The Role of Mathematics Anxiety and Mathematical Problem-Solving Skill

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Abstract. The purpose of this research is to analyze the correlation between mathematics anxiety and mathematical problem-solving skill. The data was collected by using a mathematics anxiety questionnaire and a problem-solving test. There were seven questions for the test of mathematical problem-solving and 25 questions for the mathematics anxiety questionnaire. The questionnaire was arranged by using the Likert Scale. The data were analyzed using the Pearson correlation formula. The population is the students in the calculus class. The samples are 200 students that were chosen by using a purposive random sampling technique. The results showed that there was a negative correlation between mathematics anxiety and mathematical problem-solving.

1. Introduction
Mathematics anxiety is an emotional condition related to feelings; displeased, afraid, anxious, depressed, worried, bored, and refused when discussing numbers, solving mathematical problems in daily life, or studying mathematics in the classroom. \cite{1, 2, 3, 4, 5}. Some factors cause mathematics anxiety, such as the classroom (classroom situation), an abstraction of mathematics, past experiences, family pressure, experiences of being criticized in front of the teacher's class, and teaching techniques. \cite{3}. Uncontrolled mathematics anxiety will have a serious impact on students. Many students have some difficulties/problems in learning mathematics because they feel anxious or afraid to apply and explore their mathematical abilities \cite{4, 6, 7}.

Individuals who experience Math anxiety feel less competent, which causes low learning achievement \cite{8}. Students' anxiety is generally caused by conditions considered threatening, such as complex problems or problems that are not commonly found \cite{9}. For example, students accustomed to solving math problems without a time limit will experience anxiety if given a short time limit \cite{8}.

Math anxiety was experienced by any gender, male and female, but the relationship between them could not be determined accurately \cite{10, 11, 12, 13}. Some previous studies showed that females experienced more mathematics anxiety than males, and thus they tended to avoid jobs related to mathematics such as computers and technology, mathematics career, and opportunities in problem-solving of mathematics \cite{14, 15, 16}. Conversely, some others revealed math anxiety had a greater influence on the performance of males than females \cite{17, 18}.

Problem-solving ability is important to factor in learning mathematics. This ability is still the general goal in the curriculum. All mathematical analyses need the ability of problem-solving because
the ability can improve the imaginations, develop creativity, and increase the understanding skill. Problem-solving skill can help students to improve their skill in solving the problem, understanding problem, making mathematics model, and finding the solution [19]. In Indonesia, problem-solving has been started to be involved in the mathematics curriculum. If the students can solve the problem easily, then this case cannot be called using the problem-solving skill. Problem-solving skill is a skill in solving the non-routine problem. Mathematical problem-solving skill makes the students can answer the questions from the lecturer, choose and identify the condition and relevant concept, conclude the problem, formulate the solving plan, and organize the previous skill [20].

Based on previous observation, mathematical problem-solving skill in Calculus class is still low. It can be seen from students' results at the end of the semester. Most students failed in the calculus course. There are several causing factors of that problem, such as the feeling of anxiety experienced by students when learning mathematics, which causes other feelings such as a decrease in the level of self-confidence, independent learning, and other feelings can influence students in the process of receiving mathematical information which also has an impact on their ability to solve mathematical problems [21]. So, the goals of this study are to analyze the role of mathematics anxiety and mathematical problem-solving skill and the correlation between mathematics anxiety and mathematical problem-solving skill.

2. Experimental Method
This study was correlation research. The subject of this research was 200 students in the Calculus class that was chosen by using a purposive random sampling technique. The data was collected by using a mathematics anxiety questionnaire and test for mathematical problem-solving skills. The instrument for collecting data was written based on the indicator of mathematics anxiety and mathematical problem-solving indicator. The indicators of mathematical problem-solving skill are: (1) solving the closed mathematical problem with the context in mathematics; (2) solving closed mathematical problems with contexts outside mathematics; (3) solving open mathematical problems with contexts in mathematics; and (4) solving open mathematical problems with contexts outside mathematics [22]. There were seven questions for the test of mathematical problem-solving and 25 questions for the mathematics anxiety questionnaire. The questionnaire was arranged by using the Likert Scale. We use the Pearson correlation formula, SPSS, and Microsoft excel to analyze the data.

3. Results and Discussions
We involved 200 students of Calculus class to participate in our research. They were chosen by using a purposive random sampling technique—comprising 138 females and 62 males. We gave seven questions to measure students’ mathematical problem solving and 25 questions to measure mathematics anxiety. The following table showed the correlation between mathematics anxiety and mathematical problem-solving ability.

| Table 1. Correlations between problem-solving skill and mathematics anxiety |
|--------------------------------------------------|
| MA | Pearson correlation | Sig. (2-tailed) | N | P | Pearson correlation | Sig. (2-tailed) | N |
| MA | 1 | - .545” | .000 | 200 | 1 | .545” | .000 | 200 |
| P | .000 | 200 | | | .000 | 200 | |

Based on Table 1, we can see that the relationship between Mathematics Anxiety and students' mathematical problem-solving ability skill in Calculus class have a significant relationship. Mathematics anxiety variables and mathematical problem-solving ability have a significant negative relationship. It means that the higher the Mathematics Anxiety that they had, the lower the ability to
solve mathematical problems. This significant negative result can also mean that the lower the Mathematics Anxiety, the higher the students' mathematical problem-solving ability.

Based on questionnaire and interview with the students, causing factors of mathematics anxiety are embarrassments, negative life experiences in learning mathematics, social pressures and expectations from external and internal, desires to be perfect, poor teaching methods, negative thoughts about mathematics, negative thoughts about own ability to do mathematics, preoccupation with disliking mathematics, self-doubts and worry, anxiety to the teacher, and bad score experiences in mathematics.

Based on observations during the data collection process of mathematical problem-solving skills, we found that almost all students showed nervous expressions when we distributed the mathematical problem-solving test sheets. Some students with symptoms of anxiety still tried to solve all the mathematical problem-solving tests completely. On the other hand, there are students who look calm when doing the test or solving test even though the students cannot answer the test completely. Based on students’ answer in answer sheets and questionnaire, the students that has mathematics anxiety cannot answer the test correctly, and student with low anxiety can answer the question almost perfect. The anxiety is considered as one of the inhibiting factors of learning that interfere with the performance of cognitive functions, one of which is solving mathematics problems [23]. Anxiety plays a role in determines the accuracy in solving the problem of mathematics [24, 25, 26]. Students with mild anxiety are very productive in generating various answer ideas. As stated by Stuart & Laira [27], a person's perceptual views on the level of mild anxiety increase and tend to be more creative. Students with mild math anxiety can provide more than one and different solutions and write down the solutions in their own way, which are quite unique and different.

Because there is a negative correlation between mathematics anxiety and mathematical problem-solving skills, lecturers need to explain to students the importance of problem-solving skills in mathematics, provide motivation to learn mathematics, create comfortable and enjoyable learning situations, reduce student mathematics anxiety with interesting learning methods, choosing the right learning approach, and decrease students’ mathematics anxiety who have a high level.

4. Conclusion
It can be concluded that research about the correlation between Mathematics Anxiety and students' mathematical problem-solving ability skill who take Calculus course has a significant correlation. Mathematics anxiety variables and mathematical problem-solving ability have a significant negative relationship. It means that the higher the Mathematics Anxiety that they had, the lower the ability to solve mathematical problems. This significant negative result can also mean that the lower the Mathematics Anxiety, the higher the students' mathematical problem-solving ability.

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