Experience of novice teachers to present mathematical problems

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Abstract. Mathematical problems are important in mathematics learning. Teachers should give students the opportunity to solve the problem. Novice teachers face some obstacles to present mathematical problems in their class. This study aims to describe the experience of novice teachers to present mathematical problems for their students. This article discusses the barriers experienced by novice teachers to present math problems. This research is qualitative research. The data were collected through interview five novice teachers. The results of this study reveal that novice teacher rarely present problems in mathematics learning. The low mathematical understanding ability of students are the main obstacle of novice teachers. Novice teachers assume that presenting problems affect students to be more confused. The findings of this study indicate that learning mathematics by novice teachers have not instructed students with problem-solving ability maximally. For further research, it is necessary to analyse the ability of novice teachers in preparing mathematical problems.

1. Introduction

Branca said that problem solving is heart of mathematics [1]. It is one of skill which developed in learning at 21-century. Branca (1980), Chapman (1997), argues that problem-solving is an ability which is must have and applied in daily life [2,3]. Solving problems leads to improve behavior in social skills, motivation, self-esteem, and performance in all aspects [4]. An effective mathematical problem solver can think fluently and flexible [5], because a problem is a question that the solution requires creativity, understanding, and thought [6]. Since 2006, problem-solving include in school mathematics curriculum of Indonesia. It has been a goal of mathematics learning. There have been many programs which developed to reach the learning purpose. Moreover, there has been much research which studied improving problem-solving of the student, such as using the diverse learning model or teaching material. However, data of research indicate that the problem-solving ability of Indonesian students is still low [7]. The result of TIMSS 2015 show that 4th-grade students of Indonesia get 397 points which are significantly lower than 500 as TIMSS scale center point [8]. In addition, the result of PISA 2015 shows that Indonesia students get 386 point in mathematics which is lower than the OECD average that 490 points [9]. It is contrasted with the result of Singapore and Japan students who reach 618 and 597 points in TIMSS 2015. In fact, Singapore has made problem-solving as the major theme in their curriculum since 1990 [10], while Japan teacher has had long experiences to develop the problems [11].

The development of students’ problem-solving ability is the responsibility of the teacher. Teachers should undertake efforts that provide opportunities for students to develop problem-solving skills. Therefore, the teacher's commitment to developing student problem-solving abilities must be
considered, especially for beginner teachers. They should have the spirit to develop students’ problem-solving abilities to the fullest. They have to pose a mathematical problem to their students. The mathematical problem can be tasks for students. Barakatsas (1993) said that mathematics problems are a task posed to an individual or group [12]. Moreover, Possamantier and Krulik (1998) argue that mathematical problems require solutions, and methods to find the solution never known before [13]. Therefore, there is two characteristic of mathematical problem, namely the existence of solutions to problems, and procedures for finding solutions that are not immediately known. Generally, there are two types of mathematical problems, namely closed problems, and open problems. Yee (2002) suggested closed problems as well-structured problems, while, open problems as ill-structured problems [14]. Minsky (1961) stated that well-defined problems are problems whose the solutions are unambiguous, and the method presented in a systematic way, the method presented in a systematic way, on the other hand, Reitman (1964) states that ill-defined problems allow very varied responses about information characteristics, the operations can be used, and their consequences [15].

When the teacher gives mathematical problems, certainly there are various student responses. Managing student responses is a teachers’ competence [16]. The teachers have to predict the response so that they can anticipate it. In problem-solving, the correct response is interpreted as the correct solution by students. Although students are able to solve problems, the teacher can respond to it by giving this questions: "come and show us", "why do it?", “what do you mean?”, “is that good, can you tell me more ...?“; ”that's good, what else?" [16]. The questions will encourage students to explore their ideas. On the other hand, there are some students who give an incorrect response. The incorrect response can be interpreted as an incorrect solution by students. The result of Rooge’s research shows that teachers tendency try to stimulate the students in order to know and justify their mistakes [16]. Teachers can guide students to review the problems that were solved. When students deadlock, the teacher can provide scaffolding. Scaffolding is temporary support provided to students during the learning process to help them achieve their goals [17]. Based on teachers’ experience, scaffolding can be prepared before learning. Teachers can develop worksheets as hard scaffolds which are static supporters or tools developed in advance to guide students in the learning process [17].

As a beginner, novice teacher is definitely facing challenges. Novice teachers experience a difficult transition from student teacher education to the real teacher [18]. Kuzmic (1993) state that it is essential to understand the early experiences of teachers which is the critical time for them and may determine their philosophy and attitude teaching [18]. The beginning years can also influence teachers to continue teaching or not [19]. So that, the experiences of novice teacher to present the mathematical problem for their students can affect their commitment to continue presenting or not.

2. Method
This is qualitative research. Data collected through interview novice teachers. This research does not generalized the result to other condition.

2.1. Participant
The participant of this research were selected by purposive random sampling. There are 5 novice teachers which consist of 2 male and 3 female as participants. There are some criteria that used to select the participants that have less than 5 years teaching experiences [20], and teach at junior or senior high school.

| Table 1. Characteristic of participant |
|----------------------------------------|
| Gender | Teaching experience | Topic of undergraduated theses |
| 1st participant (P1) | Female | 1.5 years | Problem solving ability of student |
| 2nd participant (P2) | Female | 1 years | Developing reasoning questions |
| 3rd participant (P3) | Male | 4 years | Developing question of PISA standards |
| 4th participant (P4) | Female | 3 years | Critical thinking ability |
| 5th participant (P5) | Male | 3 years | Action research using problem based learning |
2.2. Data collection and analyze
This research uses interview technique to collect data. The following main question given for the participant: (1) How you define a mathematical problems?, (2) How much you give mathematical problems?, (3) How is the students’ response when you present mathematical problems?, (4) What is the obstacle that present mathematical problem in your class?.

The data was analyzed by thematic analysis method. Researchers use thematic analysis method to classify and present themes (patterns) that relate to the data [21]. Miles & Huberman (1994) argue that there are three step in thematic process i.e data reduction, data display and data conclusion-drawing/verifying [21]. This research use inductive approach. Collected data start from a precise content to broader generalization.

3. Result and Discussion
All participants answer the main questions. The quotes of participant for the question are following:

**Question 1 : Define of mathematical problems.**
Answer of P1 : “Mathematical problems are questions which need students’ analyze to answer them. The questions usually presented as word problems. It not presented directly. Not like “Hint 7 + 3”, but presented as word problems.”
Answer of P2: “The problem is the challenging question which needs students’ struggle to solve it.”
Answer of P3: “Questions which make students think.”
Answer of P4: “Questions which need solution trough problem solving”
Answer of P5: “Mathematical problems are problems which can not be solved directly. It needs further understanding, such as in probability, linear programming, and etc.

**Question 2: Frequency of giving mathematical problems.**
Answer of P1: “I seldom give the problem-solving task, because the students cannot connect the learning material. I only give 3 or 4 problem-solving tasks in a semester.”
Answer of P2: “I just once give problem-solving task at the last semester but have not yet in this semester. I looked the question on the internet.”
Answer of P3: “Occasionally. Because students still confused about the routine question, even less to solve problems.”
Answer of P4: “I have given a mathematical problem for my students. It is about 5 times in the semester. I have given the problem in the students' worksheet.”
Answer of P5: “I do not often give mathematical problems, but every chapter must be there.”

**Question 3: Students’ response when given mathematical problems.**
Answer of P1: “Students are confused. Students say that ”it is difficult, I do not understand”. After that, they sometimes go out from the class.”
Answer of P2: “They feel difficulty. They ask me. Some students want to know the strategy to solve the problem, but the others complain and give up.”
Answer of P3: “There are different responses. Most of the students only wait and see how to solve the problems. Just a few students who try and ask me to solve the problems.”
Answer of P4: “Most of the students are confused, and many inquired. Only one or two students understand. Many students complain and give up.”

Answer of P5: “There are some students that can reconstruct the problems associated with the concepts that have taught, but the others do not understand directly about how to interpret the word problem into the formula.”

**Question 4: Novice teachers’ obstacle to give mathematical problems for their students.**

Answer of P1: “Students have less basic inability. Many students have not been able to multiply. Moreover, the learning facilities are less. There are only teachers books. If students have reference books, it is easier to let that students study and find the example from the books.”

Answer of P2: “There are only a few mathematical problems in the books. There are only 1 or 2 questions. Besides that, the students are difficult to understand the problem individually. If I explain the point of problems, then they can understand.”

Answer of P3: “First, reference books are less. Only 2 or 3 books. If there are more books, the application of problem solving will be easier. Second, problem solving ability of students or students’ IQ are low.”

Answer of P4: “There is no problem for me as a teacher. But it comes from the student. They do not have learning motivation.”

Answer of P5: “First, my material presentation is less precise. Second, students focus on problems, not the solution. Third, the ability of the mathematical connections of students is still low. Fourth, understanding concepts of students is still low.”

All participants define the mathematical problem as a question which needs students’ analyze to solve it. It indicates that novice teachers understand some characteristic of mathematical problems. However, some participants assume that mathematical problems must be word problems. Even though, unlike exercises and word problems, mathematical problems involve students engaging in cognition in a novel situation [22]. It means that mathematical problems can like word story or not. Moreover, mathematical problems present a novel situation for the students. It is meaningful that students have not solved the problems before. If students have solved problems before, then it will not be a problem for the students in the future.

The data show that all participants face problems to give mathematical problems for their students. According to some novice teachers, references books are very needed to support teaching and learning activities. These conditions indicate that teaching activities of novice teachers still depend on textbooks. The novice teachers have not developed teaching materials individually. The ability of teachers to organize teaching materials is one indicator of professional teaching [23] because of Weimer (2006) state that students’ learning impacted by teaching materials [24]. Besides that, developing mathematical problems ability of teachers have to be improved, because a problem has to be a novelty for the students. The teacher will be difficult to present mathematical problem continuously if they can not arrange the problems. They can not only depend on the books. They can access the internet to get more references when organizing the problems.

Furthermore, all participants said that they seldom use mathematical problems when teaching. They argue that low mathematical understanding ability of students are obstacles to present mathematical problems. Students’ mathematical understanding ability is very important things which determine the success of students in solving mathematical problems [25]. The students feel pessimistic when getting a mathematical problem. This condition influences the student's achievement [26]. In addition, it also impacts the teacher's commitment to developing the problem-solving ability of students. The researcher
asks participants that “what do the obstacles influence their spirit to present the mathematical problem?” Most of the participants state that it influences their spirit. There is a tendency that some novice teachers feel pessimistic and do not anticipate the response of students. This condition must be concerned. Novice teachers’ view must be positive to their students. There is much research that shows the problem-solving ability can be improved. That indicates that needed some effort to encourage students used to solve mathematical problems. The teacher has to choose instruction which gives opportunities for students to develop their problem-solving skills.

By the result of this study, there are some obstacles at three component of teaching and learning (eg: student, teacher, and learning material). They have to be concerned to get students used to have problem solving ability in daily life.

4. Conclusion
Based on interviewing the participants, novice teachers seldom present mathematical problems in their classes. They face some obstacle such as lessly facilities, and mathematical understanding ability of students are low. Not only some students but also novice teachers feel pessimistic that the students can solve mathematical problems.

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