Relationship between self-efficacy and mathematical connection ability of junior high school students

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Abstract. This study examines the relationship between self-efficacy and mathematical connection ability. This research used survey method with analytical technique correlational. The population in this study were VII grade students in Yogyakarta. As for the sample of this research are 70 seventh grader students, using technique of purposive random sampling. In this study, the research instrument used is a test of mathematical connection and Self-efficacy questionnaire. Data is analysed quantitatively using the Pearson correlation formula. The results of the study, there was a positive relationship between mathematical connection ability and mathematical self-efficacy of students.

1. Introduction
Mathematics is not a collection of separate topics, but it is a thorough and interconnected science or connection [1]. Mathematics is a science that has many connections, both connections between mathematical concepts, with everyday life and with other sciences. One of the skills closely related to the characteristics of mathematics is “the ability of mathematical connections. The ability of a mathematical connection is a cognitive process whereby one connects two or more ideas, concepts, definitions, theorems, procedures, representations, and meanings between each other, with other disciplines or with real life” [2].

Rowland, Turner, and Thwaites [3] state that connections are the core of learning to understand mathematical concepts. With connections, students can build new knowledge from existing knowledge. In line with [4] also states that more connections are built between the network of ideas. The stronger the students’ understanding and the lower the pressure that students experience to remember and the lower anxiety to forget the material that has been obtained. The importance of mathematical connections that must be possessed by students is also listed in Regulation of the minister of education which states that one of the abilities of junior high school students in learning mathematics is to identify patterns and use them to guess public announcements and provide predictions that are also a reflection of mathematical connections [5]. Meanwhile, in NCTM [4] the mathematical connection also became one of the five basic abilities in mathematics.
Student achievement is the main goal of learning in school, but also important to show improvement of the affective area owned by students [6]. Affective abilities such as self-efficacy can also affect students' cognitive abilities and are an important factor in learning as revealed that self-efficacy is important for students to monitor because it focuses attention on their beliefs about the effectiveness of their learning methods [7]. Self-efficacy is an important person's behaviour when trying and completing a given task. This is because self-efficacy is related to one's belief in their ability to successfully carry out their tasks. Self-efficacy influence the amount of effort shown by a person in working on a task and facing obstacle.[8]

In general, self-efficacy is the assessment of a person about his ability to run certain behaviours or achieve certain goals [9]. Then Bandura's opinion [10] that self-efficacy is concerned with people's beliefs in their capabilities to produce given attainment. The ability to accurately assess herself is very important in doing the tasks and questions asked by the teacher, with confidence he can facilitate the student in completing the task, even more than that can improve his performance. Bandura [9] reveals that accurate self-assessment is essential because the right positive feelings about self-efficacy can enhance performance, believe in the ability, develop internal motivation, and enable students to achieve challenging goals. Self-efficacy can affect students' mathematical achievement, and its reinforced by the opinion of Pajares [11] that self-efficacy, a person's belief of their capabilities, has been shown to influence student's mathematical achievement.

Relation to the ability of mathematical connection, self-efficacy has a function as a tool to assess the success of students in solving problems of mathematical connections. In the opinion of Liu & Koirala [12] students who have a self-confident attitude, that mathematics is important to their lives and help them in solving mathematical problems with fun. Although they believe that mathematics is important to them, they are not confident that they can solve math problems, it means the student has low self-efficacy. It also relates to the beliefs of students to be able to solve math problems related to everyday life which requires the ability of mathematical connections.

The ability to connect mathematical ideas is not an easy thing to do so the role of self-efficacy can make students be more diligent and have high motivation to see and understand the relationship or relationship that exist in mathematics. Lusby [13] states that "contend that self-efficacy can affect many parts of one's life as the level of motivation and perseverance in the face of difficulties and setbacks, resilience to adversity, quality of analytical thinking". So that self-efficacy is one important factor in determining the mathematical achievement of a person, especially in carrying out tasks in the form of problems of mathematical connections and it is seen that between the ability of mathematical connection and self-efficacy has a positive and mutually supportive relationship. Therefore, the researcher is interested in studying the relationship between mathematical self-efficacy and mathematical connection ability.

2. Method
The subjects of this study are the students of class VII students in one of the public junior high school in Yogyakarta academic year 2017/2018. Data collection was done on every student activity and situation related to the research using the instrument in the form of test of mathematical connection ability, student self-efficacy mathematical questionnaire and observation sheet. Questionnaires were used to collect students' mathematical self-efficacy data while written tests were used to collect data on students' mathematical connection abilities. The written test form used is in the form of short and essay entries. Questionnaire Mathematical self-efficacy is given using a Likert scale with five answer categories are very agree (SS), agree (S), doubtful (R), disagree (TS), and strongly disagree (STS). Data analysis technique will use correlation test between mathematical connection ability and student self-efficacy mathematically. The form of questionnaire items in the form of statements with a total of 30 statements consisting of 15 positive statements and 15 negative statement.
In correlational research design, there are two variables namely independent variables and dependent variables. The independent variable (X) in this research is student's mathematical self-efficacy, while the dependent variable (Y) is student's mathematical connection ability. The resulting correlation coefficient indicates the degree of relation between mathematical self-efficacy and the ability of mathematical connections. Data of mathematical connection ability is interval data while self-efficacy questionnaire data is ordinal data which then converted into interval data using software Method of Successive Interval (MSI) first, then tested normality for both data. If both data have a normal distribution, then the association test used is Pearson correlation test, but if the data does not have a normal distribution, it can be tested Spearman rho or Kendall correlation.

3. Result and Discussion

| Table 1. Descriptive Statistics of Self Efficacy based on Indicator |
|----------------------------------------------------------|
| Mathematical Connection | Mean   | Maximal Score | Conclusion |
|---------------------------|--------|---------------|------------|
| Making connection between mathematics concepts | 22.51  | 30            | High       |
| Making mathematics model from the Problem | 18.82  | 30            | Low        |
| Solving the problem with mathematical procedure and mathematical concepts | 19.98  | 40            | Low        |

Table 1 show students’ mathematical connection ability in the 3 dimensions. They were making connection between mathematics concepts, making mathematics model from the problem, and solving the problem with mathematical procedure or mathematical concepts. Most students were able to make connection between mathematical concept, but their score for two other dimensions were rather low. Students could not make connection between problem in the real life to became mathematics model, we could say that they thought mathematics concept only exist to solving mathematics problem in explicit way. There is some opinion about the students’ difficulties when they face mathematics problem in the real-life context, Arum [14] said that in solving problem of real life context students experienced difficulties in choosing and using appropriate strategies for solving the problem. It was also revealed that students could not make mathematics model from the problem because students ability to understanding the problems are low and lack of problem training.

| Table 2. Descriptive Statistics of Self Efficacy based on Indicator |
|----------------------------------------------------------|
| Self-Efficacy          | Mean   | Maximal Score | Conclusion |
|-------------------------|--------|---------------|------------|
| Magnitude               | 22.67  | 50            | Low        |
| Strength                | 44.86  | 50            | High       |
| Generality              | 20.11  | 50            | Low        |
Self-efficacy of students at a low magnitude aspect shows that students have not been able to perceive themselves to be able to complete difficult mathematical tasks so that students easily give up when experiencing difficulties. Students cannot choose the activities they will do well and have not been able to increase their business power maximally in learning mathematics. Meanwhile, self-efficacy of students who are low on strength aspects will cause students to be easily influenced in a negative direction by various situations from the environment. Students who are easily affected will make it difficult to direct themselves to have a positive attitude. Students with low self-efficacy on the generality aspect mean that they are only able to display their learning activities limited to a certain set of mathematics learning activities, cannot expand on a variety of other mathematics learning activities.

To test the truth of the hypothesis research is: "There is a correlation between mathematical connection ability and self-efficacy". Then the test was carried out statistics is the Pearson association test with the help of the IBM SPSS 21 program. This test was chosen for measure the strength of a linear relationship between two continuous variables with interval scale data as opinion [15]. Testing hypothesis based on the final score mathematical connection ability and mathematical self-efficacy in the class VII. As for the null hypothesis and match:

\[ H_0 : \text{"There is no correlation between mathematical connection ability and mathematical self-efficacy student"} \]

\[ H_1 : \text{"There is a correlation between mathematical connection ability and mathematical self-efficacy student"} \]

With a significance level of 0.05, decision making criteria is:

i) If the significance value is smaller from 0.05, then \( H_0 \) is rejected.

ii) If the significance value is greater or equal to 0.05, then \( H_0 \) is accepted.

The following is a statistical correlation test Pearson to find out how correlation between mathematical connection ability and mathematical self-efficacy.

### Table 3. The results of the prerequisite test and correlation test between self-efficacy and mathematical connection ability of VII grade students

| Test                | Statistic Method   | Criteria of Test        | Sig Value | Sig Test | Conclusion     |
|---------------------|--------------------|-------------------------|-----------|----------|----------------|
| **Normality Test**  |                    |                         |           |          |                |
| Self efficacy       | Kolmogorov Smirnov | Normal, if sig. > sig F test | 0.615    | 0.05     | Normal         |
| Mathematical connection |                  |                         | 0.226    |          | Normal         |
| **Homogeneity Test**|                    |                         |           |          |                |
| Self efficacy       | Levene's Test      | Homogen, if sig. > sig table | 0.788    | 0.05     | Homogen        |
| Mathematical connection |                |                         | 0.397    |          |                |
| **Correlation Test**|                    |                         |           |          |                |
| Self efficacy       | Pearson Product Moment | Correlation will significant, if, sig. < sig r-test | 0.001    | 0.05     | Strong correlation ( \( r = 0.775 \) ) |
| Mathematical connection |                |                         |          |          |                |

Based on Table 3. Above obtained a significance value of 0.001, so it is rejected. This matter indicated that there was a significant correlation between mathematical connection ability and self-efficacy. Pearson correlation coefficients shows the magnitude coefficient between mathematics connection ability and self-efficacy. Pearson correlation coefficient was 0.775. It showed the positive relations was strong, meaning higher self-efficacy students, the higher the mathematics connection ability score. These results are in accordance with the opinion of Ormrod [16] which states that self-efficacy can affect student learning and achievement in determining choices where students with high
self-efficacy tend to learn more and perform better than those with low efficacy. This result is also in accordance with the research conducted Lusby [13] which states that there is a positive relationship between self-efficacy and student academic success in mathematics. The correlation between mathematical achievement and self-efficacy was also revealed in the study [17] that there is a positive correlation between students' mathematical achievement and self-efficacy. Mathematical connection is a part of learning outcomes or indicate student achievement in mathematics, and self-efficacy has strong link with student achievement in mathematics such as mathematical connection ability.

4. Conclusion
The present study investigated a group of seventh grade students' self efficacy and mathematical connection abilities and relationships between them. Result revealed that student can express the relationship between mathematical concepts but the ability to make mathematical models and solve mathematical problems is still relatively low. Second, students' self efficacy is relatively low and students believe that they cannot have the ability to solve mathematical problems well, so that when students are faced with difficult tasks students tend to give up more easily. Third, there is a strong correlation between mathematical connection skills and self-efficacy of students which means that the higher the student's self-efficacy, the higher the mathematical connection abilities students had.

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