How video and course manual support teacher students in designing a fraction context problem

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Abstract. Designing a context problem becomes one choice for teachers and it is adapted according students’ familiar situations in order students understand fraction concept. However, there is a need to support teachers or teacher students in designing a good context problem. Some learning sources that can be used are video and course manual. This article describes teacher students learning process in designing fraction problem using Palembang contexts and how their students work with the context. This study is a qualitative research type descriptive study and involved 21 Master students who joined PMRI course in even semester 2017/2018 academic year. Data is collected through students’ worksheet, observation, and interview. The result showed that teacher students figured out the criterias of a good context from fraction based context problems given, tried to adapt it into Palembang context and designed fraction based context problem using Palembang context such as pempek lenjer, martabak, and kojo cake which looked like similar with fraction based context problem given in course manual and short videos.

1. Introduction

One of approaches used in mathematics learning process in Indonesia is PMRI (Pendidikan Matematika Realistik Indonesia). This approach is adopted from Realistic Mathematics Education, an instructional theory which is developed in the Freudenthal Institute, Netherlands. PMRI has been implemented since 2001 and purposed to improve interest, attitude, and learning outcome of students in Indonesia [1-3]. In instructional process using PMRI, the activity is started from context or phenomena experienced by students. This aims to provoke students to construct their mathematical knowledge [4]. By using context, students build their understanding of mathematical concept through making representation of situation [5] and use it to work more formally, that is called mathematizing [6-9].

Many previous studies showed the use of context in learning process [10-13]. However, not all of context can be used in learning mathematical concept. It is not only used to motivate students but it also bridges students to extend their mathematical knowledge [4]. Teachers, as well as teacher students who become mathematics teacher in the future, need to understand what kind of contexts based problem that can help their students in learning mathematical concept. To help students gain a deep understanding of knowledge, Gueudet [14] argued that technologies and learning resources in mathematical education have good roles.

Two learning sources that can guide teacher students to understand context in PMRI are a course manual and also short video. Course manual is kind of manual that direct teacher students to understand the role of context in realistic mathematics education through some activities. Short video is also provided to give more information and explanation about good context and models in learning fraction.
Choosing these two sources in supporting teacher students’ understanding in designing context based problem, this study purposed to describe how teacher students work with these sources and how they help teacher students in designing good problem in fraction using Palembang context.

2. Methods
Qualitative research type descriptive study is chosen as research methodology in this study. It is a kind of study investigating quality of materials, situations, activities or relationship. It emphasizes on describing in detail what really happens in an activity or situation or describing behaviours of people rather than on comparing the effect of treatment [15]. Five steps in qualitative research [15, 16] are 1) Identifying the phenomenon studied, in this study, we would like to describe the quality of course manual and short video in supporting teacher students in designing fraction based context problem; 2) Identifying research subject in the study, as many as 21 Master students, who joined PMRI course in even semester 2017/2018 academic year, were involved; 3) Generalizing hypotheses, we predicted that the use of course manual and short video could support teacher students in designing a good fraction based context problem using Palembang context; 4) Collecting and analysing data - teacher students’ slide presentations, observation, video recording, and interview are used in getting deep information about what teacher students’ thinking process and data are analysing descriptively; 5) Interpreting and making conclusion, we refer to the criteria of good problem as a guideline in interpreting and making conclusion. Frans van Galen and Dolly van Eerde define a good problem as a meaningful and interesting problem that stimulates students to think [17].

3. Results and Discussion
Students were asked to read course manual and watch short videos that were designed and developed by Freudenthal Institute as resources to learn about contexts and models in mathematics education. Then, they were asked to do tasks in course manual, one of them was about designing the next activity that would help children to have further understanding of solving fraction problems. After students complete the task, they are asked to make slides presentation and explain it in front of the class. The following are a task in course manual and short video about context and model in mathematics education:

![Figure 1. A task in course manual and short video about contexts and models](image)

Putriarum [18] designed course manual containing the role of contexts and models in realistic mathematics education. One of tasks in course manual is shown in figure 1. Together with 4 short videos, the use of course manual and short video is aimed to support teacher student in designing a good fraction based context problem using Palembang context. Type of activities which was done includes watching videos, discussing, reflecting, observing children, and designing a contextual problem.

The course manual consist of 2 main chapters which has a set of activities in each chapter and are related one to another. Table 1 shows the description and goals of each chapter.
Table 1. The content of course manual

| Chapter | Description                                                                 | Goals                                                                                                                                                                                                 | Task                                                                                                                                  |
|---------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 1       | It explains how to solve mathematical problems in fractions using the context-based learning. It starts by understanding the prior knowledge of students on how they will solve the problems, evaluate their way of thinking, and then give some further insights to reach a better understanding | • Be able to find real-life relevant contexts that are related to fraction problems.                                                                                                               | 1.1 Who will get most, who will get least                                                                                           |
|         |                                                                             | • Be able to state their own opinions on how to solve fraction problems.                                                                                                                               | 1.2 How some course provider solve this problem                                                                                       |
|         |                                                                             | • Be able to explain their line of reasoning through media (in this case: poster).                                                                                                                    | 1.3 Intro to classroom video                                                                                                         |
|         |                                                                             | • Understand how the contexts in mathematics can be used to improve the teaching and learning process.                                                                                               | 1.4 How would children solve the problem?                                                                                            |
|         |                                                                             | • Understand the strategies that can be applied to teach students about fractions.                                                                                                                     | 1.5 Children’s Work                                                                                                                  |
|         |                                                                             |                                                                                                                                                                                                     | 1.6 An analysis of students work                                                                                                     |
|         |                                                                             |                                                                                                                                                                                                     | 1.7 What activity next                                                                                                              |
| 2       | It gives further explanation about the role of contexts in realistic mathematics education and how students will design and apply this context-based learning with Indonesian children in the classroom. | • Be able to explain the role of contexts in realistic mathematics education.                                                                                                                          | 2.1 The context of sharing                                                                                                           |
|         |                                                                             | • List down the strengths and weaknesses of context-based learning                                                                                                                                      | 2.2 The role of context in RME                                                                                                      |
|         |                                                                             | • Design a fraction problem using Indonesian context                                                                                                                                                     | 2.3 An Indonesian context                                                                                                           |
|         |                                                                             |                                                                                                                                                                                                     | 2.4 Field test your activity                                                                                                        |
|         |                                                                             |                                                                                                                                                                                                     | 2.5 Publication                                                                                                                     |

Table 1 describes the content structure of course manual. It is arranged systematically starting from the example of a good fraction problem using Submarine Sandwich Context, an America context, to designing fraction problem using Indonesia context. Chapter 1 in course manual together with the short video are given purposing to explain a good fraction based context problem and analysing student’s solution in order teacher students being able to predict students thinking and help them in learning fraction. Chapter 2 provoke teacher students to design similar fraction based context problem but using Indonesia context. Four short videos given also contain explanation about context. One video can be accessed at https://www.youtube.com/watch?v=Sy7KlKw6zXI&list=PLepcmKS2i3Q0-SlsVez-FzhOXXMX14Cg&index=2. Marteen dolk, as a lecturer who work at Freudenthal Intitute, elaborates the function of context and the criteria of good context. In his short video, Marteen Dolk explain why Submarine Sanwich context is agood fraction based context problem for children in US. The following is scene of short video when he mention the reasons.
Figure 2. Lecturer mentions some reasons why Submarine Sandwich is a good context for children in US

Figure 2 is a screenshot of one video clip containing about criterias of good context. In his explanation, Marteen mentioned that Submarine Sandwich ia a good context because it is familiar for US students; it is interesting; it provokes students to thing using whatever knowledge they have; students will use different approaches; students solution can be starting point for futher mathematizing; and it lead to bar model.

After teacher students read the course manual, watched short video, discussed, they presented their work in task 1.7 purposing to design the next activity that would help children to have further understanding of solving fraction problems based on Submarine Sandwich Context used in task 1.1. Then, they got some critical comments from their friends and also lecturers from Frudenthal Institute by online meeting. It aimed to train teacher students to convince the others by giving their reason and explain what their thinking. The following is teacher students’ work in designing fraction problem using Palembang context.

Figure 3. Teacher students’ work in designing fraction problem using Palembang context
Figure 3 shows one of student works using Pempek Lenjer context in designing a fraction problem. This context is almost similar with context given in course manual. This indicates that course manual designed gave good description of proper context used in fraction problem.

Learning resources in mathematical didactics, such as software, computer, online resources, textbook, etc, are needed for students, teacher, and teacher’s trainer etc [14]. In this study, course manual and short videos are chosen as learning resources that can be used by teacher students in understanding contexts and models in mathematics education. Structure of course manual is arranged systematically. It also give example of a good fraction based context problem and analysis of children solution of the problem. Furthermore, through systematical tasks in the course manual, it guides teacher students in designing fraction problem using Palembang context. Some context that they used such as kojo cake, pempek lenjer, and martabak. It is also common to use video in teacher preparation programs [19]. Short videos are given to teacher students containing explanation about the use of context and its criteria as a good context. From teacher students’ work in designing fraction problem using Palembang context, some of them were able to choose a good context in learning fraction. It is in line with what Coles did, Coles [20] showed how mathematics teacher learn from using video. Furthermore, the result of research done by Pepin [21] also showed that the use of digital resources support the understanding of students.

4. Conclusion
To help teacher students in designing fraction based context problem using Palembang context, course manual should be arranged systematically starting from criterias of good contexts to the example of designing good context based problems and it is supported by videos containing explanation about models and context in realistic mathematics education. Based on those two learning resources, teacher students figured out the criterias of good context from faction based context problem given, tried to adapt it into Palembang context and designed fraction based context problem using Palembang context such as pempek lenjer, martabak, and kojo cake which looked like similar with fraction based context problem given in course manual and short videos.

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