The influences of peer tutoring method to improve conceptual understanding

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Abstract. This study aims to analyze the effect of peer tutoring method implementation to improve conceptual understanding. The effect will be investigated from the results of previous studies. This study uses meta-analysis. Meta-analysis is a research conducted by researchers by summarizing research data, reviewing and analyzing research data from a number of research results in similar problems. Data were taken from the various thesis and research in the last 5 years and collected by browsing electronic journals through Google Scholar. Eighteen articles related to peer tutor methods to improve conceptual understanding were found through Google Scholar. The article data is processed by summarizing and determining the essence of the research result with the peer tutor method. Then the data is reported back to quantitative and qualitative description. Based on the analysis of the results, the peer tutoring method can improve conceptual understanding from as little as 5.30% up to 39.75% with an average of 17.83%. The technique of data analysis was used paired t-test and obtained a value of significance (0.039) < α (0.050) so that the peer tutor method significantly influence the student’s conceptual understanding.

1. Introduction
Understanding the concept of subject matter is very important in the learning process. Conceptual understanding is one form of learning outcomes obtained by students from following the process of learning activities. Understanding is the ability of a person to know something after it is known and remembered, in other words, understanding is knowing something and can see it in different ways [1]. A person is said to have understood something if he can give an explanation or give a more detailed description of it by using his own words. it means students can understand the provided material and able to use it without the need to connect with other materials or see the implications. Thus, when a student has understood the content of the lesson, the learning outcomes will increase, and vice versa.

Conceptual understanding is very important because if students master the concept of the material being taught, they will be easier to understand the concept of the next material. In addition, students who master the concept can identify and work on new and more varied questions. A good conceptual understanding can help students achieve better learning outcomes as well.

The reality that many found so far in schools is teacher-centered learning and how to deliver materials which are still dominated by lecture methods. Teachers serve as the only source of
knowledge for students and the use of the method causing low student participation in learning. Students' understanding can't be monitored, and students become passive. The passivity of students during the learning process is one of the factors that can make students difficult to understand the concept of a material. If this happens, it can lead to less optimal student conceptual understanding. With less optimal conceptual understanding, then the purpose of learning will be difficult to achieve.

The low student conceptual understanding is due to students assuming that biology lessons are difficult to understand and also influenced by the learning process that has been done by teachers still use conventional learning models which are dominated by lecture methods. Students generally not active to ask questions, because teachers don't use learning models that encourage students to ask questions about materials they don't understand, so there is no interaction between teachers and students.

Students don't ask even if they don't understand the material caused by several factors, among others because they embarrassed to ask questions, they can't arrange questions properly, they not confident, even they afraid to ask. Some of these factors cause students to become passive and don't understand the material given by the teacher.

Conceptual understanding can be achieved when using the appropriate learning method. [2] Stated that now there are many learning methods that are intended to give more opportunities for students to actively learn. It also can be said that such methods for making teacher oriented learning turn into student-oriented.

One of the learning methods that can be used to improve students’ conceptual understanding is a peer tutoring method. [3] Stated that peer tutor learning is student-centered learning, in this case, students learn from other students who have the status of age, maturity, and self-esteem that is not much different from himself. This peer tutor method requires students who have more ability than their friends to be responsible to teach the subject matter to friends in the group. The language used by peers is easier to understand, no reluctance, low self-esteem, shame so that students who are less understanding of the material didn't hesitate to express the difficulties he faced at the time of the study. Peer tutor methods provide opportunities for students to be able to implement learning by utilizing other students who have more ability to help students who have learning difficulties.

The selection of this method is based on the assumption that through peer tutoring learning in addition to developing student knowledge can also develop the character of responsibility, social concern, responsibility, and diligence as learning through peer tutors leads to the discussion among students. Learning by using peer tutoring methods can also support the achievement of student-centered learning as expected in the present educational paradigm because in peer tutors the role of teachers in peer tutor learning is as a group former, group task planning, and evaluation phase results of group learning. This means that in the implementation stage, teachers only act as facilitators and learning in the domination by students.

The research of peer tutoring method in many subjects has been done. [4] In his research on the implementation of demonstration methods by peer tutors to improve conceptual understanding of science subject, the results obtained that the demonstration method by peer tutors for students can improve the conceptual understanding on science subject in VII grade student of SMP Negeri 9 Purworejo academic year 2012/2013. Before applying the demonstration method by peer tutors, students’ conceptual understanding is only 59.78%. Then it increased to 65.33% in cycle I. In the second cycle, students’ conceptual understanding reached 72.56% or already exceeded the indicator of success by 70%.

[5] In his research on improving understanding through the empowerment of peer role in science learning, the results obtained that the empowerment of peers can improve students’ understanding. Improved understanding will affect the improvement of science learning outcomes and student cooperation. The success indicators fulfilled by an increase from 60 before the research to 71.6 (cycle I) and to 75.8 (cycle II).
The result of the research of efforts to improve students' conceptual understanding and activities through peer tutoring model of integer counting operations, which is conducted by [6] stated, from 20 students, there are 4 students or 20% of students who have completed in learning mathematics. Whereas in the cycle I obtained information that from 20 students, there are 10 students or 50% of students that have been completed in learning mathematics. While in cycle II obtained information that from 20 students, there are 17 students or 85% who have completed in learning mathematics. In cycle III obtained information from 20 students, there are 19 students or 95% of students complete in learning. Thus, it can be seen from the results of research that through the use of peer tutoring methods in mathematics learning, the conceptual understanding and student activeness increased by 95%.

[7] in his research on the implementation of the problem solving model assisted peer tutoring equipped hierarchy concept to improve process quality and learning outcomes, obtained the result that the quality of learning process in terms of student activity on the cycle I obtained a percentage of achievement of 69.3% and increased in cycle II to 78.5%. While the students' learning mastery achieved the percentage of achievement of 55.2% with 21 students completed in the cycle I and increased to 84.2% with 32 students competed in cycle II for a total of 38 students.

Based on the researchers above, it is important to do a meta-analysis. Meta-analysis can be simply meant as the analysis of analysis [8]. As a research, meta-analysis is a study of a number of research results in similar problems. Meta-analysis is one way to summarize the results of research in quantitative terms. According to [9], meta-analysis is the most recent development technique to help researchers find consistency or inconsistency in a cross-study assessment of research results. [10] stated that one of the requirements that are needed in doing meta-analysis is a study towards the result of a kind of researchers. The result of the primer study analysis is used as a base to accept or support the hypothesis, reject/abort the hypothesis submitted by some researchers. Meta-analysis is used to look for the significance of treatment towards the students. For example, the effects of learning model toward student’s study result and motivation. The meta-analysis also can be used for research designed not with an experimental design, like descriptive research.

2. Research Methods
This research uses meta-analysis design. Meta-analysis is a research conducted by researchers by summarizing research data, reviewing and analyzing research data from some pre-existing research results. Collecting of research data conducted by researchers by tracing the articles contained in online journals, thesis or dissertation results in the repository, using Google Scholar. The keywords used in article search are “peer tutor” and “conceptual understanding”.

From the article search by using these keywords obtained several articles then select the articles that meet the criteria of peer tutors to improve conceptual understanding, that is the availability of data before and after the action that forms as a score. Then the scores obtained were analyzed by finding the percentage. The analytical techniques were performed using a comparative method to determine the impact of the peer tutor application.

3. Result and Discussion
From the article search obtained 18 articles related to peer tutor methods to improve conceptual understanding. The article data is processed by summarizing and determining the essence of the research result with the peer tutor method. Then the data is reported back to quantitative and qualitative description. The analysis result data of the peer tutor method can be seen as follows:
| No | Data code | Pretest score (%) | Posttest score (%) | Enhancement (%) |
|----|-----------|------------------|-------------------|-----------------|
| 1  | X1        | 68.83            | 77.17             | 8.34            |
| 2  | X2        | 64.77            | 73.87             | 9.10            |
| 3  | X3        | 62.70            | 74.60             | 11.90           |
| 4  | X4        | 48.85            | 54.15             | 5.30            |
| 5  | X5        | 59.78            | 72.56             | 12.78           |
| 6  | X6        | 34.47            | 65.53             | 31.06           |
| 7  | X7        | 55.56            | 70.37             | 14.81           |
| 8  | X8        | 40.84            | 59.16             | 18.32           |
| 9  | X9        | 69.30            | 78.50             | 9.20            |
| 10 | X10       | 56.50            | 75.50             | 19.00           |
| 11 | X11       | 64.28            | 78.57             | 14.29           |
| 12 | X12       | 47.75            | 87.50             | 39.75           |
| 13 | X13       | 51.76            | 72.94             | 21.18           |
| 14 | X14       | 66.70            | 83.30             | 16.60           |
| 15 | X15       | 51.30            | 79.50             | 28.20           |
| 16 | X16       | 60.00            | 75.80             | 15.80           |
| 17 | X17       | 55.56            | 85.19             | 29.63           |
| 18 | X18       | 53.76            | 69.50             | 15.74           |
|    | **Mean**  | **56.26**        | **74.09**         | **17.83**       |

Based on table 1 above shows that peer tutor method can improve students' conceptual understanding ability. The average percentage increase in conceptual understanding with peer tutor methods ranging from the lowest of 5.30% to the highest of 39.75% with an average of 17.83%. The average of students' conceptual understanding before using peer tutor method is 56.26% increased to 74.09%. The mean score before applying peer tutor method and after applying peer tutor method experienced a significant increase of 17.83%. This is shown by the results of different test analysis. Here are the results of Paired-Sample T Test output:

**Table 2. Paired Samples Statistics**

|                       | Mean | N   | Std. Deviation | Std. Error | Mean |
|-----------------------|------|-----|----------------|------------|------|
| **Pair 1**            |      |     |                |            |      |
| pretest               | 56.2617 | 18  | 9.49824        | 2.23876    |      |
| postest               | 74.0950 | 18  | 8.41465        | 1.98335    |      |

**Table 3. Paired Samples Correlations**

|                       | N   | Correlation | Sig. |
|-----------------------|-----|-------------|------|
| **Pair 1**            |     |             |      |
| pretest & postest     | 18  | .490        | .039 |
Table 4. Paired Samples Test

| Paired Differences | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | t | df | Sig. (2-tailed) |
|--------------------|------|----------------|----------------|-----------------------------------------|---|----|--------------|
| Pair 1 pretest - posttest | -17,8333| 9,09169 | 2,14293 | -22,35452 -13,31214 -8,322 | 17 | 0,000 |

Table 2 above shows that learning by using a peer tutor method is able to improve students' conceptual understanding of the average value 56,2617 to 74,0950. Table 3 shows there is a relation between the mean score of students' conceptual understanding before learning by using peer tutor methods and after learning using peer tutor method.

Hypothesis test results, $H_0 =$ there is no significant difference in understanding of student concepts before learning with peer tutor methods, and $H_1 =$ there is a significant difference between students’ conceptual understanding before and after learning with peer tutor methods. From table 3 shows that the value of $\text{Sig} (0,039) < \alpha (0,050)$ and Table 4 shows that $t_{\text{count}} = -8,322 < t_{\text{table}} = 2,131$ then $H_0$ is rejected. So it can be concluded that there is a significant difference between student conceptual understanding before and after learning with peer tutoring methods.

Based on the results of the research, it can be seen that every research conducted to obtain the different percentage of improving conceptual understanding. Can be analyzed that the difference of research results that have been done by the researchers is caused by internal and external factors. Internal factors are factors that exist within the students themselves (such as: health, interests, talents, intelligence, body condition), while external factors are factors that come from outside the students themselves, such as family factors, school environment, and community environment.

The background of the research site can influence the results of the research as it comes from different regions. Different levels of student ability also affect the learning outcomes obtained. As well as the health condition of students, because it could be when researchers take research data, students are not healthy enough so they can not maximal in working on the pretest and posttest. Application of different curricula can also have an impact on learning outcomes. In addition, the learning process conducted by the teacher, although using the same type of model, there may be differences in its application.

[11] stated that conceptual understanding is an important psychological element in the learning process. Furthermore, [12] mention that the level of understanding is higher than knowledge level. Understanding is not just a matter of fact, but the ability to explain, interpret, and capture the meaning of a concept. In the process, there is a full involvement of students in order to be able to find the materials learned and relate it to real life situations that encourage them to apply [13]. Peer tutoring methods can be a solution in the learning process to improve students' conceptual understanding. With the application of peer tutoring methods, students are more active to ask the tutors because they are not ashamed to the tutor, motivated to learn to work together in groups to solve problems, and conduct discussions with tutors to get a deeper understanding of the concept.

4. Conclusion

The application of peer tutoring method has been done by many researchers. Based on the result and discussion, it can be concluded that peer tutoring method can improve conceptual understanding from as little as 5,30% up to 39,75% with an average of 17,83%. The technique of data analysis was using paired $t$-test and obtained value of significance $(0,039) < \alpha (0,050)$ so that the peer tutor method significantly influence the student’s conceptual understanding.
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