A cooperative learning model type MURDER CTL on cube and cuboid material

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Abstract. A cooperative learning model type MURDER CTL is a modification of the cooperative learning model type MURDER. The learning model adds the CTL approach to the learning step. The subjects in this study were 8th-grade students from three high schools in Surakarta. The purpose of this study is to find out the differences in students’ achievements that were applied cooperative learning model type MURDER CTL and those were applied the direct learning model on cube and cuboid material. The research method used is quasi-experimental research. The data collection technique uses documentation and test method. The results of this study show that there are differences in students’ achievements that were applied cooperative learning model type MURDER CTL and those were applied the direct learning model on cube and cuboid material.

1. Introduction
Mathematics is a learning that is needed at every level of education [1-3]. That is because mathematics is very useful in every aspect of life [4, 5]. One important topic in mathematics learning is geometry [6] which studies points, lines, numbers, and relationships between lines, length, area, volume, and others [6, 7]. One of the geometry materials that needs attention is cube and cuboid material because students are still having difficulty in solving questions about the material. The 2015 PISA results, which were attended by 70 countries, Indonesia received the 63rd ranking [5, 8]. This shows the low mathematics learning achievement in Indonesia [9].

The low learning achievement of mathematics is likely due to the use of direct learning models in the classroom. Teachers dominate learning so students are less active in the learning process. Therefore, students can feel bored, unfocused and lazy to communicate with their teacher. Students need fun learning, and they can talk like friends [10]. One effort to overcome this problem is to choose the right learning model that is expected to help students understand mathematical concepts through communication between students and strengthen social sense and solidarity among them [9]. Learning models that can be the solution are cooperative learning models [11]. Some studies show that cooperative learning models can improve students’ mathematics learning achievements [11-13].

In cooperative learning, the instruction focuses on coordinating, stimulating, and encouraging the interactions among students, with students expected to learn from their activities and interaction with their peers [14]. Cooperative learning students will sit together in a group of four to master the material presented [15]. The cooperative learning model used in this study is a cooperative learning model type MURDER CTL.

A cooperative learning model type MURDER CTL is a modification of a cooperative learning model type MURDER. Many cooperative learning techniques have been developed by scholars in the cognitive psychology tradition, e.g., the dyadic MURDER script, which asks students to collaborate to perform the thinking tasks or summarize and elaborate on reading material [16, 17]. The steps of a cooperative learning model type MURDER are mood, understands, recall, detect, elaborate, and
review [17]. The cooperative learning model type MURDER has disadvantages, namely that there has not been a contextual problem given to the students [18].

Contextual teaching and learning are defined as a conception of teaching and learning that helps teachers relate subject matter content to real-world situations [19]. By applying the cooperative learning model type MURDER CTL, it is hoped that it can improve students' mathematics learning achievement. This is supported by previous research, the use of cooperative learning models combined with contextual teaching and learning can improve students' mathematics learning achievements [20, 21]. Therefore, it can be concluded that this study aims to determine the differences of students' achievement that was applied a cooperative learning model type MURDER CTL with that was applied direct learning model on cube and cuboid material.

2. Method
This study examines the differences between learning in cube and cuboid material using a cooperative learning model type MURDER CTL and direct learning model. The type of research used in this study is quasi-experimental research. The purpose of quasi-experimental research is to obtain information from actual experiments in circumstances that do not allow the researchers to control all variables [22]. The sample in this study was 190 eighth grade students from three high schools in Surakarta. Sampling is done by stratified cluster random sampling. The sample was divided into two groups. The first group consists of 93 students who were applied a cooperative learning model type MURDER CTL, and the second group consists of 97 students who were applied to the direct learning model.

The data collection techniques in this study are the documentation method obtained from the final odd semester mathematics test of the eighth grade and the test method used to collect students' mathematics achievement test data. The research procedure includes three stages, namely the research preparation stage, the research implementation stage, the data processing and preparation of the report stage. The first stage includes the preparation of the test instrument, the validity of the test instrument, instruments trials and the analysis results of the instrument trials. The learning achievement test instrument is in the form of a multiple-choice test with four alternative answers. The validity of the instrument is carried out by three validators who are experts in their field. An instrument called valid if the content validity of the instrument has been the best sample of the overall sample to be measured [23]. After the mathematics learning achievement test is ready, the test is tried out to find out whether the test instrument is good or not. The purpose of the instrument trial is to know whether the instrument is good or not [23]. The instrument testing conducted on multiple-choice tests as an effort to obtain accurate data is content validity test, reliability test, discriminating power test items, and difficulty test items. After conducting the tryout, the test instrument was analyzed to determine the best test items to be used in the study.

The second stage includes learning on cube and cuboid material in the classroom and conducting learning achievement tests. Learning on cube and cuboid material is divided into two classes, namely the first class that was applied a cooperative learning model type MURDER CTL and the second class that was applied to the direct learning model. The last stage is data processing and preparation of reports. Processing data uses quantitative data from the results of learning achievement tests.

3. Result and Discussion
The data on the initial ability of all mathematics learning achievements were 93 students who have applied a cooperative learning model type MURDER CTL and 97 students who were applied to the direct learning model. The data of students' initial abilities are obtained from the results of the repeat test at the end of the odd semester of the 2017/2018 academic year. In table 1, the mean initial ability of the class applied a cooperative learning model type MURDER is 69.653, and the class applied the direct learning model is 68.041.
Table 1. Data Description of Students' Initial Ability

| Learning Models | N  | Mean  | Standard Deviation |
|-----------------|----|-------|-------------------|
| MURDER CTL      | 93 | 71.086| 8.458             |
| Direct          | 97 | 68.041| 8.600             |

The instrument developed in this study was students' mathematics learning achievement test on cube and cuboid material. Before the instrument was used, it was tested first on 64 students. The trial was carried out in SMP N 10 Surakarta in class VIII F and VIII G. The students' mathematics learning achievement test instrument was arranged in a multiple-choice form consisting of 40 items with four alternative answers. After testing the instrument, the results showed that the students' mathematics learning achievement test instrument set for data collection were 35 items.

The review criteria invalidating the contents of the student's mathematics learning achievement test include material, construction, and language aspects. In addition to the mathematics learning achievement test, the validation of its grid was also conducted. Validator in this study was Christina Kartika Sari, S.Pd, M.Sc, teaching staff of the Mathematics Education Department of Muhammadiyah University of Surakarta, Isnaeni Umi Machromah, S.Pd, M.Pd, teaching staff of the Mathematics Education Department of Muhammadiyah University of Surakarta, Aji Pratiwi, S.Pd, mathematics teacher of SMP Negeri 3 Surakarta. The selection of this validator is because the three validators master the cube and cuboid material. In this study, validation was done by using a checklist by the three validators above. Based on the test of content and grid validity conducted by the three validators, the results show that several items need to be revised and reviewed. After repairing, reviewing, and re-validating, the test instruments for students' mathematics learning achievement tests consisting of 40 items are valid based on predetermined criteria and are suitable for research.

In table 2 is shown the discriminating power results of the student achievement test. Based on calculations, five items are not good, and 35 items are good. The items used are good items, while items that are not good must be discarded.

Table 2. A Summary of the Discriminating Power Items Calculation

| Discriminating Power | Criterion | Items                      |
|-----------------------|-----------|----------------------------|
| $r_{xy} < 0.3$        | Not Good  | 4, 9, 16, 20, 26           |
| $r_{xy} \geq 0.3$     | Good      | 1, 2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 |

Based on table 3 shown, there are 36 items which have a moderate difficulty level. For items that have an easy level of difficulty are four items and item that has difficult level is 0 item.
Table 3. A Summary of the Difficulty Level Calculation

| Difficulty Level | Criterion | Items |
|------------------|-----------|-------|
| \( P > 0.7 \)    | Easy      | 4, 9, 20, 26 |
| \( 0.3 \leq P \leq 0.7 \) | Moderate | 1, 2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 |
| \( P < 0.3 \)    | Difficult | - |

Table 2 and table 3 show the results of 20 items that have good discriminating power and moderate difficulty level. Furthermore, 35 items were tested for reliability to find out whether they were reliable or not. The reliability test in this study uses the KR-20 formula. Based on the calculation, the reliability coefficient is 0.963. An instrument is said to be reliable if it has a reliability coefficient more than or equal to 0.70. The reliability coefficient in this study was more than 0.70 so that the mathematics learning achievement test instruments were said to be reliable and could be used for research.

Students were given a mathematics learning achievement test on cube and cuboid material at the end of the study so that the mean test scores of the students who were applied a cooperative learning model type MURDER CTL and those who were applied the direct learning model can be known. Table 4 shows that the mean of students who applied a cooperative learning model type MURDER CTL was 75.108 and that of students who applied the direct learning model was 68.062.

Table 4. A Summary of Students’ Mathematics Learning Achievement Data

| Learning Models | \( N \) | Mean | Standard Deviation |
|-----------------|--------|------|--------------------|
| MURDER CTL      | 93     | 75.108 | 12.279 |
| Direct          | 97     | 68.062 | 11.843 |

Based on table 4, it is shown that there are differences in students’ achievements that are applied a cooperative learning model type MURDER CTL and those that are applied to a direct learning model. This can be seen that the students’ mean score applied a cooperative learning model type MURDER CTL is greater than that of a direct learning model. A cooperative learning model type MURDER uses a pair of dyads from a group of 4-5 people [24]. A dyad is a group consisting of two people or a meeting between two or three people who communicate verbally and in writing. The steps of a cooperative learning model type MURDER are Mood, Understand, Recall, Detect, Elaborate, and Review. A cooperative learning model type MURDER does not provide contextual problems to students [18]. Thus, the authors combine the steps of MURDER learning with the CTL approach. A cooperative learning model type MURDER CTL is not the only Mood, Understand, Recall, Detect, Elaborate, and Review but also links learning materials with real problems so that students are easier to understand and discover mathematical concepts in the material. In the direct learning model, it is usually too dominant in lectures so students feel quickly bored [10]. Each student is responsible for himself because there is no group discussion. From table 1 and table 4, it can be seen that there was an
increase in students’ learning achievements that were applied a cooperative learning model type MURDER CTL.

From this explanation, it can be concluded that students’ mathematics learning achievements in the cube and cuboid material will be more optimal if they are applied learning using a cooperative learning model type MURDER CTL. This is in accordance with the results of the study stating that students’ mathematics learning achievement on cube and cuboid material is better for students who are applied a cooperative learning model type MURDER CTL than the direct learning model. As a result, there are differences in students’ achievements that are applied to a cooperative learning model type MURDER CTL with those of direct learning model.

4. Conclusion
There are differences in students’ achievements that are applied a cooperative learning model type MURDER CTL and those that are applied to a direct learning model. The mean score of students applied a cooperative learning model is greater than that of students applied a direct learning model. In short, a cooperative learning model type MURDER CTL can improve students’ learning achievement on cube and cuboid material.

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