How students learn fraction through pempek lenjer context

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Abstract. Many prior studies were conducted related to designing instructional activities using context in learning fraction. However, the context used probably does not work in other country because it is not familiar to students. This study aimed to design fraction problem using pempek lenjer context and to describe how they work with the context. Design research is chosen as research methodology in this study and it involves 35 fifth grader students. Data collections consist of students’ worksheet, observation, and interview. The result showed that pempek lenjer context provoked students in learning fraction. Most of students use bar model horizontally or vertically to represent pempek or see the pattern from each package. The other students use multiplication and its relation with division.

1. Introduction
Fraction, one of complex concept in mathematics, plays important role in numerical development of students in elementary school [1-4]. Understanding fractions are needed to improve students’ ability in doing fraction arithmetic and in solving algebra equation [5]. However, most elementary students in the world are still difficulty in learning fractions [2, 3, 5]. To support students in understanding the concept of fraction, learning should be more meaningful so that they become more active in constructing fraction concept [6]. Context based problem can be used to stimulate students in learning because they are able to apply their prior knowledge and experience through context [7, 8].

Recently, some literatures discussed about the use of context to help students learning mathematics including fraction [3, 6, 9, 10, 13]. Shanty [13] argues that the use of length measurement context can stimulate students to begin the first activity in the learning fractions. Putri [3] used shot-put context in Asian Games to provoke students learn fraction. The result of those two studies showed that contexts can be used as starting point for students in learning fraction. However, the context used in the previous studies supported students in learning fractions as part of the whole [13] and subtraction of fraction [3]. Meanwhile, students need to extend their understanding of fraction.

One of Indonesia context that can be used in learning fraction is Pempek Lenjer, a traditional food in Palembang. Through this context, students are stimulated to determine which part is the most or the less. Therefore, this study aims to design fraction based Pempek Lenjer context problem to provoke students in learning comparison of fractions.

2. Methods
This study was conducted using design research which purposed to design context based problem in learning fraction. Design research purposes to develop local instruction theory based on theories that are existent and experiment empirically through cooperation between researchers and teacher [14, 15].
Students’ answers as well as their performances and arguments were analysed using descriptive qualitative method to know how they work with context in learning fraction. This study involved 35 students of fifth grade in IBA primary school Palembang. They were about 7 years old and have received instruction about fractions as a part of whole before.

Stages of design research consisted of preliminary, experiment, and retrospective analyses. Research data was collected using students’ poster, observation, interview, and video recording.

3. Results and Discussion
Before validation, we designed fraction context problem using Palembang context and predicted some conjectures of student’s thinking when they solve the problem. The context used was Pempek Lenjer context adapted from Submarine Sandwich Problem, a fraction context of America [16]. The problem given purposed to figure out whether students are able to determine fractions from the context, to compare those fractions, and to get the biggest value of fraction and the smallest one. The following is the fraction context problem designed.

![Fraction context problem](image)

**Figure 1.** Fraction context problem

Then, the fraction based context design was validated by Z through expert review. Z suggested to add some texts describing the pictures given. Before any problem given to students, we also did observation in school where we will conduct the research. Observation included contact with teacher, condition of school, and students. It was also a phase to choose randomly a number of students which were involved as research subjects. However, pre assessment was also useful to be done. The purpose was to investigate students’ pre – knowledge about the way they learn fraction and how far they have learned it. After fraction based context problem had been designed, research subjects had been chosen, and pre assessment had been done; designed fraction problem was given to students.

To see the practicality of fraction based problem designed, it had been tried out in one-to-one and small group. In one-to-one, the researcher gave the fraction problem to 3 students having high, medium, and low ability and they work individually. In small group, 4 student work together in solving the problem. Most of students made drawings to represent pempek lenjers and divided them into some parts by making line in their drawings. The following is one of students’ answer on the fraction problem given
In figure 2, since the number of pempek Lenjer is less than the number of people, students made shading in the last part of Pempek Lenjer for the last person. Therefore, the last person got a combination of shaded parts of pempek lenjer. Most of the drawing, student made bar model to represent Pempek Lenjer. In figure 2, student made bar model horizontally. However, some students also connect to multiplication in solving this fraction problem. It is showed from the conversation between researcher and student as follow:

Student : (drawing model of pempek and dividing them)
Researcher : What do you do next? See how much?
Student : all of them..
Researcher : How many is 8 x 7?
Student : 56
Researcher : How many did you get before?
Student : 48
Researcher : Is it wrong?
Student : yes
Researcher : for how many people are they (refer to Pempek Lenjer)?
Student : 8 people
Researcher : so what should we do then?
Student : divided by 8

From the conversation, it showed that the student use multiplication concept in solving the problem and relate it with division. Then, they got the number of pempek lenjer parts that one person must have. However, it implicate to the way they formulate what fraction number is.

In small group, the numbers in fraction problem were changed, made exactly the same numbers in fraction based Submarine Sandwich problem, a fraction problem using America context. In solving the problem, some students could see the pattern of fraction number in each package, starting from package A to package D, but some of them also did not see it. This following conversation showed how students worked together in solving the fraction problem.

Student D : pempek A, ¾ (pointing to part of package A)
Student A : this one is 7/8 (pointing to package C)
Student A : (drawing pempek in package D)
Student C : let me make it
Student A : wait for a moment! Be patient!
Student B : make 4 lines, 4
Student A and B : one, two, three, four (moving to another drawing of pempek)
Student A : one, two, three, four, it is surplus (removing the last line)
Student B: one, two, three, four (student A while writing each line)
Researcher: So how many parts in package D is?
Student A: I don’t know
Student C: 3/5
Student A: (writing 3/5), how come 3/5?
Student D: yes, it is
Student C: 3 pempeks are given to 5 people, aren’t they?

From the conversation above, it showed that some students become aware the pattern of fraction numbers from the context. However, some of them also are still difficult to determine fraction number when the differentiation between denominator and numerator number is more than 1. This following student’s poster also showed that students are still not able to determine how many part of pempek lenjer for each person in package D.

Figure 3 shows that students also use bar model to represent pempek lenjer but they draw it vertically. Students divided pempek lenjer into some parts by making line into pempek lenjer pictures. They also make some kind of squares as parts of pempek lenjer which have been separated.

Designing fraction based context problem should be done especially in teaching and learning fraction using Realistic Mathematics Education approach or PMRI approach since both of them emphasized the use of context, model, interactivity, students own solution, and intertwining in mathematical instructional activity centered to students [17].

In solving the fraction based context problem, at the beginning, students made a drawing. This is their way in translating mathematics in real situation into a symbol or notation that they understand which is named as mathematical modeling in realistic mathematics education [18-20]. Furthermore, Treffers [21] argued that models are used as a bridge to connect the informal level to the formal level. They could be symbols, diagrams, schemas, and so forth [22]. In one-to-one and small group, students mostly drew bar model to describe what form of pempek lenjer is since bar model is close to model that resembles a pempek lenjer that is like rectangular when viewed in two dimensions. After making drawing, most of students divided it into some parts and made shading to mark the parts for the last person. They did it to find out how many part of pempek lenjer that should be given for each person fairly since the number of pempek lenjers is less than the number of people. Then, some of students are able to determine the fraction number. They mostly add up each one part of a whole of each
pempek lenjer. After getting the fraction numbers, the next problem is that they have to figure out which fraction number is the most or the less one. It is also described by Stafylidou [23] about the development of students’ understanding of the numerical value of fractions that they need to understand the relation between numerator and denominator and to consider that fractions can be bigger, equal or even smaller than unit. In solving the fraction problem given, some students determine by comparing the length of their drawing, or through the magnitude of the number, the greater the numerator and denominator of the fraction, the greater the value of fraction number. Any students also use multiplication and its relation with division in determining the number of pempek lenjer parts for each person. However, they become confused in figure out what the fraction number that is suitable for each package.

4. Conclusion
It can be concluded that pempek lenjer context provoked students in learning fraction. Most of students use bar model horizontally or vertically to represent pempek lenjer and they also used it in solving the problem. Some of students are able to determine fraction number of context by shading some parts of Pempek lenjer and combine them together to get fair results, some of them can see the pattern from each package but still difficult in figure out which one is the most or the less. Some students also use multiplication and its relation with division to find out the number of pempek lenjer parts for each person.

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