# UNDERSTANDING PROFILE FROM THE PHILOSOPHY, PRINCIPLES, AND CHARACTERISTICS OF RME

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***Abstract***

The aim of this study is to create understanding profiles of elementary school teachers who have been and have not been following the workshop PMRI, before and after they learned the learning resource about philosophy, principles, and characteristics of realistic mathematics approach. This type of research used in this study is a combination of qualitative research and developmental research. The results shown in this paper is the understanding profile of one subject who is an elementary school teacher. Research subjects involved in the trial for the first task, the learning resource, and second task are six persons, which consists of three PGSD students who are working on the final project, and three elementary school teachers.

**Keywords:** Understanding Profile, Realistic Mathematics Education (RME), the Realistic Mathematics Education Learning Resource.

**Abstrak**

Penelitian ini bertujuan untuk membuat profil kognitif guru SD yang belum dan telah mengikuti workshop PMRI, serta yang belum dan telah mempelajari sumber belajar tentang filosofi, prinsip, dan karakteristik dari pendekatan matematika realistik. Jenis penelitian yang dipergunakan dalam penelitian ini adalah gabungan antara penelitian pengembangan dan kualitatif. Hasil yang ditampilkan dalam makalah ini adalah profil kognitif dari salah satu subjek yang merupakan guru SD. Subjek penelitian yang terlibat dalam uji coba untuk tugas 1, sumber belajar, dan tugas 2 ada 6 orang, yang terdiri dari 3 mahasiswa PGSD yang sedang menyusun tugas akhir, dan 3 orang guru SD.

**Kata kunci:** Profil Kognitif, Pendidikan Matematika Realistik, Sumber Belajar Pendidikan Matematika Realistik.

Realistic Mathematics Education Indonesia (PMRI) is the implementation of realistic mathematics approach in Indonesia, which began in 2001. PMRI movement is a movement to apply a realistic mathematical approach in teaching and learning process in mathematics. The aim of this movement is to improve the quality of teaching and learning process in mathematics. The implementation of PMRI started from primary level, and was started by 4 LPTK (Institute of Teacher Training). In the initial implementation, the 4 LPTK collaborated with 12 elementary/MIN. The implementation process always started with a workshop for school teachers who want to implement PMRI. There are two levels of the workshop held by the PRI team, namely local workshops and national workshops (Suryanto et al., 2010).

According the researcher, there is a quite fundamental weakness of the workshop, namely that the material given in the workshop was not illustrate how a teacher do the progressive mathematization process. The materials given in the workshop were about contextual issues that can

be used by teachers to teach a mathematical concept, and models of solution that may be made by the student to solve the contextual issues (models of), but the next steps that need to be done to help the students to achieve a model for and finally a formal mathematical knowledge were almost never given. Consequently, the understanding of teachers who attended workshops on progressive mathematization process is not complete.

This conjecture is supported by the findings that were founded by the researcher when the researcher observed on the teaching and learning process undertaken by teachers who attended the workshop PMRI when they are taught in class. The findings are teachers had difficulties to do the progressive mathematization process. One finding was discovered by the researcher when the researcher observed in grade two on September 30 and October 1, 2010. The teaching and learning process already begins by providing contextual issues that can be used by students in the phenomenological exploration, but in the next step the teacher did not give a series of problems associated with the given problem in the beginning so that the process of progressive mathematization may occur.

Base on some input from some teachers who attended the workshop PMRI that give to the researcher, the researcher knew that there were teachers who did not understand about the philosophy, principles, and characteristics of realistic mathematics approach and they had a desire to learn about realistic mathematics approach from various references, but in the process of learning they are often hampered by the language factor. Because it is for now, the realistic mathematics approach references are more in English than in the Indonesian language. According to researcher, if the teacher can learn from a reliable reference about the philosophy, principles, and characteristics of realistic mathematics approach by themselves, the teacher will also be able to construct an understanding of the philosophy, principles, and characteristics of realistic mathematics approach. Therefore, in this study, the researcher want to know about the understanding of teachers who have and have not participated in the PMRI workshop about the philosophy, principles, and characteristics of realistic mathematics approach before and after they learned the realistic mathematics approach learning resource by themselves. In other words, by doing this research, the researcher would like to get an answer for the question of how understanding profiles of teachers who have and have not participated in the PMRI workshop before and after studied the RME learning resource compiled by the researcher.

The author noticed that there are problems that need to look for the answer sought through a process of research, namely:

1. How are the understanding profiles about the philosophy, principles, and characteristics of realistic mathematics approach of elementary school teachers who have and have not been following the PMRI workshop before they study the RME learning source?
2. How are the understanding profiles about the philosophy, principles, and characteristics of realistic mathematics approach of elementary school teachers who have and have not been following the PMRI workshop after they study the RME learning source?

According Akker, Gravemeijer, McKeney, and Nieveen (in Akker, Gravemeijer, McKeney, and Nieveen, 2006), design research can be characterized as:

1. Interventionist: the research leading to the design of an intervention in the real world.
2. Iterative: the research incorporates a cyclic approach to the design, evaluation, and revision.
3. Process-oriented: a model of research that avoids the measurement of inputs and outputs, focus on understanding and improving interventions.
4. Oriented to usability: the benefits of design is measured by looking at the practicality of the design for the user in reality.
5. Oriented to the theory: design (at least partially) made by theories that already exist, and field testing of the design contribute to the development of the theory.

According Gravemeijer and Cobb (in Akker, Gravemeijer, McKeney, and Nieveen, 2006) there are three phases in the design research, namely:

1. The first phase: preparation of trial design.
2. Second phase: trial design.
3. The third phase: a retrospective analysis.

According to Denzin and Lincoln (in Merriam, 2009), qualitative research is an activity that puts the observer in the world. According to Denzin and Lincoln (in Merriam, 2009), a qualitative researcher studies things in their natural situation, try to consider, or interpret the phenomena. Van Manen (in Merriam, 2009) says that qualitative research is an umbrella term that covers an unity of interpretation techniques that try to describe, encode, translate, and interpret naturally occurring phenomena in the social world .

According to Merriam (2009), there are four characteristics of the qualitative research, namely:

1. Focus on meaning and understanding.

   Qualitative researchers are interested in how people interpret their experiences, how they construct their world, and what meaning they attribute to their experiences. Overall, the goals of qualitative research are to achieve an understanding of how people make sense of their lives, to describe the interpretation process, and to describe how people interpret their experiences.
2. The researchers are the main instrument for data collection and analysis.
3. An inductive process.

   Other important characteristic of the qualitative research is an inductive process, which the researchers collected data to build concepts, hypotheses, or theories.
4. The results of qualitative research are a rich description

According to Miles and Huberman (1994), there are three stages in the analysis of the qualitative data, namely:

1. Data reduction.

   The process of data reduction is related with the electoral process, centralization, simplification, abstraction, and transformation of data obtained from the script and transcription from the research field. Data reduction occurs continuously throughout the qualitative research conducted. Data reduction can be initiated before the data is actually collected (anticipatory data reduction).
2. Presentation of data.

   Presentation of data is the organized information is and do not contain things that are not relevant which allows making conclusions and actions.
3. Making conclusions and verification

   Making conclusions and verification are a process to record the regularities, patterns, explanations, links between one part and other part, causality, and statements that can be inferred from the existing data. A skilled researcher do not view these conclusions as something that is final, maintaining an openness and skepticism attitude, though the conclusions of global first and blurred, then rise and fundamental explicitly. Final conclusions will not appear until the collection data process is completed.

Denzin (1978 in Merriam, 2009) proposes four types of triangulation, namely: (1) method triangulation, (2) triangulation of data sources, (3) researcher triangulation, and (4) theory triangulation. In the method triangulation, qualitative researchers use a variety of methods to approximate the data. For example, data obtained from interviews with research subjects is cross-checked with data obtained from observation and reading documents. If it is done by qualitative researchers, it can be said that the researchers used the method triangulation and the method used to approximate the data is by interview, observation, and reading documents (Merriam, 2009).

**Table 1. the Component of RME and the Element of Each Component of RME**

| **Component of RME** | The element of each component of RME |
|---|---|
| **Philosophy** | Mathematics as a human activity. |
| **Meaning of mathematics as a human activity** | 1. Mathematics is constructed from human activities.<br>2. Mathematics can be implemented in human activities. |
| **Principles** | There are three principle PMR, namely:<br>1. Guided reinvention and progressive mathematizing.<br>2. Didactical phenemenology.<br>3. Self developed models. |
| **Principle 1a: guided** | 1. The reinvention process of the concepts and |

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| **reinvention.** | procedures of mathematics is done by the students themselves.<br>2. There is the guidance process in the reinvention process of the concepts and procedures of mathematics by students. |
| **Principle 1b: progressive mathematizing** | 1. Mathematizing process.<br>2. Horizontal mathematizing process.<br>3. Vertical mathematizing process.<br>4. Progressive mathematizing. |
| **Principle 2: didactical phenomenology** | There is a phenomena or a contextual problem explored by students. |
| **Principle 3: self developed models** | 1. There are models that are built as a result of the mathematizing process.<br>2. A model is a mathematics representation form of the problem and the solution of the problem in the problem solving process.<br>3. There are four levels in the model, i.e. situational model, model of, model for, and formal model. |
| **Characteristics** | Five characteristics of RME are<br>1. phenomenological exploration;<br>2. bridging by vertical instruments;<br>3. student contributions;<br>4. interactivity;<br>5. intertwining. |
| **Characteristic 1: phenomenological exploration** | 1. There are phenomena that can be explored by students to bring them to mathematizing, horizontal mathematizing, vertical mathematizing, and progressive mathematizing.<br>2. There are phenomena that can be explored by students to make them to a situational model, a model of, a model for, and a formal model.<br>3. At the end, the phenomena explored by students can bring them to the reinvention process of the concept and procedure of mathematics.<br>4. The first role of the contextual problem in realistic mathematics approach is to establish the mathematics |

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| | concept and procedure, and the second role is to implement the concept and procedure of mathematics that has been owned by the student. |
| | 5. Definition of a contextual problem. |
| **Characteristic 2: bridging by vertical instruments** | 1. The definition of mathematizing.<br>2. The four stages of the problem solving process are (1) the presentation of the problem, (2) write the problem in the language of mathematics, (3) solve the problem mathematically, and (4) translate the solution to the context.<br>3. The definition of horizontal mathematizing.<br>4. The definition of vertical mathematizing.<br>5. The definition of progressive mathematizing. |
| **Characteristic 3: student contributions** | 1. The definition of of models.<br>2. Students contribute to mathematizing, horizontal mathematizing, vertical mathematizing, and progressive mathematizing.<br>3. Students contribute to a situational model, a model of, a model for, and a formal model.<br>4. At the end, the students contribute to the reinvention process. |
| **Characteristic 4: interactivity** | 1. Students receive the guidance from the "adult" in the mathematizing, horizontal mathematizing, vertical mathematizing, and progressive mathematizing.<br>2. Students receive the guidance from the "adult" in the constructing process of a situational model, a model of, a model for, and a formal model.<br>3. At the end, the guidance of the "adults" can bring students to the reinvention process.<br>4. A negotiation process occurs between the students in the mathematizing, horizontal mathematizing, vertical mathematizing, and progressive mathematizing.<br>5. A negotiation process occurs between the students in the constructing process of a situational model, a model of, a model for, and a formal model.<br>6. At the end, a negotiation process occurs between the |

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| | students bring them to reinvention process of the concepts and procedures mathematics. |
| **Characteristic 5: intertwining.** | In order to set up a comprehensive formal mathematical knowledge, students need to get a chance to make the fabric between the knowledge which they already have and the new knowledge. |

## METHOD

Broadly, the steps are carried out by the researcher in building understanding profiles above are as follows:

1. Making an observation sheet, a worksheet 1 and 2, an interview sheet, student learning materials, and teacher guides.
2. Validating an observation sheet, an interview sheet, student learning materials, and teacher guides.
3. Implement student learning materials and teacher guides, and make a recording of the implementation process of student learning materials and teacher guides. The results of the implementation of the two become examples to explain about the philosophy, principles, and characteristics of realistic mathematics education in the learning resource.
4. Building the learning resource for teachers that contains: a description of the philosophy, principles, and characteristics of realistic mathematics approach with simple language that needs to be understood by research subjects. The steps used to build the learning resource followed the developmental research steps.
5. Trying out of the worksheet 1 and 2, the interview sheet, and the learning resource to 3 PGSD students, and 3 elementary school teachers.
6. Making understanding profiles of research subjects involved in the trial.

## RESULTS AND DISCUSSION

In this part, the researcher provides the understanding profiles of research subject 4 about the philosophy, principles, and characteristics of realistic mathematics education before and after the subject research studied the learning resource.

**Table 2. the Understanding Profiles of Research Subject 4 About The Philosophy, Principles, and Characteristics of Realistic Mathematics Education Before and After the Research Subject Studied the Learning Resource**

| Components of RME | Understanding profiles before the subject research studied the learning resource | Understanding profiles after the subject research studied the learning resource |
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| **Philosophy**<br><br>**Meaning of mathematics as a human activity** | The subject can not mention the philosophy of RME.<br>• The subject has the understanding about element 1 of the meaning of the philosophy of RME.<br>• The subject does not have the understanding about element 2 of the meaning of the philosophy of RME. | The subject can mention the philosophy of RME.<br>• The subject has the understanding about element 1 of the meaning of the philosophy of RME.<br>• The subject still does not have the understanding about element 2 of the meaning of the philosophy of RME. |
| **Principles** | The subject can not mention about how many and what are the principles of RME. | The subject can mention about how many and what are the principles of RME. |
| **Principle 1a: guided reinvention.** | The subject already has the understanding about the component 1 and 2 of the guided reinvention principle. | The subject just has the understanding about the component 1 of the guided reinvention principle. |
| **Principle 1b: progressive mathematizing** | The subject does not have the understanding about the progressive mathematizing principle. | The subject has the understanding about the progressive mathematizing principle, though not yet complete. What is understood by the subject are about mathematization, horizontal mathematizing, and progressive horizontal |

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| | | mathematizing. The understanding of the subject has not been touched on vertical mathematizing and progressive vertical mathematizing. |
| **Principle 2: didactical phenomenology** | The subject does not have the understanding about the didactical phenomenology principle. | The subject has the understanding about the didactical phenomenology principle. |
| **Principle 3: self developed models** | The subject does not have the understanding about the self developed models principle. | The subject has the understanding about element 1 of the self developed models principle. |
| **Characteristics** | The subject already knows about two characteristics of RME, i.e. the phenomenological exploration, and the student contributions. | The subjects can mention how many and what are the RME characteristics. |
| **Characteristic 1: phenomenological exploration** | • The understanding of the subject about the element 1 – 3 of phenomenological exploration characteristic confined to the existence of the phenomena that explored by students.<br>• The subject has the understanding about the first role of the contextual problem.<br>• The understanding of the subject about the contextual problem is limited to daily life problem. | • The understanding of the subject about the element 1-3 of phenomenological exploration characteristic is not limited to the existence of the phenomena that explored by students, but already more developed though not yet complete. Because the subject has not been explained that the students explored the phenomenon that can trigger mathematization process such that students can construct concepts and / procedures of mathematics. |

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| | | • The subject has the understanding of the first and second role of the contextual problem.<br>• The understanding of the subject about the contextual problem is not limited to daily life problem. |
| **Characteristic 2: bridging by vertical instruments** | • The Subject already has the understanding about the mathematization process, but not yet complete. Because the subject has not explained what needs to be done by students in such a mathematization process such that the goals of mathematization process can be achieved by students.<br>• The subject does not have the understanding about the stages of problem solving, horizontal mathematizing, vertical mathematizing, and progressive mathematizing. | • The Subject already has the understanding about the mathematization process, but not yet complete. Because the subject has not explained what needs to be done by students in such a mathematization process such that the goals of mathematization process can be achieved by students.<br>• The subject already knows about how many, and what are the stages of the problem solving process.<br>• The subject already has the understanding of horizontal mathematizing, but not yet complete. Because the subject has not been explained on the results of the horizontal mathematizing .<br>• The subject already has the understanding of vertical mathematizing, but not yet complete. Because the subject has not fully explain about the process that occurs in a vertical mathematizing. |

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| | | • The subject not yet has the understanding about the progressive mathematizing. |
| **Characteristic 3: student contributions** | • The subject does not have the understanding about the model definition.<br>• The subject lead the idea about the element 2 of the student contributions characteristic, but the idea about the element 3 and 4 of the student contributions characteristic is not arisen by the subject. | • The subject does not have the understanding about the model definition.<br>• The subject has the understanding about the element 2 and 3 of the student contributions characteristic, but the subject does not have the understanding about the element 4 of the student contributions characteristic. |
| **Characteristic 4: interactivity** | • The subject has the understanding of the element 3 and 6 of the interactivity characteristic.<br>• The subject does not have the understanding of the element 1, 2, 4, and 5 of the interactivity characteristic. | • The subject has the understanding of the element 3 and 6 of the interactivity characteristic.<br>• The subject does not have the understanding of the element 1, 2, 4, and 5 of the interactivity characteristic. |
| **Characteristic 5: intertwining.** | The subject understands that the teacher needs to help students to make the fabric of students' knowledge, but the subject does not understand why the teacher needs to help students to make the fabric of students' knowledge. | The subject understands that the teacher needs to help students to make the fabric of students' knowledge, but the subject does not understand why the teacher needs to help students to make the fabric of students' knowledge. |

## CONCLUSION AND SUGGESTION

The learning source that made by the researcher about the philosophy, principles, and characteristics of RME can help the research subject to have the understanding profiles about:

1. The philosophy of RME.
2. The first element of the meaning of the RME philosophy.
3. How many and what are the RME principles.
4. Progressive mathematizing principle.
5. Didactical phenomenology principle.
6. The first element of self developed models principle.
7. How many and what are the RME characteristics.
8. The element 1 – 3 of phenomenological exploration characteristic.
9. Two roles of the contextual problem.
10. The subject's understanding about the contextual problem is not limited to daily life problem.
11. The stages of problem solving process.
12. The understanding of horizontal mathematizing, and vertical mathematizing, though not yet complete.
13. The understanding of the element 2 and 3 of the student contributions characteristic.

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