Innovative Teacher Professional Development within PMRI in Indonesia

Rooselyna Ekawati, Ahmad Wachidul Kohar

Corresponding author: rooselynaekawati@unesa.ac.id
Departement of Mathematics, Universitas Negeri Surabaya, Surabaya 60231, Indonesia

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Abstract

The urgency of improving Indonesian mathematics teachers lead to the consideration of developing innovative Teacher Profesional Development (TPD) within PMRI (Pendidikan Matematika Realistik Indonesia) or Indonesian version of realistic mathematics education. PMRI as a promising mathematics learning approach developed in Indonesia has been disseminated through a number of stratified workshops (local and national levels) which regards to the requirement of a good TPD. In this paper, we argue that innovative TPD within PMRI provides a model of sustainable professional program. In particular, we describe some experiences from PMRI workshops to investigate the unique characteristics of TPD within PMRI. It considers the characteristics of PMRI such as considering teacher as active learners instead of passive receiver, facilitating teachers in designing and implementing PMRI lesson, and organizing sustainable follow up workshops to strengthen mathematics teachers' community. The analysis shows that there are some improvements on teacher's conception toward mathematics teaching, practical teaching, mathematics content knowledge, and the use of learning media.

Introduction

There is a general consensus on the importance of Teacher Professional Development (TPD) to develop students' mathematics learning. To facilitate teachers' learning towards this goal, there is a growing interest among educators in many countries to work with in-service teachers to develop their mathematics teaching including Indonesia. Generally, Indonesian teachers do not participate in international assessment study such as TEDS-M *(Teacher Education and Development Study in Mathematics)* so that teachers' performance could not be described in detail, however some independent study results such as by Ekawati & Lin (2014), Ng (2011), Siswono, Kohar, Kurniasari & Astuti (2015) and Wijaya, van den Heuvel-Panhuizen & Doorman (2015) each of which respectively point out the weakness of teachers' mathematics knowledge, problem solving knowledge, and teaching practice, as well as as studies on reflecting students performance such as PISA *(Programme for International Student Assessment)* and TIMSS *(Trends in International Mathematics and Science Study)* imply the urgency of improving professional teaching through Teacher Professional Development (TPD). Indonesian government also supported these movements through teachers' Law in Undang-Undang Guru dan Dosen (UUGD) no 14 year 2005 that stipulates teachers' duties as professional. To enhance teachers' professional teaching and certified in-service teacher competence with considering UUGD, there has been a number of teacher professional development (TPD) conducted by both national government, local government, and independent institution. Among those TPDs, there are likely still a number of TPDs which apply the conservative pattern in training teachers. For instance, facilitators of certain workshops of TPD explain certain mathematics topics directly and model how to teach those

topics in classroom activity that could be imitated by teachers' participants. This pattern of TPD positioned teacher as passive receiver of knowledge instead of active learners, whereas Royce (2010) argues that something which is true for students also applies in a TPD situation to adults. As a consequence, teachers learn best by doing (teaching mathematics) and building their own understandings rather than being told by instructors of TPD.

Typically, national TPD workshops in Indonesia were lack of follow-up activity in which teachers can share their further advantages and challenges of the implementation of learning approach in their classroom. Indeed, teachers need to have a kind of community as a place of sharing all these things so that the learning approach can be continuously applied and improved as suggested by Loucks-Horsley, Stiles, and Hewson (1996). Teachers need to have sense and develop their understanding of teaching mathematics through TPD they participated, otherwise there was a possibility that Indonesian teachers moved back to their original style which consider algorithmic teaching as found in the study of Ekawati & Lin (2013). Facing these exemplary challenges, Knowles, Holton, and Swanson (2005) argued that a TPD should create opportunities for teachers to take control of their own learning, deepen their subject knowledge, construct knowledge from previous knowledge and experiences, and develop intellectual community with colleagues. Therefore, in this paper, we elaborate implementation of innovative TPD approach for mathematics teaching with Indonesian version of Realistic Mathematics Education labelled as PMRI that were done with primary teachers from some district sector areas. In addition, the result of the implementation of TPD on PMRI was also described.

Elaborated principles for Innovative TPD on PMRI in Indonesia

The implementation of innovative teacher professional development in Indonesia emerged from the new visions described by Smith and Lytle (1999) that suggested opportunities for teachers to explore the cultures of schools and teachers' work. It also regards the exploration and question of their own and others' interpretations, ideologies and practices (McLaughlin, 1993 in Smith and Lytle, 1999). To elaborate that vision, some TPDs within PMRI were conducted in a district sector could be assumed to have similar school culture so that teachers' communication evolved. The TPD workshops were also in line with Lin, Hsu, Yang, Chen (2012) which suggest that the transfer of knowledge from educators, teachers, to students in professional development is not linear and one-way process in which the solutions to problem encountered in teaching and learning can be directly obtained. Therefore, teachers need to coordinate the knowledge gained from teacher professional development program and transform to the classroom practice. Those knowledge's coordination and transformation are also part of teachers' learning of PMRI (Ekawati & Lin, 2013).

Regarding RME itself, it is highlighted on Freudenthal 's view that mathematics as human activity and mathematics must be connected to reality (Van den Heuvel-Panhuizen, 2003). Mathematics must be close to children and be relevant to everyday life situation, therefore contextual situation that is relevant and familiar to students need to be elaborated within mathematics learning. Meanwhile, it should experience students with meaningful mathematics learning instead of becoming used to be spoon-fed by teachers. Van den Heuvel and Wijers (2005) explained six principles of mathematics teaching each of which reflects specific characteristic of the identity of RME such as Activity principle, Reality principle, Level principle, Intertwinement principle, Interaction principle and Guidance principles. Those principles were learned by Indonesian primary teachers within effective professional development characteristics as described by Karen M. Soine & Andrew Lumpe (2014), namely

active, engaged learning; focus on content and how students learn content; coherence with teachers' needs and circumstances; collective participation; duration and the standard of PMRI workshop arranged by IP-PMRI (Institut Pengembangan PMRI/Centre Development of PMRI). Those standards satisfy a good characteristic of TPD proposed by Loucks-Horsley, Stiles, and Hewson (1996) as presented in table 1.

Table 1. Features of Standard of PMRI workshop and a good TPD

Standard of PMRI workshop (Hadi, 2009))	**Characteristics of a good TPD** (Loucks-Horsley, Stiles, and Hewson; 1996)
1. The workshop focuses on process which makes participants easy to understand concept of PMRI as well as on products used in PMRI learning. 2. The workshop facilitates participants to actively build their own knowledge and skills related to PMRI 3. The PMRI materials satisfy the demands of current curriculum as well as both internal and external condition of schools with regard to the principles of PMRI in order to increase adaptability of PMRI in schools 4. During the workshop, participants learn the relationship among the activities undertaken, the concept of mathematics inherent in the activities, and the theoritical backgrounds of PMRI 5. The workshop empowers and fosters participants to be more confident in applying PMRI in schools consistently.	1. driven by a clear, well-defined image of effective classroom learning and teaching; 2. provide teachers with opportunities to develop knowledge and skills and broaden their teaching approaches, so they can create better learning opportunities for students; and 3. build or strengthen the learning community of science and mathematics teachers.

There are two mainstreams focused on PMRI workshop such as process and products. The TPD workshop gives an overview how a learning process inspired by PMRI approach could open an effective classroom practice. The workshop also give opportunities to participants to actively build their own understanding about PMRI learning. This is in line with a requirement of an innovative approach for professional development which focus on the construction of knowledge with the context of teachers' experiences (Campbell, 2012). Furthermore, PMRI workshops empower and foster participants to have more confident in applying PMRI in schools consistently. To keep teachers' motivation in applying PMRI continuously, the teachers will be guided by a PMRI team in designing and implementing PMRI lesson. Some *follow-up* workshops are organized to discuss experience, success, difficulties, and other problems related to PMRI implementation. They also receive a new knowledge about PMRI with regard subject matter knowledge, pedagogical knowledge, and also further principles and characteristics of PMRI during the *follow-up* workshop. To be more specific, it involve older participants enhance their understanding about new learning design and knowledge about PMRI whereas the new participants get to know what and how PMRI learning is possible to be implemented in their school. As a result, *follow up* workshop can build a strong community among teachers and facilitators to increase sustainability of PMRI learning in schools.

Implementation of TPD on PMRI workshop

In attempt to disseminate PMRI throughout Indonesia, some stratified workshops (local and national levels) for teachers and mathematics educators (university lecturers) have been developed by IP-PMRI coordinated with Directorate General of Higher Education, LPMP (Lembaga Penjaminan Mutu Pendidikan/Agency of quality assurance in education), universities from both Indonesia and overseas (especially the Netherlands), and PMRI partner schools. The programs vary depends on the set of activities, duration, and the institutions. Typically, the programs are supported by a series of workshops such as start-up workshop, follow-up workshop, and quality boost program (Hadi, Dolk, & Zonneveld, 2010; Haan, Meiliasari, & Sari, 2010).Start-up workshop is organized mainly for those who firstly recognize PMRI. For instance, PMRI workshop in Malang city, East Java Province, was organized by involving 22 lecturers and some elementary teachers with aimed at introducing PMRI as well as identifying the possibility of developing PMRI in that city based on responses of the participants (Hadi, 2009). Follow up workshop would then be organized after the start up workshop to enhance participants' understanding on PMRI. Another program of workshop, Quality Boost for improving quality of PMRI, was organized in a certain district area for a certain period to enhance key-teachers' understanding of PMRI. The key-teachers were prepared to be facilitators on some follow-up of the follow-up PMRI workshops and other PMRI dissemination programs which would be held in that district area. The programs usually organize activities from observing teaching programs in partner schools, analysing the result of observation and bring the result to the workshop, designing PMRI lesson, and finally implementing the designed lesson in a real classroom setting.

To obtain an overview about how *start-up* workshop is organized, we present an example of a workshop reported by Patahuddin, Rokhmah, Palupi, and Nubatonis, (2010). The table below shows a series of activities of the role of facilitators and teacher participants during the workshop.

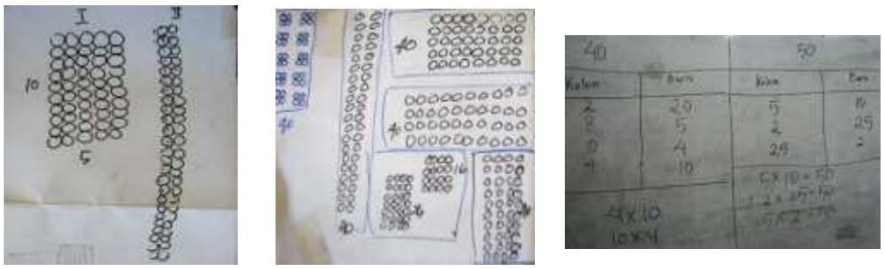
The study findings reported by Patahuddin et al (2010) above provide further evidence of the requirements of PMRI workshop which satisfies the characteristics of a good TPD proposed by Loucks-Horsley et al (1996). An analytical description of how the workshop worked is then elaborated. In the beginning session, facilitators posed some contextual mathematics tasks to be solved by teachers. Through this activity, facilitators were not only able to obtain data about teachers' mathematics content ability, but also to give teachers an overview about some typical tasks for PMRI lesson. The tasks were designed to investigate teachers' ability in modelling contextual problem into a certain mathematical structure which are then interpreted back to the initial problems. The modelling ability (or mathematizing in PMRI) as a critical feature representing students' ability to bring real world to the world of mathematics is also important to be experienced by teachers. By this experience, teacher will aware of a variety of strategies which might be appeared on students' mathematizing process. In addition, they also need to make sense with the idea of both using context and using a model as two of five characteristics of PMRI mentioned by Treffers (1987). Furthermore, having data of teachers' understanding of mathematics content, teachers' difficulties and misconception in solving mathematics tasks are important for designing the TPD's learning trajectory.

Table 2. Workshop Activities on Start-up Workshop

No	Activities		Goals
	Facilitators	**Teacher participants**	
1	Pose some contextual mathematics problems to be solved (the problems open ended in solution)	Solve the problems	Investigate teachers' initial mathematical content knowledge
2	Open a discussion of learning activity which is typically carrried out in the teachers' classroom	Share ideas of improving mathematics learning	Identify teachers' initial knowledege about pedagogical problems
3	Ask teachers to create a mathematics lesson on a specific topic without any intervention	Work in groups to create the lesson	Investigate initial product of lesson based on the work of group
4	Ask representative of groups to perform the initial lesson and then discuss interesting findings during the lesson. Here, the facilitators play role as observers	Perform the lesson with teacher participants as students	Investigate the strengths and the weaknesses of the performance
5	Perform some examples of PMRI lesson on specific topic. Here, the facilitators play role as teacher who apply principles and characteristics of PMRI.	Play role as students	Foster teachers to come up with the idea of how PMRI learning should work
6	Discuss with teachers related to the differences between the PMRI lesson and the lesson which they created in the previous step and present the principle and characteristics of PMRI inherent in the PMRI lesson	Give responses to the principle and characteristics of PMRI	Build teachers' understanding about the idea of principles and characteristics of PMRI
7	Present contents of PMRI books which were developed by IP-PMRI and ask teachers to create a learning scenario using an example of activities taken from the book	Create the learning scenario in groups and present it to the other participants	Enhance teachers' understanding about PMRI product
8	Ask teachers to create a new PMRI lesson on certain topics or on certain contextual problem using learning media provided	Make groups to create a new learning design	Develop teachers' creativity in designing a PMRI lesson
9	Have teachers to reflect on the workshop	Discuss interesting findings during the workshop and pose some recommendations for follow-up PMRI workshops	Obtain data about teachers' responses on PMRI

Regarding these, mathematics task are firstly considered for teachers' discussion within TPD. TPD's facilitators opened a discussion about how teacher and their students typically solve mathematics tasks. The purpose are developing teachers' awareness and understanding of the students' sensitivity of mathematics. This activity is one of important learning sequences in a workshop due to the result of assessment to Indonesian primary teachers' Mathematics Pedagogical Content Knowledge in 2013 showed that 70.48% teachers of the study needed more sensitivity on students (Ekawati, Lin, & Yang, 2014).

One exemplary activity in TPD of PMRI was mathematics game. For example facilitators prepared a number of coins to and asked teachers in group arrange it so that the number of coins could be easily counted. By this activity, teachers played role as students could came up with the idea of multiplication. Teachers used their own best strategy and draw the arrangement of coins on the paper. Thus, there were a variety of strategies performed by groups as a background to develop a better idea of counting coins through the concept of multiplication (see figure 2). This activity reflects on another characteristic of PMRI: using students' own production (Treffers, 1987). Wijaya (2012) argued that this characteristic is not only able to help students understand mathematics content but also develop students'creativity. Other series of activities such as working in groups, sharing idea among teachers to find the best way in solving the tasks, and presenting the result of group's work in this workshop really reflect on another characteristic of PMRI, namely interactivity. As a result of final product of the workshop, teacher created and develop their own learning design with facilitators' guidance on certain context or mathematics topics.



(a) (b) (c)

Figure 2. Teachers' work in representing the number of coins

Another PMRI workshop called 'Boost Program to Improve Quality of PMRI' was done in Banjarmasin, South Kalimantan (10-14 November 2008). This program aimed at fostering participants to be key teachers who are ready to participate in any PMRI dissemination programs at Banjarmasin. As a consequence, there were only limited number of prospective teachers who were involved in this programs. The role of key-teachers, for example, are becoming facilitators in some *follow-up* workshops, developing PMRI lesson in their KKG (Kelompok Kerja Guru/Teacher Working Group), and developing PMRI materials like books and learning media with PMRI team. Table 3 summarises a series of activities during the workshop.

Table 3. Workshop Activities on Quality Boost Program

No		Activities		Goals
		Facilitators	**Teacher Participants**	
Plan	1	Pose some critical issues regarding weaknesses of conventional mathematics learning, such as (1) many students are well-trained in performing mathematical calculation through memorizing formula and procedures instead of figuring out what really those calculation/procedures come from; (2) many students fail in connecting mathematical knowledge they are learning and how that knowledge is applied; and (3) many students find difficulties in understanding some mathematical concepts since the concepts their teachers teach were too abstract for them.	Make groups to discuss the solution of the problems Some results of discussion: 1. Students should be actively involved in building mathematical concepts 2. Teachers should open opportunity for students to solve mathematical problems using their own strategies 3. Teachers should start learning by using realistic things around students	develop teachers' awareness of problems related to mathematics learning in school
	2	Ask teachers to create an initial lesson on certain mathematics topic for elementary school based on the result of discussion	Make groups to create a learning design	investigate how teachers typically design a mathematics lesson
Do	3	Ask teachers to implement the initial lesson in *an open lesson* which would be implemented in certain school	Each group divides roles in the *open lesson*, some as teachers and the others as observers	make teachers experience on how their initial lesson is implemented in real situation
See	4	Guide teachers to discuss the result of the *open lesson*	Discuss the result by identifying the strengths and the weaknesses of the implementation	investigate the strengths and the weaknesses of the initial lesson
	5	Ask teachers to share their findings in the *open lesson* related to classroom organization	Discuss the findings and try to find the best solution of the problems found in the findings	give opportunity to teachers to share their pedagogical problems
Plan	6	Guide teachers to redesign the lesson implemented in the first *open lesson*	Redesign the lesson based on the result of investigating strengths and weaknesses as well as the principles and characteristics of PMRI	revise teachers' lesson
Do	7	Guide teachers to implement the revised lesson	Implement the revised lesson	identify the change of the revised lesson
See	8	Guide teachers to reflect on the set of activities which were done and ask them for ideas to develop PMRI community	Make a poster presentation showing ideas on how to develop PMRI	build teachers' awareness of the sustainability of PMRI

The significant difference between the workshop reported by Patahuddin et al (2010) and the workshop organized in Quality Boost Program at Banjarmasin is about the role of teacher participants in a PMRI lesson. In the start-up workshop, teachers play role as students in PMRI lesson performed by facilitators whereas in the Quality Boost Program, the workshop directly used real students in real class as subjects. This is due to the work-pattern of Quality Boost Programs which was inspired by the work-pattern of KKG-LS (Kelompok Kerja Guru-Lesson Study/Teacher Working Group-Lesson Study). KKG-LS pattern was designed similar to the cyclic processes of lesson study that consists of lesson design(plan), open lesson (do), and reflection (see) (Hadi, Dolk, & Zonneveld, 2009; Doig & Groves, 2011) (see workshop activities on table 2). Interestingly, although workshop of Patahuddin et al (2010) did not observe teachers to implement their PMRI lesson as the final product in the real class, teachers were also given opportunity to report their experience in implementing their designed PMRI lesson within *follow-up* workshop. Thus, *follow-up* workshop could be a valuable program for teachers from start-up workshop to share their experience to both new teacher participants and older participants. Here, PMRI team observed some prospective teachers who are likely able to be key-teachers to be involved in other PMRI programs, one of which is in Quality Boost Programs.

However, both the two workshops certainly have similar work-pattern, which is teachers as active learners. In these two workshops, the majority of activities were done by teachers from designing lesson, implementing lesson, and evaluating lesson based on PMRI theory. The facilitators has a key role to guide teachers' activities in understanding principles and characteristics of PMRI.

Concerning on the series of activities on those two kinds of PMRI workshops, we argue that PMRI workshop gives an understanding about teachers' role in PMRI learning. Hadi(2005) mentioned four teachers' role in PMRI learning: teacher should build interactive learning with students, teacher must provide opportunity for students to actively express their opinions in the process of learning, and teacher actively help students to interpret realistic problem, as well as teachers are not fixated on the material contained in the curriculum, but actively linking the curriculum with the real world. By involving teachers directly as students to investigate the principles and characteristics of PMRI, the workshop provide teachers with opportunities to develop knowledge and skills and broaden their teaching approaches, so they can create better learning opportunities for students. In conclusion, all of these idea of the workshop reflect on a well-defined image of effective classroom learning and teaching and a good chance for teachers to develop their teaching skill using a good learning approach (read: PMRI) as the two of three characteristics of a good TPD.

The last characteristic of a good TPD such as build or strengthen the learning community of science and mathematics teachers is shown by the two workshops. The activities were ended up with reflection activity would gave opportunity for teachers to discuss not only about what and how they did within the workshops but also what and how they would do after joining these workshops. A recommendation of organizing several follow-up workshops usually becomes a strong request from teachers to the facilitators (see figure 3). To confirm this request, PMRI team usually organize some follow-up workshops. The teachers who have ever joined a start-up workshop and start to implement PMRI in real teaching are usually recommended as teacher models in the follow-up workshops. Another idea is that teachers are asked to offer PMRI to their KKG (Kelompok Kerja Guru/Teacher Working Group) as an alternative of designing mathematics lesson. Here, PMRI team will guide them to develop lesson, implement the lesson, as well as evaluate the lesson. To strengthen this kind of teacher community, PMRI

trained several 'key teachers' from PMRI workshops who are involved in designing and developing PMRI materials as well as become a new facilitator of PMRI in their teacher community. Through this community, it is hoped that the TPD on PMRI could build a strong community of mathematics teacher.

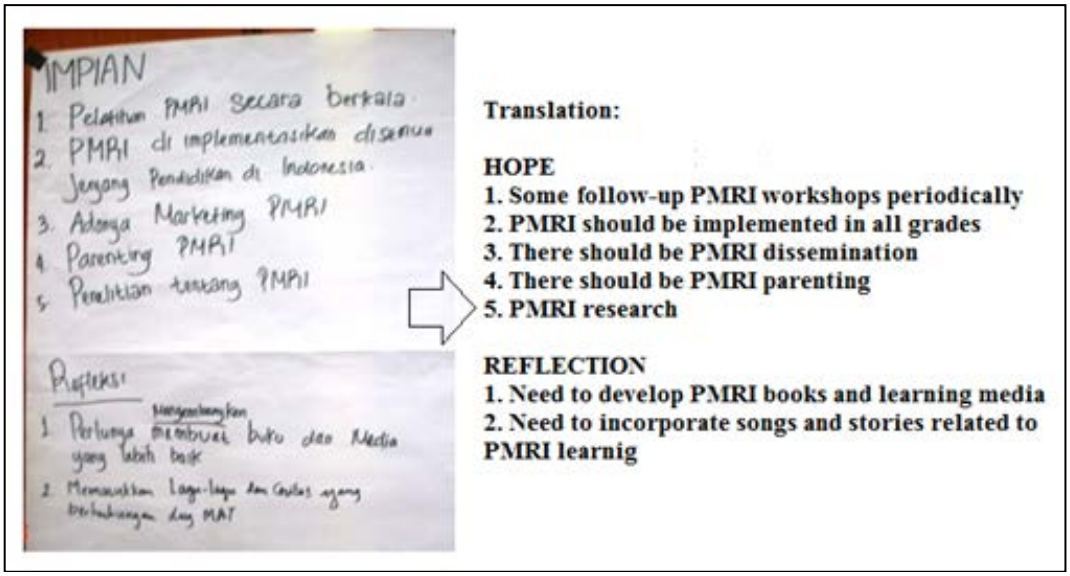


Figure 3. A teacher's response of the workshop

The result of Innovative TPD on PMRI

PMRI have been implemented in Indonesia since 2001. The development of PMRI is closely related to the success of several PMRI programs, one of which is PMRI workshop concerning on teacher professional development. During the implementation of the workshop in many areas in Indonesia, teachers have been interested in applying PMRI lesson in their teaching programs. They started to build their idea from how to change 'the way of teaching' to 'the way of making students learn'. Some improvements happened such as their conception of teaching mathematics, their mathematics content knowledge and skill, their practical teaching, and even their perception of learning media used in a lesson.

Regarding the role of PMRI workshop in improving teacher's conception on mathematics learning, we argued three changes. Firstly, PMRI workshop contribute to teachers improvement on their concept of the teaching program from telling mathematics as a ready product to let students have experience in building mathematics concept. The teachers' responses on PMRI at Semarang city, for example, revealed that an important thing in PMRI learning is that students could build their own reasoning through PMRI tasks. Furthermore, students are supported to give various strategies which bring them to their own understanding of certain mathematics concept (IP-PMRI, 2010). Secondly, PMRI workshop bring positive impacts to develop teachers' conception in building students' character. Interactivity as one of characteristics of PMRI emphasizes the social interaction among learners to support each individual learner (Treffer as cited in Bakker, 2004). A learning process will be more effective if students communicate their ideas through social interaction. Thus, PMRI learning strongly support teachers to build students' character. Wijaya (2012) argue that in PMRI learning, when students present their mathematical ideas in either discussion or presentation session, their awareness to communicate their work to their friends will be better as a result of interactivity.

Figure 4. A group of teacher participants work collaboratively in designing PMRI lesson (the photograph was taken from national workshop in Surabaya, 2007)

At last, PMRI workshops give more understanding on intertwinement principle within the mathematics lesson and organized it more effectively. This suggests that the teacher can apply the characteristics of intertwinement, that is the integration of mathematical strands or units is essential so that PMRI lesson is taught by considering the cross-connetions among subjects (Gravemeijer, 1994). The intertwinement principle also finds its meaningfullness in supporting effective lesson as reported by Jackson, Johnson & Blanksby (2014) where students in their professional program, called The Maths Skills Program developed by La Trobe University, Australia, not only could practice basic mathematics skills to achieve mastery, but also, at the same time, could work on problems in context to practice transfer of those skills into disciplinary study. In addition, some teachers' responses on some PMRI workshops showed that there is no any significant obstacle in using PMRI within the curriculum. Teachers who have ever joined PMRI workshop and applied PMRI in their learning consistently admitted that during this time there were still common opinion revealing that PMRI lesson takes longer time than usual (conventional) mathematics lesson so that it will not satisfy the demand of curriculum materials. They actually claimed the opposite: with the one-time learning PMRI students learn many mathematical concepts so that the time is used more effectively (IP-PMRI, 2010).

The findings also indicated the improvement of teachers' mathematics content knowledge. For instance, analysis by Patahuddin et al (2010) showed that teachers not only understand any misconception of certain mathematical content which they did in their typical teaching but also they could open broader knowledge about other mathematical concepts and procedures. For example, within the activity on the topics of multiplication, teachers were not only aware of the difference between the meaning of 2x3 and 3x2 in the form of repeated addition, but they also aware of finding factors of integers (2 and 3 are factors of 6). Furthermore, some contextual tasks which were designed with open-ended solution given to the teachers in the beginning of the lesson supports teacher to use their own strategies in either formal or informal. Surely, this enhance their mathematical thinking ability.

Another finding on teachers' results of PMRI workshop is the use of learning media. During the workshop, the facilitators often used simple learning media which are easily found like coins, straw, paper, bottle-cover, coconut shell, and unused plastic bottle. Bottle cover, for example, can be used in learning integer operation. Mustikawati (2007), a participant of a

PMRI workshop, used 2 models of bottle-cover which each represents positive number and negative number. If two botte-covers with symbol "+" and "-" meets, they show number "0". This idea is then organized within a set of activities in the purpose of making students understand about the concept and procedures of integer operation. This suggests that PMRI opens the opportunity for the teacher to use any resources even from unused goods to create learning media that is useful to develop students' understanding of the lesson. The challenge is that teachers are required to be more creative in utilizing items around and unused goods to be transformed into meaningful learning media.

Figure 5. Bottle-cover as a media in learning operation of integer

Having idea about the characteristics of PMRI workshop, we also argue a potential finding which might be useful for sustaining PMRI programs in Indonesia. Starting to design a mathematics lesson using certain context by applying characteristic of intertwinement is useful for teachers as a starting point to implement current curriculum in elementary school. Regarding the implementation of the current curriculum in Indonesia, mathematics learning in elementary class uses integrated thematic instruction, that is an integrated learning that use certain theme by linking several subjects so as to provide meaningful experiences to students. Thus, PMRI workshop supports the implementation of the curriculum. On the workshop in which we were involved as facilitators at Palembang city, for example, we used a theme 'playing' for the topic of length measurement for grade 2 to link some basic competences of several subjects such as bahasa Indonesia, art and culture, and certainly mathematics itself. Here, teachers learned bahasa by writing their ideas on the worksheet and presenting ideas through presentation and they also learned arts and culture by investigating a variety of traditional games from Indonesia as well as utilizing unused goods as stuff for creating useful thing.

Figure 6. Playing traditional games as context supporting thematic instruction is introduced in a PMRI workshop (the photographs were taken from a local PMRI workshop in Palembang city, 2013)

The lesson started with playing a traditional game and teachers were then asked to solve several tasks in a worksheet in groups to build their understanding about learning trajectory from learning non-standard measurement to learning standard measurement. Through this workshop, teachers not only experienced a PMRI learning, but also realized that playing traditional games

as one of cultural heritage was useful to be a valuable context of learning. Thus, we argue that we could be able to incorporate principles and characteristics of PMRI into thematic instruction in every PMRI workshop.

Conclusion and Recommendation

To conclude, we argue that TPD within PMRI can be chosen as a promising model of innovative teacher professional development to improve the quality of Indonesian mathematics teachers. The analysis reveal that PMRI workshop is strongly inspired by the principles and characteristics of PMRI which is then derived into the standard of PMRI workshop proposed by IP-PMRI. The unique characteristics of PMRI workshop, such as considering teacher participants as active learners instead of passive receiver in building their own understanding about PMRI,facilitating teachers in designing and implementing PMRI lesson using their own product, and organizing sustainable follow up workshops to strengthen mathematics teachers' community in developing PMRI materials, lead to the consideration that PMRI workshop satisfy the characteristics of a good TPD. Furthermore, PMRI workshop also indicate some teachers' improvements on conceptual teaching, practical teaching, mathematics content and skill, and utilizing learning media within PMRI learning.

To suggest, we propose PMRI workshop as an alternative model of TPD to be continuously implemented on mathematics teacher, especially for Indonesian teacher since its evidences which supports the implementation of current curriculum.

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