, where the ability consists of high, medium, and low

level abilities divided into 2 groups where Group 1 (student 1, student 2, and student 3) and group 2 (student 2, student 4 and student 6). the names of students in Table 1.

Before the learning in cycle 1 will be carried out the initial test for the six students, the test is carried out to see the students' initial ability to measure the extent to which students understand the prerequisite material and also see students' ability to solve problems related to comparison material which will be taught next. Specifically on the answer sheet of the initial test the researcher knows how students in answering each given question related to the comparison material using the *tekwan* making contest. Students are given a written test of four initial test questions, and in completing this initial test students work individually, following the situation of students in doing the initial test can be seen in Figure 1.



Figure 1: Students are working on pre-test.

The first problem given to students in cycle 1 is by using the context of the researcher through the components of the material related to the comparison material through conversation. from the picture above?



Figure 2: Problem number 1.

Figure 1 is the first problem given to students in the above questions, in the form of food ingredients that will be used to make *tekwan* consisting of milled fish and sago, students are told to think, besides the ingredients above, there are ingredients that can be used so that the food can be made.

To find out the strategies used in resolving the comparison problems given, researchers who act as teachers conduct interviews with each group.

Teacher : what picture do you see?

Group 2 : fish, sago is lacking, the water is not there ?
 teacher : oh yeah, what should we do?
 Group 2 : it seems like it's for empek -empekk
 student 2 : not empek - empek
 Teacher : besides Pempek there is another?
 student 2 : tekwan mom
 student 4 : why don't we make a technician we need a container?
 teacher : how to make a technician
 student 6 : if 1 kg of fish, 1 kilogram of sago 1500 sago and water is 600 ml
 students 4 :when I'm a fish, 800 grams of sago and water is only 400 grams
 student 2 : we don't usually have a lot of ingredients plus more results
 teacher : what does that feel like that?
 student 2 : he must be different mom

Conversational transcription above shows that students (group 2) use intuitively to solve the comparison problem given. They have not given a reason mathematically using the procedure in giving strong reasons even though the answer is correct.

The second comparison problem given is to compare three containers or comparison situations with three factors compared. The theme given is *tekwan* food with good taste, not tasty. Students are given several ingredients with sizes and sizes between 1500 gr sago, 1500 gr milled fish and 300 ml water with the provision that the three containers are loaded with the same size and other materials of different sizes in each container. Fill the ingredients above into the container provided ? explain your reasons ?

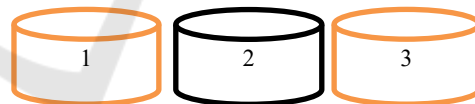


Figure 3: Problem number 2.



Figure 4. Student teaching experiment

Figure 4. Shows that in the experimental teaching students do the practice by making *tekwan* food from the ingredients that have been prepared and divide into several groups that are seen are groups 1 and 3 and start mixing some of the ingredients

divided in the three containers. Here is teacher interviews with group 4.

- Teacher : what if you want to have a different taste
 student 1 : we divide it if the fish and 1500 grams of sago are divided like 500 grams each and the water
 student 3 : if you see it the value is the same
 teacher : we want to get a different taste
 student : the meaning is divided into 3 parts
 teacher : do fish have to be the same for the part
 student 5 : sago and water, yes mom
 teacher : yeah kid
 student 1 : let it be meaningful that there are 250 grams, 750 grams and 500 grams
 student 3 : water is 150ml, 50ml and 100ml
 Teacher : yes right, so how do you taste feel from the three containers
 Student 5 : There tastes good, it's quite tasty and doesn't taste good
 Teacher : Try to conclude from the results you have obtained
 Student3 : Good , that distinguishes the taste is the amount of sago and water that is given in each container

The conversation transcription shows that group 4 has started reasoning in solving comparison problems. They give reasons and prove their alleged answers. The concept of comparison used by students 1 and 3 is to look for comparisons in each ingredient and there are 2 differences in answers that are better in the answer of student 3 there is a comparison value in Figure 5 below.

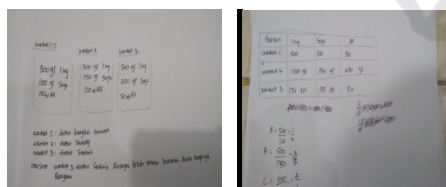


Figure 5. Strategy of the answers to group 4 students in solving the Comparison problem

That way students can produce the material then they begin to work on the results so that the *tekwan* which tastes good, medium and unpleasant
 Restropective Phase Cycle Analysis 1

Based on the activities carried out by students in cycle 1, a retrospective analysis was conducted on why students subtracted by the same number, namely 250. They replied that in order for all materials to be deducted proportionally, they had to be deducted by the same number. In this case students have not been said to reason in comparison because students still use the concept of addition and

subtraction in a comparison situation rather than the concept of multiplication and division. In addition, the comparison situation given is difficult to model. So that revisions are made to the problems given to students in the teaching experiment (cycle 2).

3.2 Discussion

The use of *tekwan* food context is the context of Palembang traditional food culture in comparative learning on comparison material can help students to understand mathematics in everyday life, besides students can reason in solving problems given, reasoning processes occur when students can find the concept of comparison to look for price and amount. for example there is a portion of food in one portion of the ingredients used are the staple ingredients of *tekwan* food and other ingredients will increase proportionally and the amount of *tekwan* food produced and conversely if one ingredient increases, the portion of *tekwan* food in one bowl and taste value will increase and different prices and resolve the problems given in LAS. Zulkardi (2002) stated that mathematics learning is a human activity and mathematics must be clearly connected to the concept of student's daily life as a source of development and to the context of everyday life as a source of development and as an application area through mathematical processes both horizontally and vertically. In the development through approach through formal and informal stages.

4 CONCLUSION

In this study stated that the concept of *tekwan* can be an ingredient in learning mathematics where each learning process takes place activities that help students in solving problems in mathematics learning, especially determining the value of price comparisons that have been the question of what causes the price of *tekwan* to vary even though the basic ingredients are the same namely fish also become students better understand the problems that are given especially everyday life.

Researchers hope that with the context of the *tekwan* can make other studies using Palembang specialties which are local and national cultural contexts to be a learning process that can lead students to be more active in learning.

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