The Development of Realistic Mathematics Education (RME) Model for the Improvement of Mathematics Learnings of Primary Teacher Education Program (PGSD) Students of Teacher Training and Education Faculty (FKIP) of Sebelas Maret University in Kebumen

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ABSTRACT

The present research seeks to describe: (1) procedures of the implementation of RME model, (2) improvement of mathematics learning using RME, (3) contraints and solutions in the implementation of RME, (4) curriculum reconstruction of Mathematics Education course of Primary Teacher Education Program, and (5) drafting of textbooks of Primary Mathematics Education. Classroom Action Research (CAR with series of cycles) involving such steps as (1) planning, (2) action, (3) observing, and (4) reflecting was employed. The research subject included third and fourth semester students of Primary Teacher Education Program of Teacher Training and Education Faculty of Sebelas Maret University in Kebumen in Academic Years 2013/2014 and 2014/2015. Data were collected using: (a) observation, (b) interview, and (d) test, and then validated using data and methodological triangulations. Afterwards, they were analyzed using qualitative analysis comprising three streams of activities: data reduction, data display, and conclusion drawing. The research finds out: (1) RME model development to find out appropriate procedures in mathematics learning for students of Primary Teacher Education program, (2) improvement of process and outcome of mathematics learning in Primary Teacher Education program with RME, (3) constraints and solutions in the implementation of RME on students of Primary Teacher Education Program, (4) curriculum reconstruction of Mathematics Education course of Primary Teacher Education Program, (5) textbooks of Primary Mathematics Education.

Keywords: Realistic, Mathematics, Education.

1. INTRODUCTION

Mathematics (math) is a universal science underlying modern technological development. In order to master and create modern technologies in the future, strong mastery of early math skills is required. Mathematics, therefore, is compulsorily taught to students since they are in primary school in order to equip them with ability of logical, realistic, analytical, systematic, critical, and creative thinking.

To support a well-organized learning process, effective learning strategies are needed, but the effective learning often requires sufficient media or audio visual aids which are suitable for all topics (regarding that not all of the audio visual aids are suitable for all kinds of topics. Mathematics learning should begin with problems in everyday life which are related to subject matter being taught. Students, hence, are gradually guided to master the closest to the furthest, the most simple to the most complex, concrete to abstract mathematical concepts. Piaget argues that children in the concrete operational stage (typically aged between 7-11/12/13/sometimes more—considered as year group at primary school level) are capable of logical thought under concrete circumstances. It is, therefore, important to select an approach to mathematics learning which is based on concrete environment in primary school students' everyday life. In addition, teachers are required to either avoid abstract subject matter or visualize them into the students' real life previously or frequently experienced. The learning should start from the closest, the most concrete and realistic environment so that the students will understand the provided subject matter better considering that they indeed come from phenomena occurring in everyday life and are represented in mathematical sentences.

An approach to learning is one of key factors supporting optimal learning outcome achievement. The emerging problem is neither on mathematical terms nor on calculation, but rather on the subject matter taught and approaches used in the learning. It is, therefore, crucial for teachers to try to optimize the use of the approaches to the learning in each learning, particularly that of mathematics. To achieve teacher competency and qualification, Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University attempts to maximally produce competent and professional prospective primary school teachers. For that reason, both in-class and out-class learning processes should be systematically managed.

With regard to findings of previous research conducted to students of Primary Teacher Education Program of Teacher Training and Education Faculty of Sebelas Maret University as prospective primary school teachers, it is found that since they were graduated from Senior High School/ MA (Islamic Senior High Schools)/ Vocational High School, they have fair level of knowledge of mathematical concepts, but poor pedagogical competence and learning method. The need to equip them with learning strategy, approach, method, technique in accordance with their scope of work in primary school, hence, emerges. The urgent need in learning process along with less-sufficient availability of audio visual aids leads to less-optimal learning, particularly that of Primary Mathematics Education course. The course is considered the most feared course and therefore it is not easy to master. The less-optimal mathematics learning is resulted from the less-sufficient availability of audio visual aids, whereas in fact more subject matters need the audio visual aids to support learning and teaching. Due to the less-sufficient availability of the audio visual aids, the students have not maximally explored and developed suitable media or audio visual aids to encourage the mathematics learning in primary school.

As a lecturer of Mathematics course, I am concerned and wonder how they can be competent and professional primary school teachers if they have experienced less-meaningful learning in their higher education. Their poor ability to master mathematical concepts is caused by less-sufficient availability of such facilities as audio visual aids, or less chance of designing the audio visual aids. For that reason, it is better for the students to be given a chance to design and create the audio visual aids suitable for a topic, as well as to use them in simulation so that their lecturers can provide feedback and suggest improvement of their concept. It is believed that a good concept results in effective and efficient mathematics learning. Then, it leads to a qualified learning and finally to better mathematics achievement (score).

It is surely not impossible to achieve provided that Realistic Mathematics Education (RME/ *Pendidikan Matematika Realistik—PMR*) is applied. RME refers to an approach in which mathematics class is not considered as a place to transfer knowledge of mathematics from a teacher to students, but rather a place where students can reinvent mathematical ideas and concepts through exploration of real problems. Mathematics is regarded as human activity which begins with problem solving (Dolk in Aisyah et al., 2007: 73). The model requires a teacher to serve as a facilitator, establish interactive learning environment, and be active in construing problems in real life and in relating Mathematics curriculum with real life, both physically and socially. For that reason, students' reasoning ability will also be determining factor in construing the problems in everyday life into mathematical sentences.

Realistic Mathematics Education (RME) is an approach in mathematics education which was first introduced and developed in 1971 by a group of mathematicians from Freudenthal Institute of Utrecht University of the Netherlands. The approach is based on Hans Freudenthal's (1905-1990) view that mathematics is human activity. Mathematics class is not considered as a place to transfer knowledge of Mathematics from a teacher to students, but rather a place where students can reinvent mathematical ideas and concepts through

exploration of real problems. Mathematics is regarded as human activity which begins with problem solving. The students should not be considered passive recipients, but rather they should be given a chance to reinvent mathematical ideas and concepts under the guidance of their lecturer. The reinvention is developed through the learning of various real daily-life problem situations. Real life is defined as anything beyond mathematics, such as daily life, surrounding environment, even other subjects. It is used as a starting point of the mathematics learning. To prove that a process is more important than an outcome, a term 'mathematization' is used in RME to refer to a mathematizing process of realistic contexts. It is illustrated by de Lange (in Hadi, 2005: 19) as an endless circle.

Gravemeijer (1994: 82) states that RME is rooted in Freudenthal's interpretation of mathematics as human activity. Freudenthal takes his starting point in the activity of mathematicians, whether pure or applied. He characterizes their activity as an activity of solving problems, looking for problems, and organizing subject matter—whether it belongs to mathematical matter or matter from reality. According to Freudenthal, the latter activity—organizing or mathematizing—serves as the main activity. Interestingly, he sees it as a general activity which represents typical characteristics of both pure and applied mathematics. Consequently, when setting 'mathematizing' as a goal for mathematics education, it can cover mathematizing mathematics and mathematizing reality. This implies that RME is mainly a combination of constructivist and contextual approaches in the sense that it provides an opportunity for the students to construct their understanding of mathematical ideas and concepts through real world problem solving (contextual). To make it clearer, a brief explanation of theory and basic principles of RME is presented.

Gravemeijer (1994: 90) mentions three main principles in RME:

> The first principle is termed "guided reinvention" and progressive mathematizing. According to the reinvention principle, the students should be given the opportunity to experience a process similar to the process by which mathematics was invented.
>
> The second principle relates to the idea of a didactical phenomenology. According to a didactical phenomenology, situations where a given mathematical topic is applied are to be investigated for two reasons. Firstly, to reveal the kind of applications that have to be anticipated in instruction, secondly, to consider their suitability as points of impact for process of progressive mathematization.
>
> The third principle is found in the role which self-developed models play in bridging the gap between information knowledge and formal mathematics.

Hadi (2005: 7) proposes the RME to combine perspectives of what mathematics is, how students study mathematics, and how mathematics should be taught. This theory is based on Freudenthal's view that mathematics is realistic activity and should be linked significantly to reality (real world). In RME, the real world is used as a starting point to develop mathematical ideas and concepts.

It is, therefore, concluded that RME is defined as an approach which utilizes or relates subject matter with real problems, in this case problems experienced (activity) by human in their everyday life through both horizontal and vertical mathematization. The learning through RME emphasizes more on students' real context and the construction of knowledge of mathematics is carried out by students.

According to Gravemeijer (in Tarigan, 2006: 6), RME is characterized by: (a) the use of real world context, (b) vertical instrument (the use of models), (c) students' contribution (the use of production and construction), (d) interactive activity (the use of interactivity), (e) topic relatedness (the use of relatedness). This means that RME belongs to: (a) 'active students' way of learning' since the mathematics learning is conducted by 'learning by doing',

(b) student-centered learning since the students solve their problem themselves according to their ability—in this case, their teacher merely serves as a facilitator, (c) guided inquiry-based learning since the students are required to invent and reinvent mathematical concepts and principles, (d) contextual learning since the starting point of mathematic learning is contextual matter—which includes students' problem in their everyday life, and (e) constructivist learning since the students are guided to reinvent their knowledge of mathematics by themselves by solving problem and discussing. In reference to the characteristics, the mathematics learning using RME is carried out in several steps, including:
(1) understanding problem/ context, (2) explaining contextual problem, (3) solving contextual problem, (4) comparing and discussing answers, and (5) drawing conclusion.

In reference to the above explanation on research background, research questions are formulated as follows: (1) how is the implementation of RME model for the improvement of mathematics learning for students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen? (2) can the model development improve the mathematics learning for the students? (3) what are constraints and solutions in developing the model to improve the mathematics learning for the students? (4) how is Mathematics Education course of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen reconstructed? (5) how are textbooks for Mathematic Education course drafted based on RME? The research aims at providing clear and detailed explanation on: (1) procedures of the implementation of RME model for the improvement of mathematics learning for students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen, (2) the improvement of mathematic learning using RME for the students, (3) constrains and solutions during the implementation of RME for the improvement of mathematics learning for the students, (4) RME-based curriculum reconstruction of Mathematic Education course of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen, (5) RME-based drafting of textbooks of Primary Mathematics Education.

2. RESEACRH METHOD

Design of Classroom Action Research (CAR with series of cycle) was utilized in the present research. It comprises two cycles, each of which covers three meetings. Each meeting simultaneously involves four steps: (1) planning, (2) action, (3) observing, and (4) reflecting. They are regarded a spiral of steps continuously conducted to find out optimal results.

The research was carried out in Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University located at Jl. Kepodang 67A Kebumen 54312, Kebumen Regency of Central Java. The campus which is located outside its main campus—Sebelas Maret University, Kentingan—belongs to the Faculty of Teacher Training and Education of Sebelas Maret University. It has been an integral part of central campus of Surakarta since the conversion of School of Teacher Education (SPG) to Two-year Diploma Program of Primary Teacher Education (D-2 PGSD) in 1990/1991 and is currently

known as the sixth campus of Faculty of Teacher Training and Education of Sebelas Maret University.

The research was conducted for two years in Academic Years 2013/2014 and 2014/2015 starting from January 2014 to November 2015. Classroom Action Research (CAR) was employed. The research subject includes all students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen comprising 73 fourth semester students taking Primary Mathematics Education course 2 (3 credits) in Academic Year 2013/2014 and 71 third semester students taking Primary Mathematics Education course 1 (3 credits) in Academic Year 2014/2015.

Data sources cover: (1) students, (2) peer observer, and (3) researcher. Data were collected using: (1) observation, (2) test, (3) interview, (4) documentation. To maintain the data validity, such triangulations as data and methodological triangulations were applied. In the former triangulation, the students, peer observer, as well as the researcher himself were involved, while in the latter, methods of observation, interview and discussion, as well as test were utilized. Both triangulations encompassed such procedures as seeking information/ conducting discussion with students and peer observer and drawing conclusion related to research questions.

The data were then analyzed using descriptive qualitative data analysis covering three streams of activity simultaneously and continuously performed during and after data collection: (1) data reduction, (2) data display, and (3) conclusion drawing or data verification.

3. RESULTS AND DISCUSSION

In reference to the aforementioned research questions, research objectives, and data analysis, the research results are discussed as follows:

1. The Implementation of Realistic Mathematics Education (RME) Model for the Improvement of Mathematics Learning for Students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen

Based on Cycle I and II results, the description of the development of RME model to improve mathematics learning for students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen is illustrated below:

Table 1: Observation Results of the Implementation of Learning Using RME Model in Cycle I and II

No	RME Steps	Score of Lecturer's Activities		Score of Students' Activities		Mean score
		Cycle I	Cycle II	Cycle I	Cycle II	
1	Understanding problem/ context	3.7	3.7	3.4	3.6	**3.6**
2	Explaining contextual problem	3.5	3.5	3.4	3.5	**3.5**
3	Solving contextual problem	3.6	3.8	3.1	3.5	**3.5**
4	Comparing and discussing answers	3.5	3.6	3.3	3.4	**3.5**
5	Drawing conclusion	3.5	3.6	3.2	3.5	**3.5**
		3.6	**3.6**	**3.3**	**3.5**	**3.5**

Note: Score of 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

By referring to analysis results of the characteristics and procedures of the implementation of RME, learning scenario using 5 steps with explanation of activities is constructed below:

Step 1: Understanding daily problem/ context which involves activities of (a) creating a classroom atmosphere for learning activities, (b) explaining learning objectives intended to achieve, (c) starting the learning by providing examples of problems of mathematics learning in everyday life, (d) demonstrating the problem solving using suitable audio-visual aids, and

(e) providing questions about problem solving which are frequently found in real life and are related to mathematics learning.

Step 2: Explaining contextual problem which includes activity of: (a) asking students to prepare discussion forum, (b) explaining the discussion procedures, (c) assigning discussion about mathematics learning to groups of students, (d) asking the students to prepare media/ audio-visual aids in accordance with their task role, (e) asking the students to conduct the discussion in accordance with their task role, (f) asking the students to relate data with mathematical concepts, (g) guiding the students to reveal the answers of the questions related to problems in the mathematics learning, (h) guiding the students to discuss and reveal information of problems in mathematics learning.

Step 3: Solving contextual problems including some activities: (a) directing students to prepare visual aids in coping with mathematics learning problems, (b) guiding students in using visual aids to solve problems in mathematics learning, and (c) guiding students to prepare mathematics learning models using appropriate visual aids.

Step 4: Comparing and discussing answers which include the following activities: (a) providing students with guidelines to solve problems in mathematics learning based on their own experiences, (b) monitoring students' activities when solving problems/doing tasks periodically, (c) requiring students to present their working results in mathematics learning consecutively in class, (d) serving as moderator and facilitator in class discussion, (e) inviting students to give responses to other students' presentation in class discussion forum in mathematics learning, (f) inviting students to make a reflection on the results of their presentation in mathematics learning, and (g) together with students, concluding the results of presentation and class discussion to be used as reference for mathematics learning.

Step 5: Drawing conclusion which comprises several activities: (a) students analyze mathematics curriculum at primary school, (b) students arrange competencies that have to be mastered by prmary school students in mathematics learning, (c) students arrange lesson plans for mathematics learning for primary school students, (d) students implement the lesson plans in peer teaching, (e) students perform class discussion and reflection towards the lesson plans that have been practiced in peer teaching, (f) students provide feedbacks for lesson plans that have been practiced, and (g) students draw conclusion on lesson plans that have been composed and practiced.

2. The Improvement of Mathematics Learning through the Development of Realistic Mathematics Education (RME) Model for Students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen

On the basis of the results of post-test in cycle I and II learnings, the following data were obtained:

Table 2 : The Comparison of the Learning Outcomes in Cycle I and Cycle II

Score	Frequency of	Frequency of	Frequency of	Note(s)

	Pre-test	Cycle I	Cycle II	
0 – 9	0	0	0	Failed
10 – 19	1	0	0	Failed
20 – 29	10	0	0	Failed
30 – 39	8	0	0	Failed
40 – 49	37	1	2	Failed
50 – 59	10	1	2	Failed
60 – 69	7	5	25	Passed
70 – 79	0	14	17	Passed
80 – 89	0	35	23	Passed
90 – 100	0	17	4	Passed
Total	73	73	73	
Lowest Score	16	24	44	
Highest Score	64	68	100	
Average	43.29	48.16	73.70	

In reference to the above table, it is presented that there was a significant improvement of learning achievement in both cycles. The lowest pre-test score was 16. The score was improved to 24 in cycle I, and 44 in cycle II, respectively. The highest score in pre-test was 64, and it became 68 in cycle I and 100 in cycle II. The average score of pre-test was only 43.29. The average score reached 48.16 in cycle I and 73.70 in cycle II. This indicates that there was a significant improvement of competency in each cycle.

3. Constrains and Solutions in the Development of Realistic Mathematics Education (RME) Model for the Improvement of Mathematics Learning of Students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen

On the basis of the results of observation and data analysis on learning using Realistic Mathematics Education (RME) model in cycle I and cycle II, data of constraints and solutions were obtained.

Table 3. Recap of Constraints and Solutions in Cycle I and Cycle II

Cycle	Contraints (s)	Solution (s)
I	1. Students do not have adequate understanding on mathematics teaching materials for primary school,	1. Reinforcing the mastery of teaching materials and mathematical concepts in primary school,
	2. Students are not familiar enough with problems in learning mathematics related to in daily life,	2. Reinforcing the relationship between teaching materials and problems in daily life,
	3. Students are not quite familiar with the usage of teaching media/visual aids in mathematics learning,	3. Reinforcing identification and usage of media/visual aids for mathematics learning in primary school,
	4. Students do not master various approaches in mathematics learning well,	4. Reinforcing the mastery of various approaches in mathematics learning in primary school,
	5. Students do not acquire skill well in arranging lesson plans for mathematics	5. Reinforcing the arrangement of lesson plans,

	learning in primary school, 6. Students are not skilled enough in the simulation of mathematics learning in primary school.	6. Reinforcing simulation of mathematics learning in primary school.
II	1. Students do not acquire skill well in arranging lesson plans for mathematics learning in primary school, 2. Students are not skilled enough in the simulation of mathematics learning in primary school.	1. Reinforcing the arrangement of lesson plans, 2. Reinforcing the simulation of mathematics learning in primary school.

Based on the above table, it can be concluded that the development of Realistic Mathematics Education (RME) model to improve mathematics learning of students of Primary Education Program of Teacher Training and Education Faculty of Sebelas Maret University at Kebumen campus faces some obstacles, including: (1) students do not have adequate understanding on mathematics teaching materials for primary school, (2) students are not familiar enough with problems in learning mathematics related to problems in daily life, (3) students are not quite familiar with the usage of teaching media/visual aids in mathematics learning, (4) students do not well master various approaches in mathematics learning, (5) students do not acquire skill well in arranging lesson plans for mathematics learning in primary school, and (6) students are not skilled enough in the simulation of mathematics learning in primary school. Solutions for the difficulties comprise: (1) reinforcing the mastery of teaching materials and mathematical concepts in primary school, (2) reinforcing the relationship between teaching materials and problems in daily life, (3) reinforcing identification and uses of media/visual aids for mathematics learning in primary school, (4) reinforcing the mastery of various approaches in mathematics learning in primary school, (5) reinforcing the arrangement of lesson plans, and (6) reinforcing simulation of mathematics learning in primary school.

4. Reconstruction of Curriculum for Mathematics Learning

In reference to the results of analysis and recommendation for curriculum development, reconstruction of curriculum for mathematics learning of students of Primary Education Program of Teacher Training and Education Faculty of Sebelas Maret University at Kebumen campus based on Realistic Mathematics Education (RME) was carried out. The reconstruction is explained below.

a. Primary Mathematics Education I (3 credits/semester III)

The Core Competencies (KI) of this course are to master and to be skilled in implementing learning theories, strategies, approaches, methods, media and assessments, as well as to be skilled in applying mathematics learning for primary school on numbers and symbols, whole numbers, integers, round numbers, prime numbers, composite numbers, greatest common factor, least common denominator, fraction, and rational numbers, as well as their application in daily life. The competencies are broken down into 12 Basic Competences, i.e. students master and are skilled in applying: (1) various theories of mathematics learning in primary school, (2) a number of strategies, approaches and methods in mathematics learning in primary school, (3) various media for mathematics learning in primary school, (4) various assessment techniques of mathematics learning in primary school, (5) development of curriculum for mathematics learning in primary school, (6) learning of numbers and symbols in primary school, (7) learning of whole numbers and integers in primary school, (8) learning of round numbers in primary school, (9) learning of greatest common factor and least common denominator in primary school, (10) learning of fraction, comparison and scale in primary

school, (11) learning of rational numbers in primary school, and (12) development of curriculum for mathematics learning in primary school.

b. Primary Mathematics Education 2 (3 credits/Semester IV)

The Core Competencies of this subject are to master and to be skilled in implementing methodology and procedures of mathematics learning in primary school for several scopes of study, including plane geometry, solid geometry, measurement, statistics and opportunity, and the application in daily life. The Core Competencies are broken down into 5 Basic Competences, i.e. students master and become skillfull in applying: (1) curriculum for mathematics learning in primary school for plane geometry topic in accordance with learning competences and grade levels, (2) mathematics learning in primary school for solid geometry topic based on learning competences and grade levels, (3) mathematics learning in primary school for measurement topic according to learning competences and grade levels, (4) mathematics learning in primary school for statistics topic in accordance with learning compteneces and grade levels, and (5) learning mathematics in primary school for opportunity topic based on learning competences and grade levels.

5. Textbooks for Primary Mathematics Education Course

By referring to the results of curriculum analysis on the subjects of Primary Mathematics Education 1 and Primary Mathematics Education 2, as well as curriculum development program based on the implementation of Realistic Mathematics Education-based learning model, the development of teaching materials for Primary Mathematics Education is done. By considering the description of Primary Mathematics Education 1 and Primary Mathematics Education 2 courses, textbook of "Guidelines for Primary Mathematics Learning (for Primary School Teachers and Prospective Teachers)" is drafted. This is carried out since Primary Mathematics Education 1 and Primary Mathematics Education 2 are two interconnected and continous courses. Primary Mathematics Education 1 is prerequisite course before taking Primary Mathematics Education 2. "Guideliness for Primary Mathematics Learning (for Primary School Teachers and Prospective Teachers)" consists of 17 chapters. Chapter 1 to chapter 12 discuss about teaching materials which are presented in Primary Mathematics Education 1 with 3 credits in the third semester. Meanwhile, chapter 13 to chapter 17 talk about teaching materials which are presented in Primary Mathematics Education 2 with 3 credits in the fourth semester. The book was printed with ISBN Number 978-979-498-975-3 by UNS Press in 2015, and has been used.

***7.* The Results of Realistic Mathematics Education (RME) Model Tryouts**

The results of RME model development, reconstruction of curriculum for Primary Mathematics Education course, and the composition of RME-based textbooks is presented below:

Table 4: The Observation Results of RME Implementation in Cycle I and Cycle II (Lecturer)

No	RME Steps		Cycle I	Cycle II	Average
1	Understanding daily problems/contexts		3.31	3.27	3.29
2	Explaining contextual problems	2.97	3.41	3.19	
3	Solving contextual problems	3.21	3.38	3.30	
4	Comparing and discussing answers	3.32	3.34	3.33	
5	Drawing conclusion	3.14	3.27	3.21	
	Average	3.61	3.78	3.70	

Note(s): Scores 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

Table 5: The Observation Results of RME Implementation in Cycle I and Cycle II (Lecturer)

No	RME Procedures	Cycle I	Cycle II	Average
1	Understanding daily problems/contexts	2.73	3.07	2.90
2	Explaining contextual problems	2.94	3.36	3.15
3	Solving contextual problems	3.03	3.30	3.17
4	Comparing and discussing answers	2.78	3.24	3.01
5	Drawing conclusion	2.62	3.04	2.88
	Average	3.19	3.63	3.41

Note(s): Scores 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

Procedures of learning using RME model include: (1) understanding problems/contexts in daily life, (2) explaining contextual problems, (3) solving contextual problems, (4) comparing and discussing answers, and (5) drawing conclusion. From those five learning procedures, score above 3.70 is obtained (good). This means that the learning activity has gone as planned. Some difficulties have been faced, comprising the limitation of time for discussing lesson plan and conducting presentation. Hence, additional time needs to be allocated for the activities.

Further, based on procedures of learning using RME, the learning outcomes of students in cycle I and cycle II are as the followings:

Table 6: Outcomes of Learning using RME in Cycle I and Cycle II

Score	Post-test Frequency in Cycle I	Post-test Frequency in Cycle I	Note(s)
50 – 59	0	0	Failed
60 – 69	0	5	Passed
70 – 79	67	16	Passed
80 – 89	4	40	Passed
90 – 100	0	10	Passed
Total	71	71	
Average	72.58	80.39	
Lowest Score	70	60	
Highest Score	80	95	
Completion (%)	100	100	

From the results of tryouts for the implementation of RME model comprising 2 cycles above, it can be concluded that the learning process goes smoothly as planned. The implementation of RME model is also effective for improving learning process and students' outcomes. Students' active performance and involvement increase and meet the expected competences. However, there are a number of learning constraints faced by lecturers and students. Lecturers face some difficulties, for instance, limitation of time for discussion in order to arrange lesson plans. Meanwhile, students are obstructed by their lacking of understanding on learning objectives they want to achieve. Those problems are overcome by allocating more time for the activities and make tragetted learning objectives clearer.

4. CONCLUSION

On the basis of research problems, research objectives, and the results of data analysis, conclusion can be drawn as the followings:

1. The implementation of Realistic Mathematics Education (RME) model for the improvement of mathematics learning for students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen campus is done through 5 steps: (1) understanding problems/contexts in daily life, (2) explaining contextual problems, (3) solving contextual problems, (4) comparing and discussing answers, and (5) drawing conclusion.
2. The development of Realistic Mathematics Education (RME) model can improve mathematics learning for students of Primary Teacher Education Program of Faculty of Teacher Training and Education of Sebelas Maret University in Kebumen campus.
3. Constraints in the development of Realistic Mathematics Education (RME) model for the improvement of mathematics learning of students of Primary Education Program of Teacher Training and Education Faculty of Sebelas Maret University at Kebumen campus include: (1) students do not have adequate understanding on mathematics teaching materials for primary school, (2) students are not familiar enough with problems in learning mathematics related to problems in daily life, (3) students are not quite familiar with the usage of teaching media/visual aids in mathematics learning, (4) students do not well master various approaches in mathematics learning, (5) students do not acquire skill well in arranging lesson plans for mathematics learning in primary school, and (6) students are not skilled enough in the simulation of mathematics learning in primary school. Solutions for the difficulties are reinforcement and assistance in: (1) the mastery of teaching materials and mathematical concepts in primary school, (2) the relationship between teaching materials and problems in daily life, (3) identification and uses of media/visual aids for mathematics learning in primary school, (4) the mastery of various approaches in mathematics learning in primary school, (5) the arrangement of lesson plans, and (6) simulation of mathematics learning in primary school.
4. The reconstruction of curriculum for Primary Mathematics Education based on Realistic Mathematics Education (RME) in Teacher Training and Education Faculty of Sebelas Maret University at Kebumen campus results in two courses, i.e. (a) Primary Mathematics Education 1 (3 credits/semester III) which equips students ability to master and become skillful in implementing learning theories, strategies, approaches, methods, media and assessments, as well as become skillful in applying mathematics learning for primary school on numbers and the symbols, whole numbers, integers, round numbers, prime numbers, composite numbers, greatest common factor, least common denominator, fraction, and rational numbers, as well as their application in daily life; and (b) Primary Mathematics Education 2 (3 credits/semester IV) which equips students with ability to master and become skillful in implementing methodology and procedures of mathematics

learning in primary school on plane geometry, solid geometry, measurement, statistics and opportunity, and the implementation in daily life.

5. Textbook for Primary Mathematics Education based on Realistic Mathematics Education (RME) in Teacher Training and Education Faculty of Sebelas Maret University at Kebumen campus has been arranged in accordance with the curriculum, entitled "Guideliness for Primary Mathematics Learning (for Primary School Teachers and Prospective Teachers)", which contains 17 chapters. Chapter 1 to chapter 12 discuss about teaching materials which are presented in Primary Mathematics Education 1 with 3 credits in the third semester. Meanwhile, chapter 13 to chapter 17 talk about teaching materials which are presented in Primary Mathematics Education 2 with 3 credits in the fourth semester. The book was printed with ISBN Number 978-979-498-975-3 by UNS Press in 2015, and has been used.

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