

Preliminary Study: Mathematics' Teacher Conception in Supporting the Integration of Mathematics' Literacy and Mathematics Teaching and Learning.

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Abstract. Indonesia's curriculum does not include the mathematics literacy as a part of it. Therefore, Indonesia's achievement in PISA depend on the competence of teachers in integrating mathematics literacy and mathematics teaching and learning in class. This teacher competence is build by the teachers conception in planning and managing the mathematics teaching and learning such as problem solving. This study is a preliminary study to explore the initial information about 1) the teachers opinion about mathematics literacy, 2) the teachers habitude in teaching mathematics, and 3) The teachers belief in integration the mathematics literacy and mathematics teaching and learning. To meet these objectives, the two types of questionnaires were distributed. The first questionnaire was given to 5 mathematics teachers in junior high school and the second questionnaire was given to 2 students who are taught by each teacher. The result of second questionnaire was used as triangulation of the results of the first questionnaire. Based on the questionnaire, data showed that 1) most of teachers do not have enough knowledge about what was mathematical literacy, 2) mathematics teaching and learning is done by focus on teaching the procedure of solving the exercises on the text book of a particular subject, and 3) most of teachers are thinking pessimistic to integrate mathematics literacy and mathematics teaching and learning in the future.

Keyword: teacher conception, integration, mathematics literacy, teaching and learning mathematics

1. Introduction

Mathematical literacy is different with the mathematics ability. Mathematical ability is the capacity to use or manipulate numbers effectively in clerical administrative, scientific and other areas of

application of number. It is ability to understand and work with numbers with idea related to numbers [1]. Mathematics Knowledge & Skills refers to the conceptual understanding of numbers, their relationships, combinations, and operations. Mathematics also includes shapes and their structure; reasoning; measurement; classification; and patterns [2]. So, mathematical ability is the capacity to use or manipulate numbers and operation, shape, reasoning, measurement and pattern. While mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens [3]. Mathematical literacy is contextual based and intended as a construct applicable to all ages and level of expertise. In other words, mathematical literacy is the ability to know what mathematical knowledge should be used in solving everyday problems. Mathematical literacy is more contextual and mathematical ability is more tends to the content. So, many people or students in abroad such as Australia think that mathematics literacy is easier than mathematics because the context used is a reality.

In fact, there are many contrary phenomenon occurred in this world. It is not uncommon that someone familiar with a mathematical tool fails to recognize its usefulness in a real-life situation neither it is uncommon for a mathematician to be unable to use common-sense reasoning (as distinct from the reasoning involved in a mathematical proof)[4]. We can say that having mathematical ability alone are not enough without knowing how to use it. Therefore, it is not surprising that mathematical literacy is becoming a capability that is considered important to master.

PISA, Programme for International Student Assessment, is an international program to assess students Mathematical literacy that held in every three years. The test subject in this program are students aged about 15 years old or age of compulsory education. It is intended to see how well students prepared for the world of work or post-school environment. Thus, the results of PISA test is often used as the basic reason for curriculum improvement of a country. As Indonesia is participant of PISA test since 2006 then the result of PISA test also become a consideration of curriculum of education in Indonesia.

Since at first participation of Indonesia on the PISA test, Indonesia performance on mathematical literacy is always on the bottom ten. On the last PISA test, held on 2012, Indonesia performance on mathematical literacy is on 62th position of 72 PISA countries participant. This position was better than previous PISA test. Based on the mean score on the PISA result of 2015, it said that Indonesia Performance on mathematical literacy improved as much as 5 point between 2012 and 2015 PISA test [5].

Lately, curriculum in Indonesia has undergone several revisions. The revised of 2013 curriculum, the revision of 2013 curriculum, is the curriculum that was implemented in 2016. As the previous curriculum, this curriculum is clearly writes that the Indonesian test results in PISA and TIMSS, another international program assessment, become the background of the revised curriculum in Indonesia. This means that mathematical literacy becomes a necessity that must be satisfied by the educational curriculum Indonesia. Unfortunately this requirement is not included explicitly in the Indonesia's curriculum. Therefore, whether mathematics literacy to be taught or not all depends on teachers' conceptions about teaching mathematics literacy in their mathematics class. Thus, it is important to explore about the teachers conception at first as the base, such that a wise decision can be made for the education development.

2. Teachers' Conception.

In some studies, teacher conceptions term is often confused with the term teachers' belief. The term conception, initially introduced by Thompson, refers to "general mental structure, encompassing beliefs, meanings, concepts, propositions, rules, mental images, preferences, and the like" [6]. In other words, conceptions integrate in unitary construct knowledge and beliefs, beliefs representing a subcategory of the conceptions.

Conceptions of teaching affect an arrays of teachers' choices in practice, which include, teaching method, design and choice of learning tasks, design and choice of assessment tasks, assessment demands and workload of a subject/course. All of these can influence students' ways of studying and the quality of learning [7]. From a phenomenographic point of view, a teacher's conception of teaching acts as a framework through which that teacher views, interprets, and interacts, with his /her teaching environment [8]. In this paper we have decided to use the terminology of teachers' conceptions in relation to teaching and learning. Then we define that teacher conceptions refers to a teacher's values, attitudes, and beliefs towards teaching.

3. Research Purposes

This research was aimed to explore the initial information about teachers conception in supporting the integration of mathematical literacy to their mathematics class, i.e.

- The teachers opinion about mathematics literacy,
- The teachers habitude in teaching mathematics, and
- The teachers belief in integration the mathematics literacy and mathematics teaching and learning

4. Research Methodology.

To meet the objectives, the two types of questionnaires [9] were distributed. The first questionnaire is teachers questionnaire was given to mathematics teachers and the second questionnaire was given to 2 students who are taught by each teacher. Both of them are used to collect data about the teacher conception in integrating mathematical literacy to the mathematics class but by different point of view. The data from student questionnaire was used as triangulation of the data from the teacher questionnaire. The questionnaire consist of two types of questions, i.e. open question that need explanation and open-closed question with qualitative scale. Table 1 below show about the description of the teachers and students questionnaire.

Table 1. Description of the questionnaires item of questions.

Aspect	Information to Explore in teachers questionnaire	Number of question	Information to Explore in students questionnaire	Number of question
Background information of the teacher	Gender, ages, years of teaching experiences, level of highest education, participation on training of 2013 curriculum,	5 questions	Gender, ages, class, the number of years they have taught by the teacher.	4 questions
Professional competencies	Attendance of proffessional development activities, the effect of the activities and their plan of other activities in the future Knowledge about mathematical literacy	2 questions and 2 subquestions 1 question and 3 subquestions		
Pedagogic competencies and the teaching and learning practices	Implementation of problem solving teaching approach, and way of teaching. Teachers understanding about: students ability, way of learning and attitudes, The use of learning media	9 questions and 40 subquestions	Implementation of problem solving teaching approach, and way of teaching. students ability, way of learning and attitudes,	5 questions and 34 subquestions

Aspect	Information to Explore in teachers questionnaire	Number of question	Information to Explore in students questionnaire	Number of question
	and the resources.		The use of learning media and the resources	
	Teachers belief about integrating mathematics literacy to mathematics teaching and learning	2 questions and 6 subquestions		

Some important question are used to explore the teacher conception in integrating mathematics literacy to mathematics teaching and learning were listed as follow:

- To explore about teacher opinion of mathematical literacy, researchers used questions number 9, 9a, 9b and 9c, i.e.
 9. Have you ever heard, read information or received any training on mathematical literacy before?

If your answer is yes, then please go the the following question but if not you can directly go to the question number 10.

 - a. Please mention your sources to obtain such information?
 - b. Based on your understanding, please write down about what is mathematical literacy?
 - c. Do you ever teach mathematics literacy in your class? Explain!
- To explore this information, researchers used question numbers 10, 11, 12 as follows:
 10. In your teaching and learning, how do you think the ability of your students in math?
 11. In your teaching and learning activities, have you taught mathematics literacy ability (as defined at the beginning) to your students?
 12. If your answer to No. 12 was “yes” then explain how is the implementation? But if your answer to No. 12 was never then explain why?
 - 13 If you ask to teach mathematical literacy to your students, what is the most suitable methods/model for teaching it to the students of your school?
- The information about teachers teaching and learning practices, researchers used question number
 14. Have you ever used problem solving approach in your class?

If your answer in number 14 is yes, please answer the questions below and if not then you can go to the question number 15

 - a. How many times it is given to your students?
 - b. When you give it to your students?
 - c. What kind of problem that used to problem solving in your teaching and learning?
 - word problem/aplication problem for certaint topics.
 - Olympiad problems
 - word problem/aplication problems from some topics
 - Another problem (mentioned it)
 - d. Please mentioned the source of the problem
 - Students book
 - The collection book of Olympiad problems
 - Blog/journal in the internet
 - develop
 - Another source(mentioned it)

The questionnaires were distributed to 25 mathematics teachers but only 15 teachers return the questionnaire completely (included the students questionnaire). Among the 15 teachers there are 5 teachers that teach for junior high school. In this paper we only discuss about this 5 teachers because Junior high school is the last level of compulsory education in Indonesia which age range of students who graduated from junior high school is about 15-16 years old, the age of the participants PISA. The information about subject background can be found at the question numbers 1 to six. Table. 2 bellow show about the subject information background.

Table 2. Subject information background.

	Subject				
	S1	S2	S3	S4	S5
Gender	Male	Female	Female	Female	Female
Age	≤ 30	31 – 40	≤ 30	41 – 50	≤ 30
Years of Teaching experiences	≤ 10	≤ 10	≤ 10	≥ 21	≤ 10
Education	undergraduate	magister	undergraduate	undergraduate	undergraduate

5. Result and Discussion

5.1. Teachers opinion about mathematical literacy

Based on the data gathered from the teacher questionnaire then the result are described as follows.

Subject S1 state that he already know about mathematics literacy through books, journals and the Internet. He describe mathematical literacy as students' ability to apply mathematics in solving mathematical problems related to everyday life/real conditions. He also stated that he ever use mathematics literacy problems in his mathematics class. In his perception, mathematics literacy question is intended to practice higher order thinking and reasoning of students. It is differ with subject S1, subject S2 stated that she already know the mathematical literacy when she was in college but she have a similar opinion in describing mathematical literacy. In her opinion, mathematical literacy is the ability to apply mathematics in a wide range of high level problems (C4, C5, or C6 on Bloom's Taxonomy). Therefore , S2 had never used or taught mathematics literacy in her class. Another result was directed from S3, S4 and S5. They states that they have never heard or knew about mathematics literacy before. Then for, S3, S4, and S5 we can not continue to asked about what is mathematical literacy or wether they ever teach mathematics literacy to their classroom.

Based on the data above, it can be said that there are 3 teachers of 5 teachers who do not know or hear or received any training about mathematical literacy. While, two of five teachers who say that they know or heard about mathematical literacy before have the conception that mathematical literacy is associated with problem solving using high-level issues and require higher order thinking skills. This opinion was not appropriate. Mathematics literacy problem is not always related to high level problem or higher order thinking skills.

5.2. Teachers belief to integrate mathematical literacy on the mathematics class

Based on the data gathered from the teacher questionnaire then the result are described as follows

Subject S1 have a positive thinking about his students. He stated that his students have a good ability in mathematics. They like to work in a group to solve mathematics problems. Therefore, he believe that his student will be able to learn mathematics literacy. Furthermore, he already apply problem solving methods using mathematics problems with high level difficulties such as mathematics literacy. He think that teaching mathematical literacy requires a longer time than usuall problem in the text books, so it should be done sparingly such that it not spend too much time.

The belief of subject S1 about integrating mathematical literacy to their mathematics teaching and learning class is very different to another subjects. Subject S2, S3, S4 and S5 fell pessimistic in integrating mathematical literacy in their mathematics classes. Subject S2 stated that her students are from suburbs area therefore they have low ability in mathematics. Moreover, she did not feel confident because she never learned about mathematical literacy. In her opinion without deep understanding about the matter to teach then she will not succeed to deliver the knowledge to students. Another opinion come from subject S3. She believe that in order to succeed in mathematics literacy then the students should have a curiosity and dare to ask when they encounters difficulties. Unfortunately, she belief that only a small percentage of her students who have the curiosity and brave to ask.

Belief of subject S1, S2, and S3 about the importance of students ability in mathematics also agreed by S4 and S5. Both S4 and S5 stated that the reason of why they did not have a belief in itegrating mathematical literacy in their mathematics classes is their students ability in mathematics. They believe that their students ability does not reach the level of mathematic literacy. In addition, S4 said that another barriers in integrating mathematics literacy is the difficulty of managing the time to teach anything beyond mathematics curriculum content.

Based on the data, it shows that among 5 subject only one teacher who belief that he can integrate mathematical literacy teaching in his mathematics class. He have a belief that his students have a good abily in mathematics. While the rest for teachers agree that it is difficult to integrate mathematical litreacy teaching and learning because of some condition, ie:

- Students ability in mathematics is not good enough
- Students attitude and curiosity in struggling with new problem
- The lack of time because of the demands of the school curriculum in the conten mathematics.
- The teachers missconception that mathematics literacy is identic to difficult problem with higher order thinking,

5.3. Teachers teaching and learning practices

Based on the data gathered from the teacher questionnaire that triangulated by students questionnaire then the result are described as follows

Subject S1 stated that he teaches problem solving at least 4 times in a month either through assignments, homework, or tests. While the questions used in problem solving is usually a word problem on certain topics or a combination of several topics or problems on mathematics olympiad question. He get that problems directly from students' books, Olympics problems collection books, internet or develop their own. Further, he also state that he is more likely to use students' books as a source of problems. For the math test, S1 is more often using the questions that had been given previously with little change in the number or in the question. While in teaching problem solving, S1 often give problems from the easier to the more difficult and then invite students to analyze and interpret every sentence in the matter, asking questions inducement, then gave an example and demonstrate solutions to problems in front of the class

Subject S2 teaches problem solving once or twice for every chapters. The problem only given to one or two students who considered to have the capability good enough. Sometimes they get bored with the usual questions because they are usually finish earlier than their other friends. S2 more likely to use the lecture method of teaching problem solving. So, she usually demonstrate the way to solve a problem for the class and then give a similar problem to check whether her students undertand the way or not. It is rarely for her to give a new problem that her students never encountered without any example or demonstration of how to solve it. According to S2, problem solving is about the word problem or the application of certain topics obtained from students' books or book of problems collection.

Subject S3 occasionally teach problem solving to her students. It is depend on the students' book presentation. If the exerices of the subject in the students' book contain a word problem then she will teach it by problem solving. She also strengthen this statement by her next statement that the only

source of the material used in her class is the students' book and word problem is the only kind of problem suitable for problem solving. To help her students learn S3 frequently provides examples and explains how to solve the problem then she asked the students to solve problems such as those exemplified.

Subject S4 state that her consideration for teaching problem solving depends on the density of learning material, if the material is very dense then S4 does not teach problem solving. In teaching problem solving she prefer to develop her own problem. The problems created in problem solving are word problems or application problem of a certain topic. To help her students learn problem solving, S4 often provide examples and explain how to solve the given problem. Then she will pose similar situation problem and questions with the previous by giving the numbers variation. S4 rarely read sentence by sentence of the problems with the break. She prefer to ask students read whole of the problem then write down the given and the question directly. In order to not spend much time, she rarely leave a question that makes students rethink and analyzes the problem.

S5 subject stated that she had been teaching problem solving in mathematics but only once on every chapter. Just like S2, S5 also give the problem solving only to a few students who have more ability in mathematics. In addition, she also stated that her classes, there are only 2 to 3 students who have enough skills in problem solving. The questions used to teach problem solving are word problems rooted in a collection of books about the Olympics and or internet. She usually used a lecture methods by direct instruction to teach problem solving in her classes. To help students learn, S5 mathematics clearly explains the material, giving examples of simple exercises and explains how to solve problems / issues. S5 so rarely asked students to use their own way to solve the problem.

Based on the data above, it shows that:

- There are 4 from 5 teachers that rarely (no more than twice in a chapter) used problem solving in their class. They only give it to 2-3 students that have a high performance/ability in mathematics.
- One teacher used problem solving using problem that requiring HOTS at least 4 times in a month
- Mathematics problem solving teaching and learning is done by focus on teaching the procedure of solving the exercises on the text book of a particular subject.
- In teaching problem solving, teachers often give examples of how to solve a problem and then asks the students to solve similar problems to the way of the example.
- In addition, the methods used in the study were impressed more to teacher centered than problem solving.

6. Conclusion and suggestion.

Based on the data analysis and result above it can be concluded that most of teachers do not have enough knowledge about what was mathematics' literacy. While the teachers who stated that they had known about the mathematical literacy fall out to identify the type of problem that is a problem of mathematical literacy. Teachers rarely used problem solving in their class. When they implement problem solving, it is done by focus on teaching the procedure of solving the exercises on the text book of a particular subject. Most of teachers are thinking pessimistic to integrate mathematics literacy and mathematics teaching and learning in the future. They worried that their students doesn't have enough capability and that it will spend much time to implement problem solving.

There are some suggestion considered to the result finding and some barriers in conducting the research. Researcher argue that is important to find this conception with more subjects and combining the methods of getting the data by interview such that the result can be more valid and reliable. the result of this research is needed to let us know about what are the barriers of Indonesian teachers in integrating mathematical literacy to mathematics teaching and learning such that a wise desicion can be made. In addition, further research is also needed to obtain teachers content knowledge on mathematical literacy, teachers pedagogical content knowledge in preparing, implementing, and assessing the integration of mathematical literacy teaching and learning .

7. References

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