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FRACTION LEARNING USING DAILY CONTEXT FOR PRE-SERVICE PRIMARY SCHOOL TEACHER EDUCATION

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Abstract

Fractions are important material to understand because fractions are often encountered in everyday life. This research aims to analyze the fraction learning process using the PMRI approach for pre-service primary school teachers. This type of research is descriptive qualitative research with a PMRI approach using the context of everyday life. The subjects of this research were 20 students at second semester. Data collection techniques included tests, documentation and observation. The data analysis technique uses the Miles and Huberman model. The results of this research are a description of the thinking framework of pre-service primary school teachers using daily life contexts in the form of objects and food in determining the concept of fractions. Students are able to implement the concept of fractions using the PMRI approach through the use of the context of objects and food that exist in everyday life. It is that this research will become a guide in learning fractions and can be developed into student worksheets.

Keywords: context, fraction, pmri, primary school

1. Introduction

Learning mathematics at various levels of education ranging from kindergarten to university has made a fundamental contribution to the development and progress of student intelligence. This is in line with the objectives of mathematics learning to be achieved, the ability to understand concepts is an essential competency and is the vision of learning mathematics. There are three scopes of elementary school mathematics, namely numbers (integers, whole numbers, prime numbers, fractions, multiples and factors, simple powers and roots), geometry and measurement (plane figure and spatial shapes, relationships between lines, measurements (weight, length, area, volume, angle, time, speed, and discharge, location and coordinates of an object), and statistics (presenting and interpreting single data) in solving everyday life problems.

Fraction learning is one of the materials that contains the meaning of dividing something intact into several parts of the same size (Braithwaite, & Siegler, 2020). The concept of fractions means fair or not one-sided. When someone learns about fractions, they indirectly understand the concept of counting operations starting from addition, subtraction, multiplication, and especially division. Not only that, understanding fractions is an important part of understanding decimal numbers (Resnick et al., 2023). Fraction learning is one of the basic concepts that need to be learned by elementary school teacher education students who will become elementary school teachers (Alqahtani et al., 2022). This is because the concept of fractions has been learned since the third grade of elementary school, which should be a basic understanding that must be mastered by students (Lisnani, 2019). However, the concept of fractions is a topic that is more difficult than with whole numbers because learning the concept of fractions allows students to have misconceptions.

However, students tend to experience problems when learning fractions, namely the lack of understanding of the concepts of fractions, decimals and percentages will affect students in developing knowledge of proportional reasoning and algebraic and probability topics (Perry, 2023). Students' difficulty in understanding the concept of fractions is thought to be because they find it difficult to digest in real terms (Kania, 2018). There are various ways to overcome these difficulties carried out by researchers such as the use of learning media (Pujiningtias et al., 2021; Suciati, 2020; Anggraini, 2016), the use of certain learning approaches (Chityadewi, 2019), teaching aids (Kania, 2018), the use of Newmann's theory (Murtiyasa & Wulandari, 2020), and the use of LKPD (Putra et al., 2021). However, researchers are interested in using the PMRI approach (Agustyarini, 2021; Marhammah et al., 2011).

A prospective elementary teacher needs to understand the initial concept of fractions. However, in reality there are various difficulties faced by prospective elementary teachers in understanding about fractions. In fact, when students learn about fractions, it is not difficult because fractions themselves are around us so it is not difficult to find a context. There are many contexts around us such as the use of food context, object context, and various contexts that exist in human life. The use of context is one of the characteristics of the Indonesian Realistic Mathematics Education (PMRI) approach. The use of context aims to find mathematical concepts through things that are around us. The aim of this research is to determine the results of fraction learning analysis using the PMRI approach for pre-service primary teacher education at one of private university in Indonesia.

2. Method

This research uses a qualitative approach with descriptive methods. The data in this study were collected in the form of tests, documentation, and observation. A series of tests given in the form of questions where students look for the context of objects and food around them that can be used as a context in learning fractions.

The subjects in this research were 20 students in the second semester of pre-service primary school teachers (initials S1-S20). Data collection was carried out in the even semester 2022/2023 in the Lower Grade Mathematics Learning course. Data was taken from February to April 2023. The resulting data was analyzed using the Miles, et al (2014) data analysis technique consisting of: 1) data collection, in the initial stage the researcher collected data on pre-service primary school teachers test answers. The test results will be discussed one by one based on the context used by students when working on the test questions; 2) data presentation, data is presented in the form of qualitative descriptive analysis in the form of images/documentation and videos when students explain the context of the pliers used and the concept of fractions used; 3) data reduction, data reduction is carried out on the same data in terms of test answer results and use of context; 4) drawing conclusions/verification, drawing conclusions on all data that has been

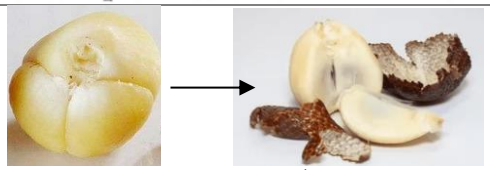
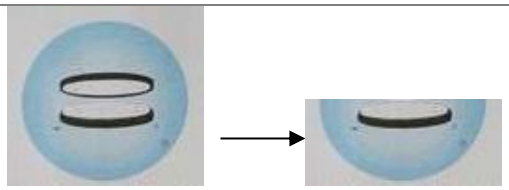
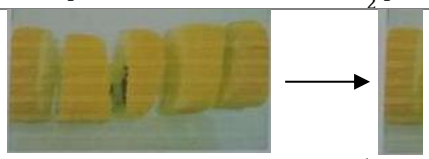
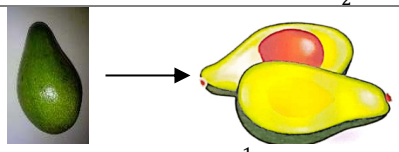
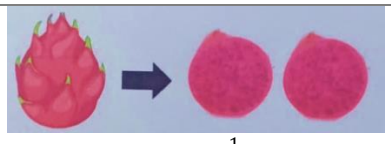
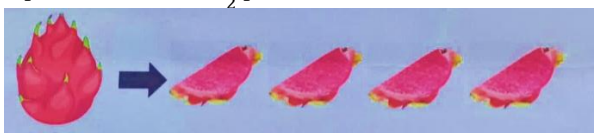
reduced and analyzed by researchers in the form of fractional concepts and context mapping.

3. Result and Discussion

3.1 Research result

The research results are described in the form of descriptive analysis data based on students' answers in finding the context and concept of fractions through a series of contexts presented by students. Students use a variety of contexts in everyday life. Some use food contexts in the form of sobek bread, wafers, pizza- shaped jelly candy, chewing gum, chocolate, biscuits, fruits such as apples, avocados, snake fruit, dragon fruit, there are also those who use the context of objects such as watercolors and human images. All of these contexts are the findings of all students who attended this lecture. The overall context used by students is described in table 1 below.

Table 1. Context of Fraction Material

Context	Fraction Concept
Chocolate 	
Snackfruit 	 3 parts $\frac{1}{3}$ parts
Biscuit 	 2 parts $\frac{1}{2}$ parts
Sobek Bread 	 5 pieces $\frac{1}{5}$ pieces
Wafer 	 1 pieces $\frac{1}{2}$ pieces
Avocado 	 1 part $\frac{1}{2}$ part
Dragon Fruit 	 1 part $\frac{1}{2}$ part  1 part $\frac{1}{4}$ part

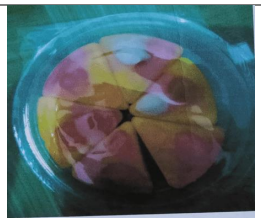
Context	Fraction Concept
	 1 part $\frac{1}{6}$ part
Apple 	 1 $\frac{1}{2}$ $\frac{1}{3}$
Human Image: Family Photos 	  2 members 4 members
Watercolor 	  12 colour $\frac{1}{12}$ colour
Pizza Shaped Jelly Candy 	  6 pieces $\frac{1}{6}$ pieces

Table 1 describes the discovery of fraction concepts found in various contexts resulting in various fraction forms such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{12}$, dan $\frac{2}{6}$. In addition, there were various student answers which were further analyzed by researchers regarding the use of context such as pictures 1, 2, 3, and 4.

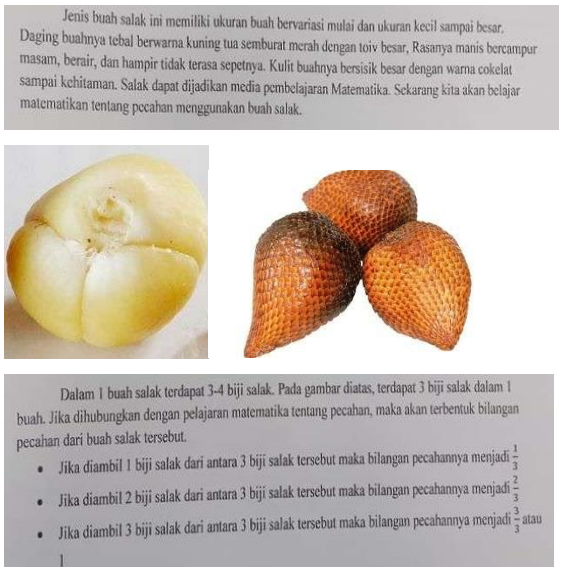
Figure 1 explains the concept of the fraction of salak fruit starting with the shape, color and taste of salak fruit. Apart from that, the concept of fractions can be seen from 1 snake fruit having 3-4 snake fruit seeds so that the possible fractions if 1 snake fruit has 3 snake fruit seeds are $\frac{1}{3}$, $\frac{2}{3}$, and $\frac{3}{3}$. However, if 1 snake fruit has 4 snake fruit seeds then the possible fractions are $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$ and $\frac{4}{4}$. The concept of fractional number material is in the form of a fractional number line. Based on the analysis of error answers to the concept of fractions, 1 snake fruit consists of 3-4 snake fruit seeds in the form of pieces of snake fruit with different sizes. The concept of fractions does not only apply to fruit, but also snacks, one of which is chocolate which is discussed in figure 2. The number of items given by the lecturer totaling 1 question. Documentation in the form of evidence of the results of the students exposure when explaining fractions through the context used by students.Observation is done by students in finding the context about fractions.

Figure 2 describes the thinking framework of S2 regarding the fraction of 1 chocolate bar consisting of 6 pieces which are distributed to 3 people so that each person gets 2 pieces of chocolate expressed in the form of the fraction $\frac{2}{6}$. The results of S2's answers show that there is a

concept of dividing fractions through 1 chocolate bar. Apart from snacks, concrete objects are used in the form of family photos such as picture 3.

Figure 3 shows that the image used is a picture of 1 family consisting of 4 people, namely father, mother and 2 children. S3 explains that there is a concept of fractions in the family picture. Based on the results of the analysis, the researchers found that there was an error in the concept of fractions because the family picture did not contain the same pieces. Each piece is different, some are small and large. This concept of fractional numbers is also found in the dragon fruit used by S4 as in Figure 4.

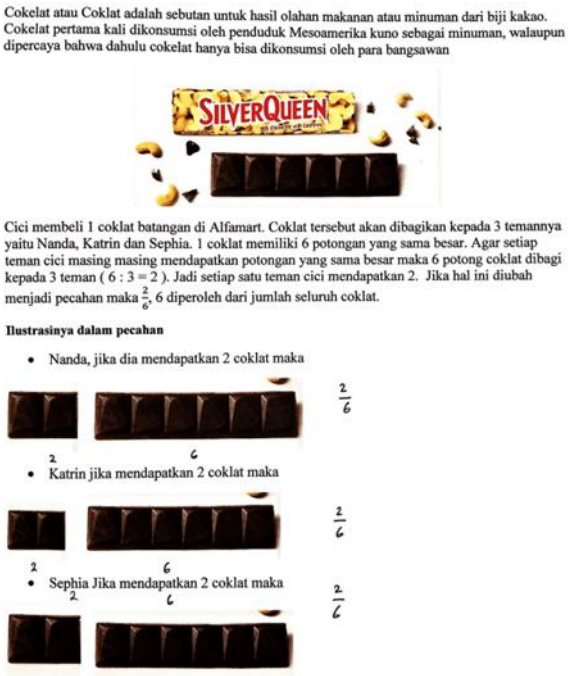
Figure 4 shows a dragon cut into several parts starting from 2 parts, 4 parts, and 6 parts so that the fractions $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{6}$ are obtained. Each piece of dragon fruit must be the same size so that the concept of fractional numbers is clearly visible on the dragon fruit. Here there is the concept of fractions which means justice. The entire context used is explained by students in turn, as shown in Figures 5, 6, and 7.



Snakefruit varies in size from small to large. The flesh of the fruit is thick, dark yellow and large, the taste is still a mixture of sour, watery, and almost does not taste astringent. The skin of the fruit has large scales with a brown to blackish color. 1 snake fruit contains 3-4 snake fruit seeds. In the picture on the side there are 3 snake fruit seeds. The concept of fractions is seen in the form of fractional numbers.

1. If 1 snakefruit seed is taken from among the 3 snake fruit seeds, the fraction number will be 1/3.
2. If 1 snakefruit seed is taken from among the 3 snake fruit seeds, the fraction number will be 2/3.
3. If 1 snake fruit seed is taken from among the 3 snake fruit seeds, the fraction number will be 3/3.

Figure 1. Results of "S1" Pre-service Primary Teacher School



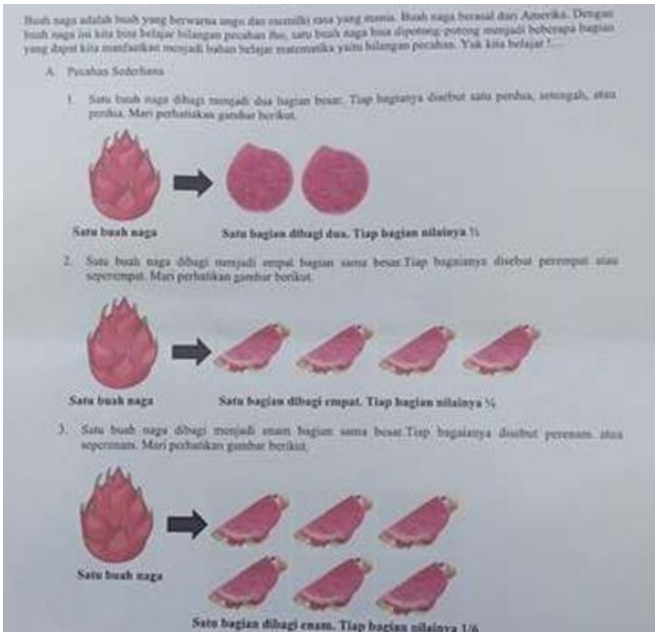
Chocolate is a processed food or drink made from cocoa beans which was consumed by ancient Mesoamerican people as a drink, although it is believed that in the past chocolate could only be consumed by nobles.

Cici bought 1 chocolate bar which she shared with 3 friends, namely Nanda, Katrin and Sephia. 1 chocolate has 6 equal pieces. So that each of Cici's friends gets the same size piece, 6 pieces of chocolate are divided among 3 friends (6 : 3 = 2). So, each of Cici's friends gets 2 pieces of chocolate which are expressed in shape $\frac{2}{6}$.

Figure 2. Results of "S2" Pre-service Primary Teacher School

Family photo consisting of 4 people, 2 of whom are parents, namely father and mother. The rest are children, what is the fractional share of the parents? The answer obtained is $\frac{2}{4}$ where the number 2 indicates the number of parents (numerator) and the number 4 indicates the number of all family members (denominator).

Figure 3. Results of "S3" Pre-service Primary Teacher School



Dragon fruit is a purple fruit with a sweet taste that originates from America. The concept of simple fractions is found in dragon fruit which is cut into several parts. 1 dragon fruit is cut into 2 parts to obtain the fraction number $\frac{1}{2}$. 1 dragon fruit is cut into 4 parts to obtain the fraction number $\frac{1}{4}$. 1 dragon fruit is cut into 6 parts to obtain the fraction number $\frac{1}{6}$.

Figure 4. Results of "S4" Pre-service Primary Teacher School

Figure 5. Presentation of S5, S6, and S7

Figure 6. S8's interactions with her peers

Figure 5(a) describes S5's explanation of the concept of fractions using an image of pizza consisting of 4 slices of pizza with the concept of pieces being the same size, resulting in a fraction of 1/4. Next, in Figure 5(b), S6 uses torn bread as a context for learning fractions. S6 tore the bread without using the right measurements so the concept of fractions conveyed was not correct. This is because the torn pieces of the bread are irregular so the context used does not explain the concept of fragments due to the irregular technique of tearing/dividing the bread.

In contrast, Figure 5(c) shows S7 which uses watercolors in a box as context. The box contains 12 watercolors in different colors. The use of a watercolor context is not the appropriate context to explain the concept of fragments because the watercolor box is not a piece/whole part of the watercolor. This means that in this case there is an error in using the context because of the watercolor and the box. Apart from presentations from students who were research subjects, interactions were found that were characteristic of PMRI as in Figure 6.

Figure 6 shows S8 using the context of chocolate whose slices are regular. At the beginning of the interaction, it shows that S8 explained about chocolate and the ingredients for making chocolate. There is interaction with colleagues in counting chocolate pieces. The number of chocolate pieces is 6 pieces. Next, S8 distributed chocolate to 3 of his colleagues. This shows the contribution of colleagues who explain the characteristics of PMRI.

The first colleague gets 1 piece of chocolate so that the fraction is 1/6. The second colleague gets 2 pieces of chocolate so the fraction is 2/6. The third colleague gets 3 pieces of chocolate to get the fraction 3/6. The concept that S8 wants to convey is the concept of dividing fractions. Not only that, S8 explained the importance of sharing with others if we have something that reflects PMRI principles, namely didactical phenomenology which is educational when introducing mathematical contexts and topics.

Figure 7 explains how S9 uses apples as context, starting by explaining the benefits of apples. Next, S9 uses a knife to divide 1 apple into 2 equal parts. These evenly sliced apples show the concept of a fraction, namely 1/2. This shows the ability of pre-service primary school teachers in various fraction material (Baharuddin et al., 2021).

3.2 Discussion

Ability to present mathematical concepts using context starting from the form of fractions, equivalent fractions (Agustyarini, 2021) to fraction calculation operations including division and multiplication of fractions (Novita et al., 2022; Pangaribuan et al., 2021). Through the results of a series of contexts used by students, it shows that most students already understand fractions (Karika & Csiko, 2022).

Apart from that, the use of this context indirectly influences students' perceptions of their understanding of fractions (Tastepe, 2023). This indicates that students discover about fractions through the use of the context of food and objects around them. Through the use of context that guides students' perceptions about fractions, it can become a basis for students' perceptions at the elementary school level about fractions as a whole, especially regarding content (Wardana & Damayanti, 2017),

The use of context is also an important part of the PMRI approach used by most researchers in the field of mathematics in introducing fraction material to students (Oktaviani et al., 2023; Haniek & Rianasari, 2015). Through the use of context, it leads students to discover various principles and characteristics of PMRI during the learning process.

Learning fractions using the PMRI approach brings out PMRI principles such as guided reinvention and progressive mathematics,

didactical model, and self-developed model. Apart from that, during the learning process PMRI characteristics are created through a series of activities including: 1) using context; 2) using models; 3) using student contributions; 4) use an interactivity format; 5) intertwinning (utilizing linkages) (Oktaviani et al., 2023; Agustyarini, 2021).

4. Conclusion

The concept of fractional numbers is a fundamental concept found in Lower Grade Mathematics Learning courses that needs to be understood by pre-service primary school teachers who will later become elementary school teachers. The use of context in the form of food and objects around us that can be studied in depth. The use of context becomes a bridge for learning mathematics which was initially abstract and becomes real in everyday life. The use of context is one of the PMRI characteristics which supports the emergence of other PMRI characteristics and principles.

When students use various contexts, the concepts of fractional numbers, fractional number lines, addition and division of fractions are discovered through the contexts used by S1 to S20. The concept of fractional numbers contains the meaning of fairness and dividing something in the same size. So it can be concluded, each student has different analytical skills regarding the context of daily life used.

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