Students metacognitive skill in learning mathematics through cooperative based emotional intelligence

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Abstract. This type of research is quasi-experimental research which aims to determine whether mathematics learning through cooperative based emotional intelligence can improve the metacognitive skills of students Class X MIA SMAN 4 Palopo. The experimental design was one group pretest-posttest design. The population in this study were all class X SMAN 4 Palopo whose samples were determined using purposive sampling technique. The instrument of this study used a test of metacognitive skills and emotional intelligence questionnaire which were then analyzed with descriptive statistics and inferential statistics. The results of this study indicate that the average of students’ metacognitive skills is 85.67 and the results of hypothesis testing indicate that there is an increase of students’ metacognitive skills in learning mathematics through cooperative based emotional intelligence.

1. Introduction
Mathematical learning is often seen as one of the difficult subjects for students because it is abstract and has many formulas. Mathematics is a frightening spectre for most students. Students are afraid, because it is difficult to solve problems. Most of the students’ difficulties come in the form of understanding the purpose of the given problem, understanding what is being asked about or students’ lack of understanding of the material related to the issue. In addition, sometimes students make errors in their calculations [1]. One of the causes that is currently considered the most influential and can explain this fact is the low thinking ability including students’ metacognitive abilities.

Metacognitive is interpreted as awareness and control upon the cognitive process, or thinking about thinking, as well as process to know and to monitor thinking process or cognitive process and employing strategies to enhance and problem solve solutions when there is understanding failure [2]. The results of the study found that students whose on mathematical learning processes contained metacognitive skills realized their cognitive processes during solving the problem; they look more likely to be able to capture their thinking processes regularly and the process seems to contribute to students' success in solving problems [3]. The components of metacognition are planning, monitoring and reflection. One important component is the planning of problem solving steps with suitable mathematical tools. Second, the use of the tools has to be controlled, an analysis of the latest state of what has been achieved is necessary, a comparison with the goals set has to be made. The administration of this controlling and comparison is called monitoring. A third component is reflection, for example, on the given problem, on the understanding of mathematical concepts and tools, or on the discrepancy between representations and conceptions [4]. Metacognitive skills play a role in guiding students to realize and control the process of interaction in thinking. Internally students will build knowledge by interacting ideas in their minds.
based on their prior knowledge and externally students build knowledge through interaction with their environment including their friends to achieve a more perfect understanding. Thus the learning process will be more effective in achieving goals.

Meanwhile, to create a mathematical learning process by optimizing the students' potential, then emotional intelligence that owned by students needs to be a concern. Considering emotional in learning mathematics in a special way may be a little more helpful in accepting mathematics, in the midst of the assumption that is still believed by most students, that mathematics is a difficult subject. Thus, the presence of emotional intelligence can be seen as an aspect that needs to be considered, it can even be used as a basis for following a problem-based learning process well so that the achievement of mathematics learning results as a whole.

Emotional intelligence has the meaning to get and manage emotions in oneself and others [5]. Emotional intelligence as a potential to understand what influences thoughts, feelings and responses and how one can manipulate information for oneself and establish harmonious relationships with others [6].

The highest intellectual intelligence contributes approximately 20% to the factors that determine individual success in life while 80% are filled by other forces including emotional intelligence [7]. One characteristic of children who do not have good emotional intelligence in learning mathematics is that children are less passionate or lackluster, are not critical and only think about and focus on the final results or answers [8]. Emotional intelligence is one of the intelligence possessed by everyone. Given the importance of the application of emotional intelligence in this era of development, then in the world of education a teacher must also be able to manage the emotional intelligence possessed by his students. There are times when knowledge of emotional intelligence is applied in teaching and learning activities. Although mathematics is a subject that is related to intellectual intelligence, it will be very interesting if the teacher can also know the relation between mathematics and emotional intelligence.

One way to maximize metacognitive skills and emotional intelligence is to apply innovative learning models and can help students understand the mathematical concepts that was cooperative learning models. Learning patterns that are able to develop emotional intelligence and children's thinking are learning patterns that are socially nuanced, namely learning patterns that involve interactive learning communities [9]. Cooperative learning models provide opportunities for students to think in answering questions or completing individual or group tasks. Then the students are given the opportunity to reflect on answers or ideas that are delivered both in class discussions and presentations. These activities provide opportunities for students to identify concepts or subject matter that has been known or not yet known. Thus, Mathematics learning through cooperative based emotional intelligence has the potential to empower students' metacognitive skill.

Mathematics learning through cooperative based emotional intelligence is the learning method which combine cooperative learning and emotional intelligence in learning mathematics intelligence or integrating emotional intelligence into the mathematics learning through cooperative to increase students’ metacognitive skill.

These are the steps of the learning method,

• Teacher asks students to consider him while explain the topic of learning, to consider other students who have a question or an argument, and asks students to not mock each other but to support each other.
• Teacher asks students to work cooperatively and to be responsible for their work
• Teacher motivates students to be patient and concentrate during the learning process,
• Teacher asks students how to control feelings of anger, how to discuss their problems and how to overcome the problems they face,
• Motivate students that the topic of learning is important to be learned, Asking students to present their work, and give them reward.

Based on the description above the purpose of the study is to increase students’ metacognitive skill in learning mathematics through cooperative based emotional intelligence.
2. Method
This is a quasi-experimental research using a one group pretest-posttest design. The subjects in this study will get treatment, namely Cooperative Based Emotional Intelligence. Then students are given a test before treatment and after treatment.

| Table 1. Design of cooperative learning based on emotional intelligence |
|---------------------------------|-----------------|-----------------|
|                                 | Pretest          | Treatment (X)   | Posttest (O₂) |
| Information:                   | O₁               | O₂              |
| X                               | Pretest of Metacognitive Skills Test |
| O₁                             | O₂: Posttest of Metacognitive Skills Test |

This research was conducted in Class X MIA SMAN 4 Palopo Even Semester Academic Year 2018/2019. The instrument used was a test of metacognitive skills and Emotional Intelligence Questionnaire which was then analyzed using descriptive statistical analysis and inferential statistical analysis. Inferential analysis uses the normality test and hypothesis testing with one sample t test.

3. Result and discussion

3.1. Result
The results of the descriptive statistical analysis show the characteristics of the score distribution of each variable and at the same time the answers to the descriptive problems formulated in this study.

The results of the emotional intelligence questionnaire is to identify which student have high emotional intelligence and then put each one of them into the each group to help teacher develops emotional intelligence in the group. The result of the emotional intelligence questionnaire is shown below.

| Table 2. Students’ emotional intelligence |
|---------------------------------|-----------------|-----------------|
| Category            | Criteria         | Frequence | Percentage (%) |
| Low                 | < 84.29          | 8         | 28.57          |
| Medium              | 84.29 ≤ x ≤ 99.71 | 14        | 50             |
| High                | > 99.71          | 6         | 21.43          |
| Total               | 28               | 100       |

Based of the table above there are six students that have high category of emotional intelligence. The sixth students then put on each group to help teacher develops emotional intelligence of the students.

The results of the tests of students’ metacognitive skills in Mathematics Learning Through Cooperative Based Emotional Intelligence which can be seen in the following table.

| Table 3. Frequency |
|-------------------|-----------------|-----------------|
| Statistic         | Pretest | Posttest |
| Sample            | 28      | 28          |
| Maximum Score     | 54      | 98          |
| Minimum Score     | 30      | 74          |
| Mean              | 42.60   | 88.67       |
| Median            | 40      | 89          |
| Mode              | 39      | 90          |
| Range             | 24      | 24          |
| Varians           | 43.35   | 34.81       |
| Standard Deviation| 6.58    | 5.90        |
The above results show the average score of students' metacognitive skills on pretest 42.60 and posttest 88.67. It means that there was an increase of the students’ metacognitive skill.

Score of the increase of students’ metacognitive skill that learned by mathematics learning through cooperative based emotional intelligence can be seen by using gain normalized classification that shown below.

### Table 4. Score of gain normalized of students’ metacognitive skill

| Coefficient of gain normalized | Classification | Frequence | Percentage (%) |
|-------------------------------|----------------|-----------|----------------|
| g < 0,3                       | Low            | 0         | 0              |
| 0,3 ≤ g < 0,7                 | Medium         | 20        | 71.43          |
| g ≥ 0,7                       | High           | 8         | 28.57          |
| Total                         |                | 28        |                |

Based on the table above 71.43% students at medium category and 28.57% at high category. The average of the gain normalized is 0.67 or at medium category. It means that the increase of the students’ metacognitive skill at the medium category.

Based on indicators of metacognitive skills scores obtained for each indicator can be seen in the following table.

### Table 5. Score of students metacognitive skill

| Metacognitive Skill | Score  |
|---------------------|--------|
| Planning            | 82.25  |
| Monitoring          | 77.71  |
| Evaluation          | 72.05  |

In Table 5 shows that the scores of students' metacognitive skills for aspects of planning, monitoring and evaluation are 82.25, 77.71 and 72.05.

The results of inferential statistical analysis based on Kolmogorov-smirnov probability value of the student's gain normalized score is 0.200. This means that $p > 0.05$. Based on the results of the normality test it can be concluded that the distribution on students' metacognitive skills in mathematics learning through cooperative based emotional intelligence is normally distributed. While the results of the t-test for one sample obtained a probability value (2-tailed) $0.000$. Because the probability value (2-tailed) $<0.05 (0,000 <(0.05))$ then $H_0$ is rejected and $H_1$ is accepted, such that there is increase of students’ metacognitive skill in learning mathematics through cooperative based emotional intelligence.

### 3.2. Discussion

Based on the results of the study, first it was found that there is an increase of students’ metacognitive skill after taught by mathematics learning through cooperative based emotional intelligence. Based on the results of descriptive statistics it can be seen that the average of students’ metacognitive skill that taught by mathematics learning through cooperative based emotional intelligence is 42.60 on pretest and increase to be 88.67 on posttest. It can be said that mathematics learning through cooperative learning based emotional intelligence increases students' metacognitive skills. Cooperative learning is created to influence the pattern of student interaction in learning by giving students the opportunity to think individually, in groups, and share throughout the class while mathematics learning based emotional intelligence builds a conscious effort for students in developing strategies to solve mathematical problems.

The combination will have an effect together in developing students' thinking skills and learning skills. Students that taught by cooperative learning based emotional intelligence can practice thinking about their own thinking processes, and practice applying certain learning strategies to complete their learning tasks. Mathematics learning through cooperative based emotional intelligence is based on
constructivistic strategies that give students the opportunity to construct their own knowledge through their active involvement in learning. The process of knowledge construction can be achieved by students through a process of discussion, presentation and collaboration between students in the completion of their learning assignments that have been designed in the worksheet. Thus mathematics learning through cooperative based emotional intelligence provides an opportunity for students to develop their thinking skills and learning skills.

This research supported by other research said that Cooperative learning can be successfully used to promote student’ performance in mathematics. It was found that students’ performance in mathematics and attitudes towards mathematics were affected by exposure to the cooperative learning. Students seem to prefer learning mathematics by sharing knowledge. They feel contented when they can function effectively in the group work [10]. For the successful completion of a complex problem a variety of metacognitive processes is needed. A successful problem solver realizes that they can guide their efforts by finding and recognizing steps that were previously done by combining and connecting information between past knowledge and problem situations. The less experience a problem solver has, he cannot monitor the resolution process effectively, even though they can continue the problem solving process but maybe the strategy used is wrong [11].

In general, metacognitive theory focuses on: (1) the role of awareness and the management of thought processes; (2) differences in self-assessment and management of cognitive development; (3) main knowledge and abilities that develop through experience; and (4) strategic and constructive thinking [12]. Metacognitive strategies can help students to solve problems through effective design, which involves the process of knowing problems, determining the characteristics of problems that need to be solved and understanding effective strategies to solve problems [13]. Based of those then it can be said that the mathematics learning through cooperative based emotional intelligence increase students’ metacognitive skill.

4. Conclusion

The results of this study indicate that mathematics learning through cooperative based emotional intelligence increase students’ metacognitive skill.

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