

Developing workshop module of realistic mathematics education: *Follow-up workshop*

E L W Palupi, S Khabibah

Department of Mathematics, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia.

evangelistapalupi@unesa.ac.id

Abstract. *Realistic Mathematics Education* (RME) is a learning approach which fits the aim of the curriculum. The success of RME in teaching mathematics concepts, triggering students' interest in mathematics and teaching high order thinking skills to the students will make teachers start to learn RME. Hence, RME workshop is often offered and done. This study applied development model proposed by Plomp. Based on the study by RME team, there are three kinds of RME workshop: start-up workshop, follow-up workshop, and quality boost. However, there is no standardized or validated module which is used in that workshops. This study aims to develop a module of RME follow-up workshop which is valid and can be used. Plomp's developmental model includes materials analysis, design, realization, implementation, and evaluation. Based on the validation, the developed module is valid. While field test shows that the module can be used effectively.

1. Introduction

Since 1971 the Freudenthal Institute has developed Realistic Mathematics Education (RME). The RME group in the Netherlands reviews about math, how students learn mathematics, and how math can be taught [1]. The principle underlying RME is influenced by Freudenthal's idea that mathematics is a human activity.

In the view of RME, the subject matter that is to be mathematized should, in all cases, be experientially real for the students [1]. Thus the teaching materials which are to be mathematized and they can be the real examples for students. That is why this approach is called RME. This does not mean that RME always uses real-life problems [2], but it can also use things that students have experienced or understood or students can imagine [3]. There are three RME principles, namely: 1) rediscover, 2) didactic phenomena, and 3) self-developed models. Based on these three principles, the RME approach has five characteristics: 1) real-world use, 2) modelling, 3) use of production and construction, 4) use of interaction and 5) intertwining [4–6].

RME in Indonesia is an instructional approach adapted from RME. It holds RME principles and characteristics. This makes RME is considered to be one of the suitable approaches to teach mathematics based on the aims of the curriculum which is focused on teaching high order thinking skills to the students, includes constructing their own knowledge, problem-solving, and critical and creative thinking.



The success of PMR in teaching mathematics concepts, triggering students' interest in mathematics and teaching high order thinking skills to the students will make teachers start to learn PMR. Hence, PMR workshop is often offered and done, one of them was offered by RME team Unesa.

Based on the study of the RME team of Unesa, RME workshop can be done in three types, they are startup workshop, follow-up workshop, and quality boost. Startup workshop is intended for schools or teachers who are interested and want to implement mathematics learning with RME approach. At the startup workshop, participants are introduced to RME and invited to analyze mathematical learning using RME approach and those who do not use it. While the quality boost is intended for schools or teachers who have experienced in implementing mathematics learning with RME approach. The purpose of quality boost is to broaden teachers' insight into learning by RME approach by training them to conduct Classroom Action Research.

The follow-up workshop which is the focus of this research is intended as a training to strengthen the implementation of RME which has been done in pilot schools which accompanied by the model teacher [7]. Before the workshop is held, there will be a visit to the partner school with the model teacher who will see directly (through video) the RME implementation directly by the RME assistant and the RME expert team. Therefore the successful experience that emerges during the implementation of RME can be shared with other teachers so it can motivate other teachers to apply RME and indirectly encourage the dissemination of RME in all schools in Indonesia.

In order to hold a good workshop, the module should meet the standards of RME workshop. Hadi [8]formulates that the RME workshop standard is: (1) focus on process and product, (2) facilitate participants to experience RME characteristics directly, (3) synergy with applicable curriculum, (4) gives opportunity to reflect RME theory and practice, and (5) to strengthen sustainability of RME implementation In schools. In addition, Hadi et al [8]states that the standard of a workshop must meet: (1) the existence of a strategy that can be applied practically, (2) offer cognitive experience through pedagogic content, (3) contain learning experience from the learner's point of view as a reflection material , (4) facilitating the network as a supporter of RME implementation, and (5) able to prepare teachers as leaders of change in their schools. However, particularly in Unesa, there is no standardized module of RME workshop. This study aims to develop a follow-up workshop module of RME which meet the standard, valid and can be used.

2. Methodology

The development model used in this research is the development model proposed by Plomp [9]. The steps of the general model of development are 1) problem analysis, 2) design, 3) realization, 4) implementation and 5) evaluation. The five development steps are described as follows:

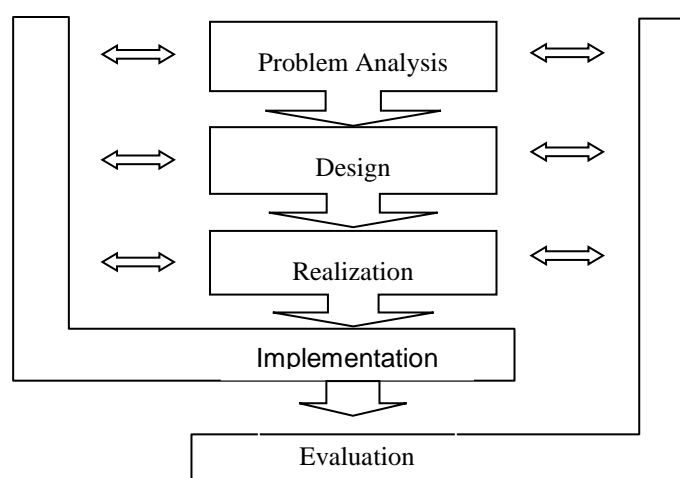


Figure 1. Developmental model of Plomp [9]

In detail, this study is conducted based on the proposed developmental model by Amin [10] which includes the developmental steps proposed by Plomp [9] (Figure 2).

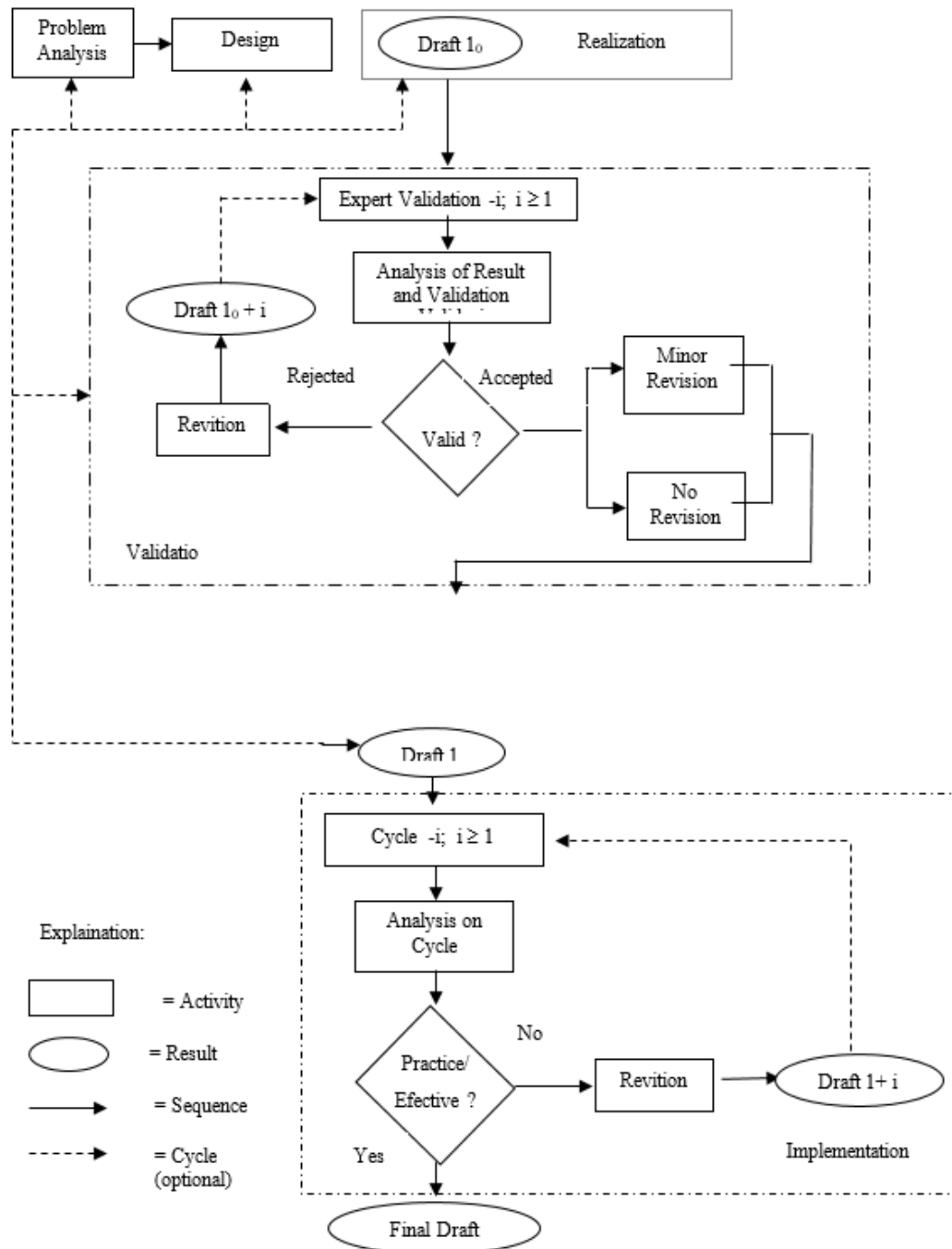


Figure 2. Flowchart [10]

The validity of the workshop material is known through the validation results by the validator that refers to the standard workshop RME [8]. While the practical criteria refer to whether or not the developed workshop materials can be used in the training class.

3. Results and discussion

3.1. Problem analysis

In the problem analysis stage, we brainstormed the initial design of the workshop activities and analyzed the problems that emerge or may arise during the workshop. One of the most common problems arise on a workshop is that the tutor will different materials, conduct different activities to teach the same objectives. This is seen as a problem because there is no standard and we can not assess whether all the participants at different room will have the same knowledge and whether they reach the same objectives. In addition, if there is another tutor that should continue the lesson then it would be difficult. Thus, the designed module should give the clear direction of the workshop, materials, and activities that should be conducted.

Besides analyzing the problems that may occur during workshop, objectives, participants, and technical provisions of the workshop were also discussed. Workshop materials that will be developed and used include RME learning video, RME activity sheet, RME learning design, and RME media.

3.2. Design

Based on the results of the analysis stage, the module is then designed. This includes its layout, objectives, participants, materials, and its activities.

Based on the design of the planned workshop, the workshop module is designed in accordance with the designed workshop and follow the format of writing modules by Higher Education. In the module will be included on a general overview of the workshop, the purpose of the workshop, technical guidelines, allocation of time, move the workshop, materials like video RME Plan Lesson Plan RME (RPP), and slide power point to other supporting material.

Follow-up workshop is focused on the sharing of successful experiences in implementing RME in school. This successful experience can be derived from the successful experience of the workshop participants, RME teachers, and/or experience of the facilitator and experience that can be seen in the video RME learning. With these activities, workshop participants are expected to be motivated and inspired to design realistic mathematics learning activities and implement them in the classroom or school. In addition, the realistic mathematics learning activities are expected by seeing directly or through a video how RME applied in the classroom, workshop participants can identify and how RME used in the class, clearly. In general, in the follow-up workshop, participants actively examined. The facilitator does not continuously provide the theory but the facilitator invites and involves participants in practicing what has learned. So, most of the activities in the workshop should focus on works and practices. The activities planned on follow up workshop can be seen below:

- Introduction: The facilitator delivers the background of the purpose and outline of the workshop
- The principles and characteristics RME: the facilitator recalls what RME is and how, what are the principles and characteristics of the learning
- Share success story 1: facilitator or teacher who has implemented RME in class tells the success of the learning done
- Reflection on success story 1: participants and facilitators reflect on the success of constraints and solutions when implementing RME
- Success story 2: participant videos and facilitators display RME learning videos and ask participants to observe the learning on the video
- Video analysis: workshop participants analyzed the learning-related videos and the appropriateness of learning with RME principles and characters
- Exposure to the results of the analysis: the participants present the results of the analysis that has been done, the discussion focused on the principle and character RME
- Hypothetical learning trajectory (HLT): the facilitator explains the learning path on RME and ICEBERG as well as question and answer
- RME simulation: facilitator simulate RME learning so that participants experience firsthand how RME

- Discussion: the focus of the discussion is how the learning loop on learning is simulated by the facilitator. any major mathematical ideas that arise, the context used, the goals and the activities
- Designing HLT: with facilitator's guidance, participants in groups are asked to design a learning path with a specific topic
- Gallery: participants display the design results on poster paper. facilitators and participants give each other opinions and suggestions
- Reflection workshop: facilitator and participants reflect on their workshop. participants fill out a response questionnaire

3.3. *Realization and validation*

The designed module then is written in the Realization phase. The first draft is produced and has been validated. Draft 1 of follow-up workshop module was validated by a lecturer who is competent in implementing RME. The aim of the validation is to get feedbacks to revise the module and to know whether Draft 1 is already suitable for the standard of follow-up workshop RME. Validation results of Draft 1 reveal that the designed module meets the standard of RME workshop, yet the needed materials are not yet attached.

Draft 1 then is revised based on the validation results. Materials needed for powerpoint slide of introduction activity, the lesson plan is added. The revision of Draft 1 then is called as Draft 2 which is then to be validated again. From the validation results of Draft 2, it is known that there are still many things that need to be revised such as (1) background should be focused on follow-up workshop, do not write it as a general workshop. (2) Language used should consider the characters of the participants, (3) Participants character should be clear, (3) Workshop is for 2 days, 180 hours is too hectic, and (4) it would be better to add slide about character and principles of RME to be used as a guideline in evaluation whether the implementation of the RME is a success or not. These feedbacks are used to revise Draft 2 to Draft 3. Draft 3 which is assessed and validated by the validator then is implemented in a real workshop to collect more feedback and to see whether the module can be used in a real workshop or not.

3.4. *Implementation and evaluation*

As we revised Draft 2 become Draft 3 then we try to use the module in a real workshop. Test field involves 40 mathematics teachers of elementary school who know about RME. During the implementation, it happens that the module can be used by the facilitator, success stories of implementing RME in a lesson by the facilitators successfully motivate workshop participants to implement and disseminate RME. Furthermore, we collect some data on Hypothetical learning trajectories (HLT) on mathematics topics created by the participants.

HLT which is created by the participants shows mathematics is the big idea of the topic, mathematics contexts, learning the purpose, and activities. However, most of the mathematics context is not yet a meaningful real problem (Figure 3). This suggests that explanation about mathematics problem, the real problem, and the meaningful problem should be added to the workshop activity and materials. Thus, participants can design meaningful activity for their students.

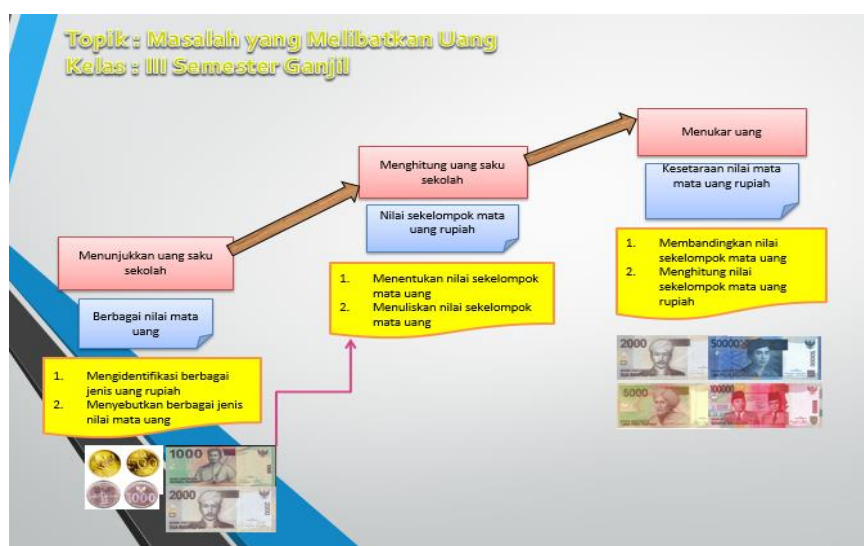


Figure 3. HLT produced by workshop participants

The positive response from the participants is given for the conducted workshop. Ninety percent of participants stated that they enjoyed the workshop and learned more about RME and its implementation from the workshop. Only 10% percent who said that they were sad because of external factors like missing their families. Even, there is one participant that argue that he is sad because that he realized that there is so much thing about RME and teaching mathematics that he did not know. All participant write that they wish that the similar workshop could be conducted again next time.

4. Conclusion and discussion

The developed module is valid and can be used. Workshop conducted based on the developed module got positive responses from the participants. However, the reliability of the module was not be tested. We still do not know whether the developed module can be used by other facilitators without briefing and whether the workshop can be conducted independently. It means the participants are teachers that do not know about RME and/or do not attend the start-up workshop.

References

- [1] Fred D and Dolk M 1995 *Freudenthal Institute* (Utrecht: Universiteit Utrecht)
- [2] Lange D and Jzn J 1978 *Mathematics Insight and Meaning* (Utrecht: OW & OC)
- [3] Slettenhaar 2000 Adapting Realistic Mathematics in the Indonesian Context *Maj. Ilm. Himpun. Mat. Indones.*
- [4] Treffers 1991 Didactical Background of a Mathematics Program for Primary Education *Realistic Mathematics Education in Primary School* (Utrecht: Freudenthal Institute)
- [5] Streefland L 1991 *Realistic Mathematics Education in Primary School* (Utrecht: CD Press)
- [6] Heuvel-panhuizen marja van den 1998 Freudenthal Institute *Work Prog.*
- [7] S H, M D and E Z 2010 The Role of Key Teachers in RME Dissemination *A decade of RME in Indonesia* ed R Sembiring, K Hoogland and M Dolk (Bandung, Utrecht: APS International)
- [8] S H, Zulkardi and Hoogland K 2010 Quality Assurance in RME - Design of Standards for RME *A decade of RME in Indonesia* ed R Sembiring, K Hoogland and M Dolk (Bandung, Utrecht: APS International)
- [9] Plomp T 2001 Development Reseach in/on Education and Training *National Conference of Matematika Realistik Indonesia* (Yogyakarta: Universitas Sanata Darma)
- [10] Amin S M 2006 *Pengembangan Buku Panduan Guru untuk Pembelajaran Matematika yang Melibatkan Kecerdasan Intrapribadi dan Interpribadi* (Universitas Negeri Surabaya)