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PRIMARY TEACHERS' ABILITY IN DESIGNING AND SOLVING CONTEXTUAL PROBLEMS IN DIVISION WHOLE NUMBERS

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ABSTRACT

This study was aimed to describe primary school teachers' ability in designing and solving contextual problems especially in division of whole numbers. This research was held in KanisiusDemangan primary school in Yogyakarta with the subject 14 teachers. Data collection was gathered in the form of the written test at the end of the workshop. Thetest showed that there were 8 teachers that had good ability in designing and solving contextual problems in division whole numbers, 3 teachers not written the contextual problem, and the othor, 3 teachers had study to design contextual problem in division whole numbers. From the analysis, we found that a teacher is struggling in understanding the concept of the division on whole numbers andthere were 5 strategies used by the teachers in solving the problems. The strategies are multiplication invers, using horizontally repeated subtraction, vertically repeated subtraction, and modeling the contextual problem using pictures that closely related to the context.

Keywords: *primary teachers, ability in designing and solving problem, contextual problems, division.*

Nowdays, the quality of mathematics educations in Indonesia needs to be improved. The result of PISA and TEAMS shows that the competence of students in mathematics is still lacking. Indonesia was in rank of 64 from the 65 particiapating countries in 2012 and in 2015 Indonesia was in rank 69 from the 75 countries participating in PISA. PISA evaluates literacy skills, the skill to solve contextual problems in mathematics and application problems in mathematics. From the result indicates that ability in solving contextual problems in mathematics is still lacking.

TIMSS evaluates mathematics ability on 8th grade student in the content of number, algebra, geometry, data and change. One of competence in number especially whole numbers is compute (+, -, ×, ÷) with whole numbers (Gronmo, et all, 2015). The result of TIMS shows that mathematics achievement of Indonesia students was in rank 36 from the 49 countries in 2007 and in 2011 was in rank 39 from the 43 countries participating in TIMSS. We can say that ability in numbers domain is still lacking.

There are many factors that influence the lacking of ability both on numbers ability or literacy ability that include ability to solve contextual problems. One of the factors is teacher, especially primary teachers. Campbell,et all (2014) said that mathematics ability and pedagogy ability of primary teachers have positive correlation with student achievement in mathematics. Primary teachers teach basic competence in mathematics for the children, they formalize thinking pattern in mathematics to the students. Because of that, it is necessary to improve mathematics skill of primary teachers.

The result of study that done by Hadi (2002) shows that developing model to improve teacher's professionalism is introducing a new approach in learning mathematics that can enrich knowledge and increase teachers ability in mathematics. That approach is PMRI. Learning trajectory in PMRI is illustrated as ice-berg that concludes of mathematical world orientation, model material, building stone; number relations, and formal notation (Atmini, 2010). Mathematical world orientation means using contextual or daily problems to construct mathematics thinking. The solving of that problem is using model material, number relations, and formal notation. Based on the reasons, this study aims to describe primary school teachers' ability in designing and solving contextual problems especially in division of whole numbers.KanisiusDemanganBaru primary school wants to improve students achievement in mathematics, so this study is held in KanisiusDemanganBaru primary school.

PMRI is adapted from RME, Realistic Mathematics Education that occurred in Netherland. Realistic mathematics education is founded by Freudenthal. RME take starting point in the activity of mathematics, whether pure or applied mathematics. Activity of mathematics is as an activity of problem solving, looking the problems and organizing a subject matter-whether mathematical matter or data from reality. Marpaung… said that Learning trajectory in PMRI is illustrated as ice-berg that concludes of mathematical world orientation, model material,

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building stone; number relations, and formal notation (Atmini, 2010).

The key process and goal for realistic mathematics educations is mathematizing, this can involve mathematizing mathematics and mathematizing reality. Realistic mathematics educations elaborate three key principles that can be seen as heuristics for instructional design. They are 1) reinvention/mathematizing, 2)didactical phenomenology, and 3) self-developed models (Gravemeijer, 1994).

Reinvention/mathematizing similar solution procedures create the opportunity for the reinvention process. Reinvention process can be look at figure below.

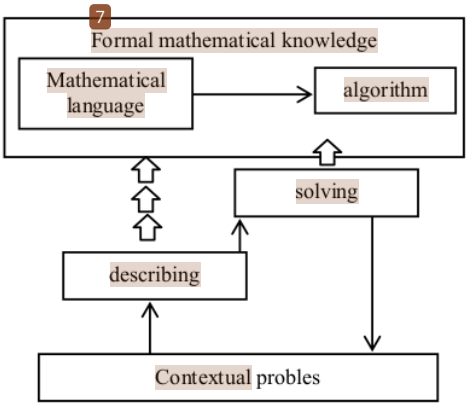

Figure 1. Reinvention (Gravemeijer, 1994: 94)

According didactical phenomenology, situations where a given mathematical topic is applied are to be investigated to reveal the kind of applications that have to be anticipated in instruction and to consider their suitability as points of impact for a process of progressive mathematics (Gravemijer, 1994: 90). Self-developed models play in bridging the gap between informal knowledge and formal mathematics.

The three principles of realistic mathematics education approach explain that to learn a material such as long division is based on student activities. First, division is associated with real-life activities, here students bring on their situation knowledge and strategies and apply them in the situation. This step is not boundaries by procedure. The next, students create a model of this situation, division problem is modelled by repeated subtraction. The last, the students write algorithm for long division.

From the explanation of realistic mathematics education, PMRI also based on the mathematics philosophy that mathematics as human activity. Similar with in realistic mathematics education, in PMRI a problem is called realistic problem if that problem can be imagine by students. PMRI approach is a method used in teaching and learning mathematics by associating learning to imaginable situation by students or to daily life problems (Wijaya, 2011).

METHOD

The subject is 14 KanisiusDemanganBaru primary teachers. The teachers are not only mathematics teacher but also class teachers. This is a qualitative research and data collection was gathered in the form of the written test. Primary teachers' ability in designing and solving contextual problems in division of whole number is based on PMRI approach which to explain division whole number must be presented in contextual problems in real life before be solve with many strategies. Based on PMRI, there are many strategies to solve division problem. There are informal procedures (dividing on a geometrical basis, distributing one by one, grouping, using multiplications fact) and formal procedures (repeated subtraction and long division). Data are analyzed qualitatively by data reduction, data presentation, and conclusion (Miles and Huberman, 1994).

FINDING AND DISCUSSION

After primary teacher school is introduced about PMRI approach, they do test to measure ability in designing and solving contextual problems. Based on PMRI theory, teaching and learning must be associated with imaginable problems or daily life (Wijaya, 2011). First problem in test is how to design contextual problem 48÷6. After designing in contextual problem, teachers solve the problem. There are many solutions wrote by teachers.

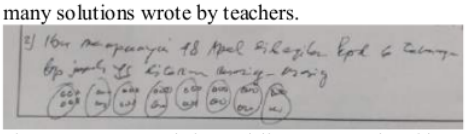

Figure 2. Error Sample in Modeling Contextual Problem in Division

Figure 2 shows that teacher has problem in solving contextual problem especially modelling the problem. Modelling the problem is unstructured procedure to make imaginable problem for students. The correct one, division number i.e 6 must illustrate the number of circle and not number of apple.Besides that, teacher only write the contextual problem without solve the problem.

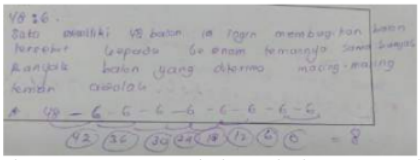

Figure 3. Correct Sample in Designing Contextual Problem in Division

Figure 3 shows that teacher can design the contextual problem and solve the contextual problem. The contextual problem solve by horizontally repeated subtraction strategy. 6 other teachers, 3 of them don't write the contextual problem and 3 of them had study to design contextual problem as a Figure 3. The similar error also is found on answering other division problem in figure below.

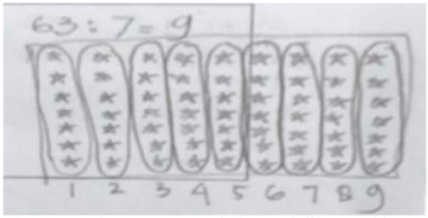

Figure 4. Other Error Sample in Modelling Problem

After teacher designing the division problem to contextual problems, the teachers solve the contextual problems. Data test show that there are many strategies used to solve the division problems. The strategies are horizontally repeated subtraction, vertically repeated subtraction, long division, and using multiplication invers. The strategies can be seen in many figures below.

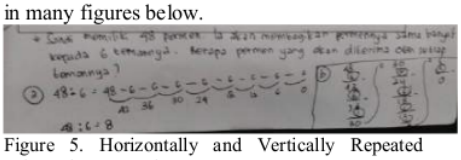

Figure 5. Horizontally and Vertically Repeated Subtraction Strategies

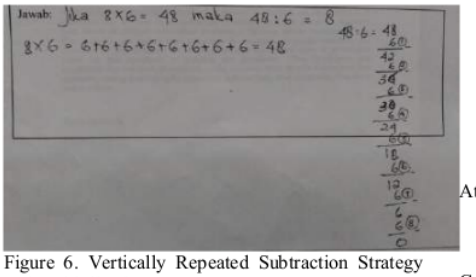

Figure 6. Vertically Repeated Subtraction Strategy and Multiplication Invers Strategy

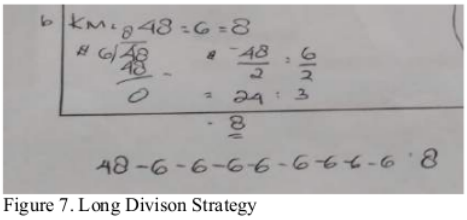

Figure 7. Long Divison Strategy

Although many teachers can write the solution in division problems, many of them only write a strategy to solve contextual program. The completely data about primary teachers' ability in designing and solving contextual problem in whole number can be seen in table below.

Table 1. Completely Data of Primary Teachers' Ability

	Ability in Design CP			Strategies to solve CP
	Correct	Incorrect	No Solution	
T1			√	-
T2	√			Long Division(1), Horizontally Repeated Subtraction(2)
T3			√	Multiplication invers(3), Vertically Repeated Subtraction(4)
T4		√		Modelling (5)
T5		√		Not Correct in modelling (5)
T6			√	-
T7		√		Vertically Repeated Subtraction (4)
T8	√			Horizontally Repeated Subtraction(2)
T9	√			
T10	√			-
T11	√			Vertically and Horizontally Repeated Subtraction (2) and (4)
T12	√			Modelling (5)
T13	√			Vertically Repeated Subtraction (4)
T14	√			-

From the table, researcher can't conclude the ability of T1 and T5 in design and solving contextual problem of division. But there is one teacher that misunderstanding in solving division problems.

CONCLUSION

The test showed that there were 8 teachers that had good ability in designing and solving contextual problems in division whole numbers, 3 teachers not written the contextual problem, and the other, 3 teachers had study to design contextual problem in division whole numbers. From the analysis, we found that a teacher is struggling in understanding the concept of the division on whole numbers and there were 5 strategies used by the teachers in solving the problems. The strategies are multiplication invers, using horizontally repeated subtraction,vertically repeated subtraction, andmodeling the contextual problem using pictures that closely related to the context.

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