Integrating Mathematics Literacy and Mathematics Teaching and Learning in a Mathematics Class

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Abstract. Having a mathematical literacy means not only mastery the mathematics content but also able to use it in daily live. As it does not include in Indonesia's mathematics curriculum explicitly then the teaching and learning of mathematics should integrate both the teaching and learning of mathematics and mathematical literacy. Mathematics problem solving performance modeling as the framework and the local culture as the context of the problem can be applied to integrate both of them. This paper aimed to describe how the integration be conducted in the mathematics teaching and learning. For this purpose, a set of instructional instrument has been developed and implemented at three classes of two schools. Observation of the teaching and learning process, and the students-teacher interaction are taken. Based on the research, both the using of local culture as the context, and habituation of problem solving would attract the students to learn and strengthen students's mathematical literacy.

Keywords: mathematics literacy, mathematics teaching and learning, integration, mathematics problem solving performance modelling, local culture.

According to Stacey (2011: 103) this concept of mathematical literacy is closely associated with concepts that are often discussed in mathematics. Mathematics in everyday life does have many benefits in daily life, but because of the mathematical properties are abstract enough then it is difficult to be able to apply mathematics in daily life. The most important part in mathematics is the mathematical modeling (relating to mathematical according to de Lange, 2006) and processing. A feature to distinguish mathematical literacy from mathematics is an emphasis on the use of mathematics in context (PISA 2003; Steen, 2001; Brown and Schafer, 2006). In particular, contexts that is common or relevant to the day-to-day life of the 'ordinary' person in society (Duba, 2004; Laridon, 2004; Brown and Schafer, 2006). The context may be of a personal nature, involving problems or challenges that might confront an individual or one's family or peer group. The problem might instead be set in a societal context (focusing on one's community—whether it be local, national, or global), an occupational context (centered on the world of work), or a scientific context (relating to the application of mathematics to the natural and technological world). A problem is also characterized by the nature of the mathematical phenomenon that underlies the challenge (PISA 2015). And it is the use of mathematics in these contexts, by this 'ordinary' person that is an important focus of mathematical literacy. That is, to be mathematically literate, it is important that a person be able to identify mathematics relevant to the context at hand and then be able to use this mathematics as one means contributing towards the achievement of one's goals in the context (Brown and Schafer, 2006:44).

Indonesia's students performance in mathematical literacy is measured by PISA. In PISA 2009 (OECD, 2010), Indonesia was ranked 61 out of 65 countries, even based on the last PISA test in 2012 (OECD, 2013: 3) Indonesia rank declined to rank 64 of the 65 participant countries PISA. This result impact to Indonesia education system. In year of 2013, Curriculum 2013 of Indonesia appeare as a reaction to the PISA results. Therefore, the implementation this

curriculum in mathematics should can be used to teach and improve students' mathematical literacy. But, the curriculum 2013 does not state the mathematics literacy competencies to the mathematics competencies explicitly.

Curriculum 2013 emphasizes the use of scientific approach and thematic subjects for junior and senior high school. Applicative problems (in daily life) that can be observed and intertwined with other topics may be the right tool in the teaching of mathematical literacy. This aplicative problem should be package in a relevan and familiar context. Therefore, this study was linking between education and culture in problem solving and mathematical literacy. Education and culture is something that is inevitable in everyday life, because culture is a unified whole and thorough prevailing in a society. Unconsciously, activities of daily life become a specific culture of social life that can not be spared. By using culture as the context of teaching and learning, the students expected to have a good understanding to mathematics. In other hand, the used of problem solving may be come a good way to teach mathematical literacy.

Mathematics problem solving performance modelling is a model of teaching that intoduce by Lestari&Sugiarti (2014). This model of teaching aimed to teach the problem solving skill to students. This model of teaching view that by modelling the students performance and the way to asess the ability, students have their own experience to do the problem solving in order to teach the ability. In this research, researcher do a few modification in the teacher activity on orientation and evaluation phases. The activity distributing and explaining of exemplars problem and exemplars rubric that has been fulfilled and assessed on orientation phase was elliminate. On the evaluation phase, the activity added by two activity i.e. teacher together with the students discusses the answer of the evaluation and then student should fulfill the student rubric. Table 1 bellow show the modified syntax used.

Table 1. The syntax in Mathematics Model of Teaching Based on Authentic Assessment through Exemplars Problem

No	Phase	Teacher's Activities	Students' Activities
	Pre Teaching	Categorizing the level of the students 'problem solving skill by conducting pre test	Doing the pre test
1	Orientation	Present the learning objective and motivating students through the provision of problem samples closely related to daily life. Pointing out explanation or review on the prerequisite materials and or problem solving strategies which might be possibly applied to solve problem in the next phase	Listening to teacher's explanation, answering or solving the given problem Listening to teacher's explanation, making notes, receiving the exemplars problem and exemplars rubric, asking when there is explanation in question, and responding to teacher's inquiries.
2	Individual Problem Solving	Distributing the exemplar problem and the problem solving guidance Explaining how to use the guide of problem solving Asking the students to do the exemplar problem individually Observing, making a note and assessing on how students solve a problem	Receiving exemplar problem and problem solving guidance Listen to the teacher's explanation and ask questions if find the miss understanding Work on exemplars problem by referring to the exemplars rubric. In solving the problems, they can do the problem solving on the exemplars rubric directly.
3	Group Organization	Organizing students into heterogeneous learning groups based on their problem solving level (4-5 students). Distribute worksheet (exemplars problem and exemplar rubric which are exactly similar to the previous) for each group.	Deploying themselves into their group Receiving, read and try to understand the exemplars problem and exemplars rubric.
4	Group Discussion	Asking the students to do the worksheet Asking the student to discussion each other to repair each student work in order to find the best solution Observing, making note, and assessing the student attitude in solving a problem.	Doing the worksheet Sharing ideas in groups when working on exemplars problem by referring to exemplars rubric. Asking the question if they have any difficulties

No	Phase	Teacher's Activities	Students' Activities
		Being a facilitator in group discussion and giving help to groups if they find any difficulties. Ask the students collect the work discussed	Collect the work discussed
5	Class Discussion	Ask the representatives from several groups to present their discussion result. Facilitating the class discussion refer to the exemplar rubrics Observing, making note, and holding assessment the student in both affective and cognitive aspect of problem solving	Several group representatives present their discussion result. The other students have to comment on or ask some questions on the presentation refers to exemplar rubrics
6	Assessment Modeling	Demonstrate on how the groups solve problem Asking the students to assess their individual problem solving	Listening to teacher's explanation, making notes, receiving exemplars rubric and exemplars problem, pose questions if there are any question.
7	Evaluation	Evaluating the students achievement by exemplar problem B Discussing the answer of exemplar problem B Asking the student to do self-asessment.	Doing the exemplar problem B Discussing the answer of exemplar problem B Doing self-assessment using exemplar rubric
8	Closing	Both teacher and students cooperatively infer ideas or concepts that have been elaborated in that day. The techniques applied can be greatly varied. Such technique as teacher's giving inquiries which stimulate them to reach the desired points	
	Post Learning	Giving the post test and categorizing students based on their ability	Making notes on the elaborated conclusion

The research question is:
How the integration of mathematical literacy teaching to mathematics teaching and learning is conducted?

RESEARCH METHODS

Researchers will answer the research question by describing the implementation of instructional tools of mathematics problem solving performance modelling model of teaching by using mathematics literacy problem. For this purpose, the researchers have developed 16 sets of mathematics instructional tools sets based on local culture and scientific approach for VIIth grade of Junior high school students. performance modelling model of teaching (Lestari, N.D.S., & Suwito., 2014). four content of PISA was used in this sets, i.e. change and relationships, uncertainty and data, quantity dan shape and space. Each content consisted of four instructional tools i.e teachers' guidance book, students worksheet, exemplar problems, and 4) lesson plan.

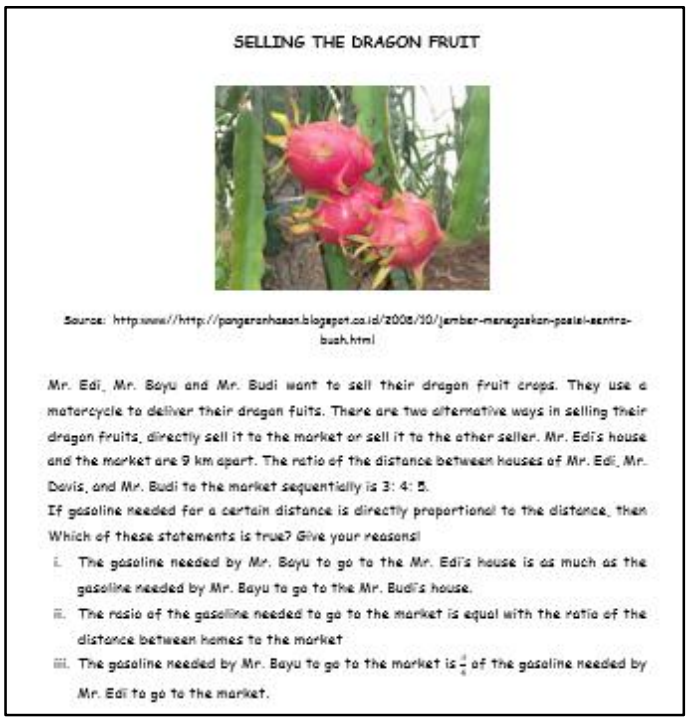
Two schools has been choosen to implement the instructional tools sets. They are SMPN 12 Jember dan SMPN 7 Jember. Before the implementation, the teachers asked to prepare everything needed in the teaching and learning class. Teachers also asked to explain about how to use students' exemplar rubric and guidance for problem solving. The teacing process and students-teacher interaction was recorded, analyzed, abstacted dan described.

RESULT

This paper will describe one set of teaching and learning by mathematics problem solving performance modelling model of teaching to integrate mathematical literacy teaching and learning to mathematical teaching and learning in the class.

Preparation.

Before the teaching and learning, the teachers should choose an appropriate problem to explore and mastery the problem



SELLING THE DRAGON FRUIT

Source: http:www//http://pangeranhasan.blogspot.co.id/2008/10/jember-menegaskan-posisi-sentra-buah.html

Mr. Edi, Mr. Bayu and Mr. Budi want to sell their dragon fruit crops. They use a motorcycle to deliver their dragon fuits. There are two alternative ways in selling their dragon fruits, directly sell it to the market or sell it to the other seller. Mr. Edi's house and the market are 9 km apart. The ratio of the distance between houses of Mr. Edi, Mr. Davis, and Mr. Budi to the market sequentially is 3: 4: 5.
If gasoline needed for a certain distance is directly proportional to the distance, then Which of these statements is true? Give your reasons!

i. The gasoline needed by Mr. Bayu to go to the Mr. Edi's house is as much as the gasoline needed by Mr. Bayu to go to the Mr. Budi's house.
ii. The rasio of the gasoline needed to go to the market is equal with the ratio of the distance between homes to the market
iii. The gasoline needed by Mr. Bayu to go to the market is $\frac{4}{5}$ of the gasoline needed by Mr. Edi to go to the market.

Figure 1. Examples of Problem Based on Local Culture

The domain of the problem
Content: change and relationship
Context: occupational
Process: employing mathematical concepts, facts, procedures, and reasoning;

The context used in this problem is occupational. The local culture inserted to this problem is the fact that some of the Jember community are farmer, and trader. Besides the beautiful view of the town of Jember, from the top of Rembangan tour destination are also seen some farms, paddys and beautifull mountains views. Jember Tourism Rembangan surrounded by coffee plantations and dragon fruit plantations. And this region became the largest supplier of dragon fruit in Jember. On the journey to the sights of this winding, all eyes will be treated by the dense of dragon fruit plantations. Many houses cultivate dragon fruit in the yard of their house or along the road. To sell crops dragon fruit, usually local people sell in the local market, or at a specific location on the edge of the road along with the other sellers within the house or farm. They will take the second option if they are far away from the local market. Of course, the further away will be even greater sales costs necessary. By this context, the students are leading to understand the problems through local culture.

Based on the observation before the teaching and learning, we found that teachers who try to solve the problem at first before give it to the students have a better fluency in delivering the problem than teachers who are just trying to understand the problem through reading. This is because; they have more learning experience to be used when teaching mathematical literacy.

Teaching and Learning Process

The prerequisites material required to solve these problems are cicle and distance, ratio, and numbers operation. Students need the knowledge about circles to describe the position

between houses and markets. Consider that the market as the central point of the circle then the position of Mr.Edy's, Mr. Budi's and Mr. Bayu's house are varied infinitely specific locations as long as the circumference of the circle. The other prerequisites material is ratio. Students need to interpret the meaning of the ratio and use of the concept of ratio to be able to choose the statement that is true. The students must understand that the farther the distance the more gasoline they need. Number operations are necessary if the student prefers involve mental processes and calculation to solve the problems.

Based on the teaching and learning observation, the teacher has delivered this prerequisite material in the orientation stage through classical question and aswer. At the first teaching and learning set, the activities of this classical question and answer can not activated all students. Only certain students are actively asking or answering. By the observation, we know that after a few times teaching and learning using this model, students are increasingly accustomed to and actively asking or answering

There are three important things to do by the students in mathematics problem solving performance modeling such that it can use to teach mathematical literacy to student. While students do their task, the teacher also has to do their role to facilitate the students. Here are the brief explanations.

Student has to solve the problem individually by referring to the problem solving guidelines based on Polya.

Before ask students to solve the problems, the student should be informed the minimum ability in solving the problem expected by the teacher. Teacher are required to communicate the assessment indicators of students problem solving skills through problem-solving guidelines. When students try to solve the problem individually, the teachers should be go arround to observe the students' work and try to find students difficulties in solving the problem.

Based on observation in this study, the teacher can detect the students' difficulties in solving the problem individually, such as:

a. Students can understand the problem but student have difficulties in finding and communicating problem-solving strategies. The use of context that closed to the student would help students to understand the problem, but unfamiliarity of students to communicate the problem solving strategy makes students difficulties in solving problems logically.
b. Students have difficulties to think divergently because they don't have a meaning full understanding about some concept. Therefore, the solution with the previous procedure that they have learnt is the only thing to think. They think without considering the possibility of other alternative. For example, students were only able to draw a plan such that the market and each house are in a straight line in the same direction. They usual to draw a position of two or more object in one straight line, and their understanding about the concept of circle are not adequate enough.

Students' must be communicating their idea or the result of the group discussion to other groups or teacher in orally or in writing.

Communicating of thoughts is another form of role as the member of the group. By the observation, in a group only certain students who braved to express their thoughts, while others prefer to keep silence. Sometimes, it is not always because they did not have any idea but they are reluctant to communicate it. This may often occur for the first or second times using this model of teaching. In the next meeting the teachers continuously try to facilitate the students who are not active in group discussions but have an answer or idea (even though incomplete solution) on individual problem exemplar. By these methods, teachers could foster the students such that they would communicate their thoughts. Similarly, in the class

discussion the teacher has an important role in fostering students and groups to be able to understand the problem, to plan, to formulate and to apply their knowledge and mathematics concepts to solve problems. Each step is important to be reaffirmed by the teacher. Thus, students can learn problem solving skills and mathematical literacy.

For the problem presented above, the teacher should take some strategy such as: explain the meaning of the concepts related to the problem and show about how to use the concepts. In addition, other strategy also should be taking giving some examples about how is the strategy to understanding the problem, such as: draw a sketch of the problem, underline the importance words or terms.

Students must be Asses their problem solving performance indivually or in group.

Experiences in assessing their problem solving performance by their self will lead them to the understanding of what should they do and not to do in solving a problem. In asseasing their performance, they use a student rubric (Lestari and Suwito, 2015) which contain indicators of mathematical literacy that combined with problem solving ability. In order to give student knowledge of how to assess a performance, the teacher must present an example in assessing the performance of at least one group. At first the students ask to assess the ability of the group performance based on the student work sheet, this activity aimed to train the student in assessing the performance. Next, students will learn to assess their individual performance in the next exemplar problem.

DISCUSSION

Preparation is a step for choosing or developing the teaching equipment. In choosing the teaching equipment there are some things to be consider, ie.

1. Wheter the content and material in a device have been learned the students?
   Due to the integration of mathematical literacy in mathematics uses mathematics problem solving performance modeling model of teaching then the content of the materials used must be content that at least the concept has been learned. Thus, students have the knowledge to be selected and applied in solving mathematical problems in everyday life. Teacher guided on the school curriculum to see whether the content of such material has been owned by the students or not
2. Does the context used in the problems a context that close to the students?
   Understanding of the problem is the fundamental needed to solve a problem especially mathematics literacy problem. Indonesian students are not familiar with the problem that present as mathematics literacy problem Therefore, the context used must be close to the students. One of context that suitable to this requisition is the local culture context. By the research, there are several advantages associated with the use of local culture as the context of the problems.
   a. Local culture context will be easier the students to understand mathematical literacy problems. The problem in local culture context is actually experienced by their self or it is around the students.
   b. Local culture context provide regional insight for students to know the culture of the region of students.
   c. Local culture context will attract students to learn. They feel that they know the context in the problem.
3. What objects of mathematical are to be taught to the students?
   Mathematical objects in this paper are definitions, facts, concepts and principles (Bell, 1992). Each object associated with the content, context and process must be taught or refreshed to students and interpreted by students

If the equipment owned is not qualified in these considerations, teachers should adapt the devices such that it match to the characteristics and abilities of students

CONCLUSSION

Based on the research results, some fundamental things are needed to integrate mathematical literacy in mathematics. The first is the selection of the appropriate context of the students' problems. The appropriate context can use the existing context in the local culture of students. The second is the understanding of the objects of mathematics. It is important to build students' understanding of the problems such that students are expected to be able to take the first steps to develop strategies for problem solving. The third is the habituation to the mathematics literacy problems through mathematics problem solving performance modeling model of teaching can improve mathematical literacy and sensitivity, as well as skills in solving daily problems

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