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RESEARCH ARTICLE

Mathematics Preservice Teachers' Views on Mathematical Literacy

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ABSTRACT

This study aims to know mathematics preservice teachers' common sense understanding of mathematical literacy. The results will later be used to design a learning program to introduce mathematical literacy to preservice teachers so that they have a better understanding of mathematical literacy. Data were collected by giving questionnaires to one hundred and eight mathematics preservice teachers. The result showed that mathematics preservice teachers' views on mathematical literacy can be categorised into 5 areas: 1) ability that has to do with problems in people's daily life, 2) communicating using mathematics concepts and properties, 3) interpreting mathematical sentences into everyday language or vice versa, 4) activity related to reading and writing about mathematics, 5) basic knowledge of mathematics. Preservice teachers agreed that learning mathematics in schools should connect mathematical concepts with real-life problems. They are also ready to increase the mathematical literacy abilities of their future students.

1. INTRODUCTION

Education is expected to be able to develop students' abilities in thinking creatively, flexibly, solving problems, collaborative and innovative skills needed to succeed in work and life (Pacific Policy Research Center, 2010). Core competencies in the Curriculum 2013 Contents reflect efforts to develop these abilities. Based on the Curriculum 2013 content standards, mathematics as one of the compulsory subjects at all levels is expected not only to equip students with the ability to use calculations or formulas in working on test but also to be able to involve their reasoning and analytical abilities in solving everyday problems (Sari, 2015; Masitoh, 2018; Nasir, 2018). This is in line with the Program for International Student Assessment (PISA) view which reveals that mathematics is an important tool for a person in dealing with personal, social, work, scientific and problematic problems and challenges in their lives (OECD, 2015).

The data from OECD (2016) shows that Indonesia's participation in the PISA since 1999 has not shown satisfactory results. The PISA study in 2015 shows that Indonesia on ranks 62 of 70 countries with an average mathematical literacy score of 386, far below the average OECD mathematical literacy score of 490. Further data is also obtained that in 2015, only 0.8% of Indonesian participants were able to reach level 5 or 6, up from the achievement in 2012 which was only 0.3%. In 2015, the percentage of students who were only able to reach level 1-2 decreased from 75.7% in 2012 to 42.3%. Despite having improved from 2012 to 2015, these results are still far from expectations, especially to prepare students to face future challenges in the era of globalization. Every student must have different abilities in applying mathematics to understand and solve problems. PISA calls the ability of individuals to formulate, use, and interpret mathematics in various contexts as mathematical literacy. Mathematical literacy includes mathematical reasoning and the use of concepts, procedures, facts and mathematical tools to describe, explain, and predict phenomena which can lead individuals to explore the role of mathematics in life and make good decisions needed by society (OECD, 2017). Stecey & Tuner (2015) defined literacy in the context of mathematics as the power to use mathematical thinking in solving everyday problems in order to be better prepared to face the challenges of life. Mathematical thinking is intended to include a problem solving mindset, logical reasoning, communicating and explaining.

The Mathematical Council of the Alberta Teachers' Association views mathematical literacy as connecting mathematics to the real worlds, using mathematics appropriately in variety of contexts, communicating using the richness of mathematics, synthesizing, analyzing, and evaluating the mathematical thinking of others, appreciating the utility and elegance of mathematics, understanding and being conscious of what has been learned mathematically (MCATA, 2002). The Indonesia government through Curriculum 2013 seeks to provide opportunities for students to develop these capacities with scientific approach. In addition, in developing mathematical literacy abilities, the role of teachers is needed in enriching students' learning experiences. The teacher plays a role in providing literacy activities and developing contextual teaching materials. They also need to understand the purpose of using literacy strategies in their classroom (Cappelli, 2015). To carry out this role, the teacher must have good conception of mathematical literacy.

The main aim of this study was to know mathematics preservice teachers' common sense understanding of mathematical literacy. The results will later be used to design a learning program to introduce mathematical literacy to preservive teachers so that they have a better understanding of mathematical literacy. Furthermore, they are expected to be able to design learning that can develop students' mathematical literacy abilities.

2. RESEARCH METHODS

This study was conducted in the academic year 2017/2018. The participants were 108 mathematics preservice teachers in STKIP PGRI Pasuruan. Data were collected by giving questionnaires.
Participants were asked whether they have heard about mathematical literacy before participating in this study, their view about mathematical literacy, their perception about their own mathematical literacy ability, and their confidence to be good teachers in their future classess. Responses about views regarding mathematical literacy were categorised based on the similarity of responses.

3. RESULTS AND DISCUSSION

The results along with the discussion of the findings of this research are presented in this section. Table 1 shows the characteristics of preservice teachers participating in the study.

Table 1. Demographic characteristics of participants

Demographic characteristics of participants		f	%
Gender	Female	77	71
	Male	31	29
Heard about mathematical literacy before participating in this study	Yes	39	36
	No	69	64

Preservice teachers' views on mathematical literacy are determined and summarized in the Table 2 below.

Table 2. Preservice teachers' views on mathematical literacy

Preservice teachers' views	f	%
Basic knowledge of mathematics (easier than common mathematics)	21	19
Activity related to reading and writing about mathematics	33	31
Ability that has to do with problems in people's daily life	21	19
Interpreting mathematical sentences into everyday language or vice versa	15	14
Communicating using mathematics concepts and properties	18	17

The majority of participants (31%) have an understanding of mathematical literacy as activity related to reading and writing about mathematics. This is understandable because they usually used word "literacy" as an activity of reading and writing. Mathematical literacy is as important and as necessary as the dominant literacies of reading and writing ((MCATA, 2002). This view is also in line with the views of other participants that mathematical literacy is about communicating using mathematics concepts and mathematical abilities properties (17%). Communication is one of fundamental mathematical capabilities used in PISA 2015 frameworks. Mathematical literacy involves communication, because in the problem-solving process students need to express ideas to understand, clarify, and formulate a problem. Later on, students need to present the solution and explain to others (OECD, 2017).

Fifteen participants responded that mathematical literacy is about interpreting mathematical sentences into everyday language or vice versa. This view is similar with one of mathematical literacy processes used by PISA. The word *interpret* used in mathematical literacy focuses on the abilities of individuals to reflect upon mathematical solutions or conclusions and interpret them in the context of real-life problems (OECD, 2017). Twenty one participants have views that are almost the same as the definition of literacy according to some experts. Participants stated that mathematical literacy has to do with problems in people's daily life. Mathematical literacy is defined as the ability to use mathematical knowledge and understanding effectively in facing the challenges of everyday life (Steen, Turner & Burkhard, 2007). Ojose (2011) stated that mathematical literacy is the knowledge to know and use the basis of mathematics in everyday life. Someone who has good mathematical literacy skills has a sensitivity to which mathematical concepts are relevant to the phenomenon or problem.

About 19% of the participants have this view of mathematical literacy, which coincides with view that mathematical literacy is a basic knowledge of mathematics or an easier version of common mathematics. This view or conception is a lower conception of mathematical literacy. Many mathematics educators agree that mathematical literacy is not easier version of mathematics (Mbekwa, 2006). Brombacher (2005) also stated that mathematical literacy is a different kind of mathematics, not a lower level of mathematics (Mbekwa, 2006). The mathematics preservice teachers' on mathematical literacy represent authentic views without the intervention of researchers and literatures. Most of the participants' views corresponding with some ideas in the literatures of mathematical literacy. Participants' perception about their own mathematical literacy ability and their confidence to be good teachers in their future classess are presented in Table 3 below.

Table 3. Preservice teachers' perception on their mathematical literacy ability.

Aspect	4 (%)	3 (%)	2 (%)	1 (%)
I enjoy the process of learning mathematics on campus	26	37	37	0
I actively participate in every mathematics learning process on campus	18.5	29.6	51.9	0
My mathematics knowledge and skills increase every semester	7.4	66.7	25.9	0
Mathematical problem solving abilities that I have:	0	55.6	40.7	3.7
In problem solving, I developed my own strategy	0	14.8	74.1	11.1
I can solve mathematical problems related to everyday life	3.7	25.9	66.7	3.7
The mathematization and generalization capabilities that I have:	0	33.3	63	3.7
Learning activities on campus have been able to improve students' skills in connecting abstract mathematical concepts with more concrete problems of daily life	7.4	55.6	37	0
Mathematics learning in schools should connect mathematical concepts with real-life problems	48.1	51.9	0	0
As a teacher candidate, I have the skills to connect school mathematics concepts with problems in real-life with:	3.7	51.9	44.4	0
I am ready to be a teacher who is able to design meaningful mathematics learning in my future classes	14.8	51.9	33.3	0

Note:
4 : Strongly Agree/ Always/ Very good
3 : Agree / Often/ Good
2 : Disagree/ Sometimes/ Poor
1 : Strongly disagree/ Never/ Very poor

Based on the results of the questionnaire, it was found that the majority of respondents enjoyed the process of learning mathematics on campus and agreed that they had increased mathematics knowledge and skills in each semester. However, the results of the questionnaire showed that the majority of respondents were not always active in learning mathematics. In terms of measuring problem-solving abilities, the majority of respondents think that their abilities are in a good category. In the aspect of developing problem-solving strategies, solving mathematical problems in the everyday context and the ability to prove and generalize, the majority of respondents think that their abilities in these aspects were poor. Even so, the majority of respondents have a positive perception of the development of mathematical literacy in schools. They agreed that learning mathematics in schools should connect mathematical concepts with real-life problems. As preservice teachers, respondents are ready to design meaningful school mathematics learning in their future classes.

Teachers need to understand the purpose of using literacy strategies in their classroom and the strategies must match their routines, philosophies, and view of how they think mathematics should be learned (Cappelli, 2015). In order to achieve these expectations, teachers should have good views on mathematical literacy. Teacher education programs should provide preservice teachers the opportunities to develop their ability in mathematical literacy, so they can have a better conception of mathematical literacy. Professional skills development should be integrated with courses and learning activities. Effective professional development must be sustained, content-focused, and collaborative to effect change in teacher practices in ways that ultimately improve student learning (Li & Protacio, 2010).

4. CONCLUSIONS

Findings of the research show that mathematics preservice teachers' views on mathematical literacy can be categorised into 5 areas: 1) ability that has to do with problems in people's daily life, 2) communicating using mathematics concepts and properties, 3) interpreting mathematical sentences into everyday language or vice versa, 4) activity related to reading and writing about mathematics, 5) basic knowledge of mathematics (easier than common mathematics). Teachers should have good views in mathematical literacy in order to understand the purpose of using literacy strategies. Mathematical literacy ability is not limited to the ability to apply quantitative aspects, but involves mathematical knowledge in a broad sense.

Mathematics preservice teachers stated that they still have lack of mathematical literacy abilities and need to be improved. However, they agreed that learning mathematics in schools should connect mathematical concepts with real-life problems. They are also ready to design meaningful mathematics learning to increase the mathematical literacy abilities of their future students. Identifying the mathematical literacy views of preservice teachers when they are still students is very important to ensure that they have good conception of mathematical literacy.

It would be advised that any future research regarding mathematical literacy focus on the factors influencing the preservice teachers' views. Additionally, similar studies with larger sample can facilitate more generalizable result.

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