The attitude of senior high school teachers on mathematical problem solving

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Abstract. Teacher attitude toward mathematical problem solving and its learning process is very influential on the teaching of problem solving in classroom. There have been many research experts who focus on research about teachers attitude toward mathematics in general, but they rarely sees how the teachers attitude toward mathematical problems solving and its learning process. This study aims to answer both that questions. The research type is qualitative with survey method. Three mathematics teachers from three different schools were selected as research subjects. Teaching videos of each teacher, questionnaires, and interviews with open questions were used as instruments to see the attitude. Each teacher was given a questionnaire on teachers attitude toward mathematical problem solving and its learning process, after which the teachers was also interviewed. Based on the research process, it can be concluded there are three categories of teacher attitude level toward mathematical problem solving and its learning process: good, very good, and excellent.

1. Introduction
Attitude is an individual tendency to respond in a special way toward the stimulus which exists in the social environment. Teachers attitude is the teacher response about idea, object, people or situations either positively or negatively. In this study the things that become ideas or objects are mathematical problem solving and its learning processes. There have been many research experts who focus on research about attitude of teachers toward knowledge, mathematics and their mathematics learning process. Koballa in his research assessed the influence of teacher attitudes toward science on beliefs and actions of the teacher. In his research, Koballa asserted that a person attitude will affect how a person will act and assert about the relationship between beliefs and attitude [1]. Hereinafter, attitude changes will also affect a person beliefs toward something [1-3]. Further, Zsoldos study has seen how the attitude of elementary school teachers to mathematics [4]. The conclusion Zsoldos research is the attitude of a primary school teacher to mathematics will affect their mood attitude [4]. A positive mood toward mathematics tends to be influenced by teacher positive attitude toward math.

Zsoldos's research also emphasizes on if we want to change student attitudes toward mathematics then it should change the teachers attitude towards a more positive first [4]. A professional teacher in the process of learning mathematics should have a positive attitude both to the mathematics itself and the learning process. Furthermore, Ernest explains what attitude is about mathematics and attitude
toward mathematics learning and the factors which influence [5]. Ernest provides a definition of attitude toward mathematics and to the process of learning mathematics as the following that are [5]. Attitude to mathematics first of all, there are the teachers attitudes to mathematics itself. These include liking, enjoyment, interest in mathematics, or their opposites, which in the extreme case can include math phobia. There is also the teacher confidence in his or her own mathematical abilities; the teachers mathematical self-concept, and the teacher valuing of mathematics while the attitude for the learning process is attitude to teaching to mathematics include liking, enjoyment and enthusiasm for the teaching of mathematics, and confidence in the teacher own mathematics teaching ability (or their opposites).

Based on these expert studies, all of these studies focus on attitude towards mathematics, seldom researchers focus on attitude toward problem solving and learning process on mathematical problem solving. When viewed thoroughly problem solving, it is a very important content in the learning process of mathematics, then it is necessary to be examined how the attitude of teachers to solve mathematical problems and learn process on mathematical problem solving. This study aims to see how the attitude of teachers toward mathematical problem solving and learning process on mathematical problem solving.

2. Method

2.1. Description of the study

This research has seen how the teachers attitude toward mathematical problem solving and its learning process. The learning process in mathematical problem solving has been documented observed and documented in the form of learning videos at the beginning of the study. Furthermore, teachers were interviewed with open questions and given a questionnaire to find out the categories of teachers attitude toward mathematical problem solving and learning process in mathematical problem solving.

2.2. Participants

Three Junior High Schools in Bandung City of Indonesia with different clusters were selected as research sites. The purpose of selecting a school with varying levels is in an attempt to avoid the problem of reliability and validity that may be in small sample sizes [6]. One of volunteer teachers in the eighth grade of each school served as the subject of the observation in the learning process of mathematical problem solving.

In the descriptive research, the researcher is the main instrument in the research, and the additional instruments used as a tool for collecting data are questionnaire with 20 item statement, interview sheet with 20 items open question, and analysis of teacher learning video documentation used as data triangulation, if teacher type cannot be obtained through questionnaires and interviews. Questionnaire was designed to talk about. The Formulation of Aspects and Indicators of Teacher Attitude to Mathematical Problem Solving and its learning process will be presented in table 1.

Table 1. The formulation of aspects and indicators of teacher attitude to mathematical problem solving and its learning process.

| Aspects to be measured | Indikator |
|------------------------|-----------|
| The teacher attitude toward mathematical problem solving | Attitudes towards solving mathematical problems in general |
| | Attitude towards the process of understanding mathematical problems |
| | Attitude towards the process of selecting a mathematical problem solving strategy |
| | Attitude towards how to run the selected strategy plan in mathematical problem solving |
| | Attitude towards the process of verifying solutions in mathematical problem solving |
| The teacher attitude towards learning about mathematical problem solving | Attitudes toward the learning process in understanding mathematical problems |
| | Attitudes toward the learning process in the selection of mathematical problem-solving strategies |
| | Attitudes toward the learning process in executing the chosen strategy in mathematical problem solving |
| | Attitudes to the learning process in verifying mathematical problem solving solutions |
Some questionnaire forms of twenty questions will be presented in the table 2. These statements are related to each attitude indicator above. The statements in table 2 will be filled by each teacher in each school.

### Table 2. Some of teacher attitude statements on mathematical problem solving and its learning process.

| No | Statement                                                                 | SS  | S   | N   | TS  | STS |
|----|---------------------------------------------------------------------------|-----|-----|-----|-----|-----|
| 1  | Mathematical problem solving is an indispensable content in the learning process of mathematics |     |     |     |     |     |
| 2  | I feel totally challenged how to understand mathematical problems in non-routine questions |     |     |     |     |     |
| 3  | I lack of strategy variation in non-routine problem solving               |     |     |     |     |     |
| 4  | I do not feel confident in choosing a strategy when dealing with new non-routine issues (never completed a similar thing before) |     |     |     |     |     |
| 5  | I always try to find a strategy that will make students easy in solving non-routine problems |     |     |     |     |     |

**2.3. Procedure**  
Each teacher is recorded during the learning process on problem solving in three meetings. The selected material is geometry because it is thought to be giving mathematical problem-solving problems. Each teacher was also asked to fill out a questionnaire related to the teacher attitude in mathematical problem solving and its the learning process. Furthermore, teachers were interviewed based on questionnaires selected by teachers.

**2.4. Data analysis**  
The results of teacher interviews is written, then coded and matched with teacher questionnaire to obtain attitude category on each teacher towards mathematical problem solving and its learning process. If the category cannot be established it will be synchronized with the learning video analysis on each teacher.

**3. Results and discussion**  
Based on the data analysis, it is obtained three categories of attitudes teachers toward mathematical problem solving and its learning process. That is exploration will be viewed in table 3.

### Table 3. Three categories of attitudes teachers toward mathematical problem solving and its learning process.

| Aspect                                      | Good                                                      | Very Good                                                  | Excellent                                                                 |
|---------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------|
| Teachers Attitude on mathematical problem solving | Teacher is phobia (fear) when faced with mathematical problem solving content | Teachers have a little phobia (fear) when faced with problem-solving content matematis | Teachers like, enjoy, and are interested, when faced with solving content |
| Attitude of teachers to learning about mathematical problem solving | Teachers look nervous in the learning process of mathematical problem solving | Teachers do not seem nervous in the learning process of mathematical problem solving, but they do not like totally, enjoy, or excited | Teacher looks to like, enjoy, and passionate in the learning process of mathematical problem solving |

The categories in table 3 are obtained by coding and triangulating from the questionnaire answers, interviews, and analysis on mathematical problem solving by the teacher. The following will illustrate one of the aspect of attitude of teachers to learning about mathematical problem solving, for other aspect were obtained in the same way.
3.1. Some examples of interview footage of teacher who comes from school one (T-1) related to attitude toward problem solving and learning process in problem solving

3.1.1. T-1 teacher (teacher who comes from school one) teachers Attitude toward mathematical problem solving. Some examples of interview footage of teacher who comes from school one related to attitude toward problem solving.

In the attitude indicator on problem solving in general, teacher T-1 (teacher come from school one) strongly agrees that mathematical problem solving is the indispensable content in the learning process of mathematics. This can be seen in the following interview footage.

Interviewer : Teacher truly agrees with mathematical problem solving which is the indispensable content in the process of learning mathematics. Why?
Teacher (T-1) : Indeed, the curriculum the highly accentuate problem solving. The main topic is more to solve the problem, and should be familiarized to the students to solve the problem.

Furthermore, teacher attitudes toward the process of understanding mathematical problems are illustrated by that one school teacher strongly agrees with the statement "I am so challenged how to understand mathematical problems in non-routine questions". This was revealed by the teacher in the following interview footage.

Interviewer : Then, you strongly agree with the statement that I really feel challenged how to understand mathematical problems in non-routine questions. Why?
Teacher (T-1) : Absolutely yes, because as a teacher we should be like that. Sometimes if the problem cannot be solved, teacher can do hours of work and feel at home.

The attitude toward the process of selecting a mathematical problem solving strategy, Teachers disagree with the statement that I lack a variety of strategies in non-routine problem solving. This is reinforced by the following interview footage:

Interviewer : You do not agree with the statement that I lack a variety of strategies in non-routine problem solving. Why?
Teacher (T-1) : It must that, in solving non-routine problems, we have to understand with what strategies are used for the settlement. Sometimes, we even have to combine several strategies. Why do not you choose to strongly disagree? Because sometimes there are also several times to find difficulties and confusion to determine what strategy should be used.

Based on the fragment of the interview above, T-1 teachers can be categorized as excellent teachers in attitude toward mathematical problem solving, because it shows orientation to attitudes of liking, enjoying, and interesting when faced with mathematical problem solving content.

3.1.2. T-1 teacher (teacher who comes from school one) teachers Attitude toward learning process in mathematical problem solving. Some examples of interview footage of teacher who comes from school one related to attitude toward learning process on mathematical problem solving.

Interviewer : Do you strongly agree with the statement that I want students to be able to understand non-routine problems in their own way. What is the reason for that statement Mom?
Teacher (T-1) : Yes, it must be, it is the goal of constructing knowledge, so that students develop the creativity they have not received from the teacher.

Interviewer : Do you strongly disagree with the statement that I always direct students to understand non-routine problems with an understanding that I have. Why Mom?
Teacher (T-1) : Strongly disagree, freedom must be given to students.

Based on the fragment of the interview above, T-1 teachers can be categorized as excellent teachers in attitude toward learning process in problem solving, because it shows orientation to attitudes of liking, enjoying, and interesting when faced with learning process in problem solving.
3.2. Some examples of interview footage of teacher who comes from school two (T-2) related to attitude toward problem solving and learning process in problem solving

3.2.1. T-2 teacher (teacher who comes from school two) teachers' Attitude toward mathematical problem solving. The orientation has a phobia (fear) when faced with the solving content that is shown by teacher T-2 (teacher come from school two). It is concluded based on questionnaire and interview analysis. The following some examples of interview footage of teacher who comes from school two related to attitude toward problem solving.

In the attitude toward problem solving in general, teachers have argued that solving mathematical problems is an indispensable content in the learning process of mathematics. Teacher revealed that, "Mathematics is not just a problem in the classroom, in everyday life many mathematical problems to be solved. Thus, it is better if the mathematical problem solving content is incorporated into the curriculum and implemented into the learning process. Mathematical problem-solving content can also train students' thought". Teachers also agree with the statement "I really feel challenged how to understand mathematical problems in non-routine questions". This was revealed by the teacher in the following interview footage:

Although the teacher has shown a positive orientation in the attitude toward general mathematical problem solving and attitude toward understanding mathematical problems, the T-2 teacher has a little phobia toward the process of selecting a mathematical problem-solving strategy. Teachers argue in terms of attitude to the process of selecting problem-solving strategies, namely: "I lack a variety of strategies in non-routine problem solving, I feel not confident in choosing a strategy when dealing with new non-routine questions similarly before. Developing my own strategy made me feel hesitant in the process of solving mathematical problems. "This can also be seen from the following interview footage:

Based on the fragment of the interview above, the teacher T-2 can be categorized as a very good teacher because it shows the orientation to the attitude that has a little phobia (fear) when faced with mathematical problem solving content.

3.2.2. T-2 teacher (teacher who comes from school two) teachers' Attitude toward learning process on mathematical problem solving. Some examples of interview footage of teacher who comes from school two related to attitude toward learning process on mathematical problem solving.

Interviewer : Why did you feel so challenged to understand mathematical problems in non-routine questions?
Teacher (T-2) : Yes, even though having to ask many times, study more about explores non-routine issues. Thus, our ability develops to solve non-routine problems. If there is a problem then I am curious to find the solution, then I have to learn with other friends.

Interviewer : Why did you feel so challenged to understand mathematical problems in non-routine questions?
Teacher (T-2) : Yes, I am not confident because I am not familiar with non-routine questions. Usually there are teachers who are appointed as Olympic trainers, maybe they are used to but I am not, and have to learn more.

Teacher (T-2) : Yes it was, because it is poorly trained and not accustomed, and I often feel hesitant in the process of solving mathematical problems. So, I am little bit doubtful.

Based on the fragment of the interview above, the teacher T-2 can be categorized as a very good teacher because it shows the orientation to the attitude that has a little phobia (fear) when faced with mathematical problem solving content.
Based on the fragment of the interview above, the teacher T-2 can be categorized as a very good teacher because it shows the orientation to the attitude that has a little phobia (fear) when faced with Leaning process on mathematical problem solving.

3.3. Some examples of interview footage of teacher who comes from school three (T-3) related to attitude toward problem solving and learning process in problem solving

3.3.1. T-3 teacher (teacher who comes from school three) teachers Attitude toward mathematical problem solving. The orientation has a phobia (fear) when faced with the solving content shown by teacher T-3. It is concluded based on questionnaire and interview analysis. In the attitudinal section on problem solving in general, the T-3 teacher (teacher is from school three) is neutral to the assertion that mathematical problem solving is an indispensable content in the learning process of mathematics. Here is an excerpt of an interview with an T-3 teacher.

**Interviewer** : You replied neutrally to the statement that mathematical problem solving is an indispensable content in the learning process of mathematics. What is your reason?

**Teacher (T-3)** : Not all materials must have mathematical problem solving, like the equation of lines, there is no problem solving mathematical problems

Furthermore, the teacher attitude toward the process of understanding the problem is that the T-3 teacher is also neutral to the statement "I deeply feel challenged how to understand mathematical problems in non-routine questions". This was revealed by the teacher in the following interview footage:

**Interviewer** : You are also neutral with the statement that I really feel challenged how to understand mathematical problems in non-routine questions, why?

**Teacher (T-3)** : I just feel simple if there is work, I do, but if it is difficult I will ask a clever friend to help me

Hereinafter, the attitude is shown by the T-3 teacher toward the selection of mathematical problem solving strategy. Teacher T-3 agrees with the statement that "I lack a variety of strategies in non-routine problem solving" with the reasons below.

**Interviewer** : Why do you agree that there is less variation of strategy in non-routine problem solving?

**Teacher (T-3)** : Yes, if the problem which is given is a non-routine problem such as problem solving, it usually can be learned in the book, and we can try it ourselves, later if cannot be asked to friends, so I agree

Based on the above description, it can be concluded that orientation aimed at teacher T-3 tends to the teacher phobia (fear) when faced with mathematical problem solving content, which is suitable to good category.

3.3.2. T-3 teacher (teacher who comes from school two) teachers Attitude toward learning process on mathematical problem solving

**Interviewer** : Mother is neutral in the statement that I am confident that I can find mistakes made by students in solving problems that are not true. What is the reason, Mom?

**Teacher (T-3)** : Yes, sometimes I feel confident too, sometimes not too. If students' difficulties cannot be solved in class, then they are taken home to be used as student homework.

Based on the results above it can be seen that each teacher has a different attitude. Attitude of teachers who are still at the lower level can be increased to the upper level. This was disclosed by Evans in his study which measured several teachers, there was a finding that at the beginning of the study attitudes and mathematics knowledge of teachers was not very good [7]. After the measurement was done Evans gave a treatment in the form of Teach for America (TFA) program, after the program was carried out, the first year the teacher's attitude and knowledge was again measured [7]. After the measurement is done in the first year during the program there is a significant increase between the attitudes and knowledge of the teacher as the subject of the study. Thus, the final finding in Evans's research is that there is a positive correlation between attitudes toward mathematical knowledge and mathematics content training [7]. Furthermore, teacher attitude is closely related to one's pedagogy skills, according to Negassa who examines the impact of pedagogical abilities of university teachers on the learning
process which is pursued [8]. Participants were 111 teachers with random techniques. The teachers come from six different schools. The instruments used are questionnaires and checklists. Based on these research findings there is a correlation that teacher attitudes need to be improved so that their teaching practices are also good.

For research recommendation, it can see how the influence between teacher attitude to student mathematical problem solving abilities, student behavior in solving mathematical problems and gesture of students in solving mathematical problem. Gesture students in mathematical problem solving have been researched by Harisman and Noto [9,10].

4. Conclusion

Based on the results of the study there are variations in the categories of how teachers behave toward solving mathematical problems and the learning process on mathematical problem solving. The results of the research can be used as a reference to review how teachers should respond to mathematical problem solving and learning process. It is very important to know because how the teacher behaves towards mathematical problem solving will affect how the teacher will do teaching in class.

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