The effect of connecting, organizing, reflecting, and extending (core) instruction model by work card toward students’ mathematical problem-solving skill

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Abstract. The objective of this study was to observe the effect of Connecting, Organizing, Reflecting, and Extending (CORE) instruction model by work card toward students’ mathematical problem-solving skill. The research method was quasi-experiment using non-equivalent post-test only control group design. All classes in seventh grade become the population in SMP Negeri 1 Klari. Two-stage sampling technique, namely purposive sampling and cluster random sampling technique, were used to select VII-A as the experimental class who treated with the CORE instruction model by work card and VII-B as the control class who treated with direct instruction model. Students’ mathematical problem-solving skill was measured by the test which created based on problem-solving skill indicators. The hypothesis was tested using independent sample t-test with a significance value of 0.05. The result of the research shown that there was a significant difference between the experimental and the control class. There was t count = 4.693 > t table = 1.667, so H₀ was rejected. This result was indicated that the average of the students’ problem-solving skill who using CORE instruction model by work card higher than the average of the students’ problem-solving skill who using conventional instruction model. Therefore, it can be concluded that CORE instruction model by work card affected students’ mathematical problem-solving skill.

1. Introduction
Mathematics is the basic science to develop thinking skills. Mathematics is also a science that underlies other sciences. It can be seen from the existence of mathematics learning which one of the important subject in every educational unit, start from elementary school, high school, until college. The mathematics learning skills according to NCTM are include problem-solving, reasoning and proof, communication, connection, and representations [1]. Basically mathematics learning cannot be separated from problem-solving, because succeed or not a person in mathematics is detected by the skill to solve the existing problems.

Problem-solving is a major part of mathematics. Problem-solving is not only an essential skills, it is also intertwined with a robust and flexible understanding of mathematical content [2]. Problem-solving is the process of working through details of a problem to reach a solution. Meanwhile,
problem-solving skill is a students’ capability to solve the problem structured through step by step. Kilpatrick, Swafford, and Findell argue that problem-solving skill can be improved when student have the opportunities to solve the problem themselves and see the problem being solved [3]. Thus, through problem-solving skill, students can increase their mathematical conceptual understanding. Unfortunately, mathematical problem-solving skill is still not owned yet by students.

The results of PISA 2015 shown that Indonesian ranking was 64th with 386 points below the average set of 490 points [4]. The outcomes also revealed that students was weak in working on questions that demand the skill to solve problems, argue, and communicate [5]. Besides that, TIMSS 2011 is contain two dimensions on mathematical tests, i.e. content dimension and cognitive dimension [5]. In the cognitive dimension, problem-solving is the main focus in each content dimension. Nonetheless, the test results shown that the skill of Indonesian students was still below the average set. Indonesia only gained 386 points from the average set of 500 points [6]. Based on the results of PISA 2015 and TIMSS 2011, it can be concluded that students’ mathematical problem-solving skill in Indonesia are still at low level.

Karawang Regency is one of Indonesian area that has low level of problem-solving skill. This matter evidenced by Imami’s research, which states that the mathematics problem-solving skill of seventh grade in SMP Nurul Huda was relatively low. The result of Imami’s research was only 32% students who able to answer correctly from 5 mathematics problem-solving questions given [7]. Furthermore, there was an interview with one of the Mathematics teachers in Karawang, i.e. SMP Negeri 1 Klari. The result was alleged that students’ mathematical problem-solving skill of seventh grade still low. Some students distress to solving mathematical problems, such as identifying known information and changing problems into mathematical models. This matter makes misapplying the strategies which will be used. Moreover, some students are lazy to solve the mathematical problems. The item analysis was done to essay number three on the Final Semester Assessment (PAS) question that containing 20% problem-solving problems. The calculation was taken from one class consisting of 40 students and randomly selected. The result was expressed that no one student can answer the questions correctly and according to the problem-solving steps.

There are many factors cause students’ mathematical problem-solving skill at a low level; one of the factors is that the learning process is still teacher-centered. Based on the results of the interview, the learning process is still tended to use the direct instruction model. The direct instruction model according to Suprijono is also called whole-class teaching, because the teacher is actively involved in carrying out the contents of the lesson to students and teaches it directly to the whole class every learning activities [8]. The direct instruction model is called conventional instruction model in this study. Teachers who only rely on students’ handbooks in the learning process become a trigger for the emergence of less interesting and meaningful learning. Therefore, the teacher must find the right model and media to optimizing students’ mathematical problem-solving skill. One of the classroom management efforts offered by the researcher was using connecting, organizing, reflecting, and extending (CORE) instruction model by work card.

The purpose of this study was to determine the effect of CORE instruction model by work card toward students’ mathematical problem-solving skill. CORE instruction model is an alternative learning model that can be used to activate students in optimizing their knowledge. CORE instruction model is one of instruction model that uses a constructivism approach with student-centered learning activities and the teacher acts as a facilitator [9]. Sliomin said briefly that CORE instruction model contains activities to connect old information with new information (connecting), activities to organize ideas to understand problems (organizing), activities to rethink, explore, and explore information that has been obtained (reflecting), and activities to develop and expand existing material (extending) [10]. CORE instruction model is an instruction model with a discussion method that aims to activate and develop learners’ reasoning [11]. In carrying out the discussion process, students need the ability to realize, choose, and use the knowledge they have to solve problems.

CORE instruction model will be combined with work cards to attract students’ attention during mathematics learning. Card media is one of the visual media that contain of images, captions, questions or answers to questions following the material presented. Work card media consists of many cards with different levels of questions. The level of work card media starts from developmental
questions from essential material, consolidation and application, and enrichment in the form of investigations, problem-solving, puzzles, or games [12].

Students can improve mathematical problem-solving skills by practicing the questions contained in the work card. Each indicator of problem-solving skill is contained in the questions provided on the work cards. Media work cards are also done in pairs or groups so that students can exchange ideas or opinions and can enrich their knowledge. The application of the CORE instruction model by work cards is expected to be able to improve students' mathematical problem-solving skill.

2. Method
The research method is quasi-experiment using non-equivalent post-test only control group design. All classes in seventh grade become the population in SMP Negeri 1 Klari. Two-stage sampling technique, namely purposive sampling and cluster random sampling technique was used in this study. Purposive sampling was used to select classes who taught by the same teacher, while cluster random sampling was used to select VII-A as the experimental class who treated with CORE instruction model by work card and VII-B as the control class who treated with the conventional instruction model.

The preliminary data was the result of mathematics PAS in the odd semester of seventh grades. The analysis of preliminary data was used to determine the normal and homogeneous population and to know the average students’ skill. Besides that, the collection of final data using mathematics problem-solving skill instrument of a test in the form of 4 essay questions quadrilateral and triangle material..

3. Result and Discussion

3.1. Statistical description data
The data of post-test on students’ mathematical problem-solving in experimental class and control class are presented in table 1 below.

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Variance</th>
<th>St. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>36</td>
<td>31.25</td>
<td>84.38</td>
<td>55.47</td>
<td>159.754</td>
<td>12.64</td>
</tr>
<tr>
<td>Control</td>
<td>37</td>
<td>9.38</td>
<td>70.31</td>
<td>40.63</td>
<td>241.890</td>
<td>15.55</td>
</tr>
</tbody>
</table>

Table 1 shows the average of post-test mathematical problem-solving skill of experimental class is 55.47 and control class is 40.63. This matter has shown that the average of experimental class is higher than control class. The normality test of this research using Lilliefors test with significance value of 0.05. The result presented in table 2.

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>L₀</th>
<th>L_{Table}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>36</td>
<td>0.093</td>
<td>0.148</td>
</tr>
<tr>
<td>Control</td>
<td>37</td>
<td>0.084</td>
<td>0.146</td>
</tr>
</tbody>
</table>

The post-test of mathematical problem-solving of both classes has normal distribution. It can be seen from table 2 that shows the L₀ of both classes is less than the L_{Table}. Hereafter, the homogeneity test of this research using Fisher test with significance value of 0.05. The result is F_{\text{Count}} = 1.514 is less than F_{\text{Table}} = 1.748. It means that the post-test of mathematical problem-solving is homogeneous.

Based on the results of the data analysis prerequisite test after treatment, it is known that experimental class and control class are normally distributed and have the same variance. Therefore, the hypothesis test of this research carried out using the t-test with two independent samples. The calculation in this study obtained t_{\text{Count}} = 4.693 > 1.667 = t_{\text{Table}}. So it can be concluded that CORE instruction model by work card has a significant effect on students' mathematical problem-solving skill than direct instruction model.
3.2. Interpretation of students’ mathematical problem-solving skill

Treatment was given 7 times in each class. The experimental class was applied by CORE instruction model and the control class was applied by direct instruction model. The different post-test results are due to differences in the model applied. During treatment, students in the experimental class were accustomed to actively think in constructing and connecting the material that had been and was newly obtained, discussing with group members, and expressing their opinions on the resolution strategies of a problem given by the teacher.

In the connecting phase, students are assisted by a yellow work card that contains essential development questions, pictures, and instructions for the process. In addition to work cards, students are also assisted by the teacher questioning about related material. Hereafter, students are given a green work card containing application questions, drawing, and instructing the process. This green work card is given at the organizing phase. Students prepare and arrange the material that has been received with hope of being able to solve the problems given.

In the reflecting phase, students will be asked to presentation and discussing the answers from work cards that have been worked on. Besides, this phase also aims to equalize the concepts that have been accepted by students. The teacher guides students so that there is no misconception during learning. After exchanging information and equating concepts, students are given more red work cards. This red work card is included in the extending phase, where students must develop the information that has been collected.

The application of this work card trains students to discuss between group members in constructing information to solve routine and non-routine problems. With discussions between members and between groups, learning process becomes student-centered. Work cards that contain questions, pictures, and instructions for the process also make students have better experience in solving problems. Moreover, the contain instructions in the work card also make students independent and familiar with the steps to solve mathematical problems. Therefore, the application of the CORE instruction model by work cards is quite effective in improving students’ mathematical problem-solving skills.

4. Conclusion

This result was indicated that the average of the students’ problem-solving skill who using CORE instruction model by work card higher than the average of the students’ problem-solving skill who using conventional instruction model. Therefore, it can be concluded that the CORE instruction model by work card affected toward students’ mathematical problem-solving skill.

5. Acknowledgments

The author expresses her gratitude to the mathematics education lecturers, particularly Dr. Lukman El Hakim, M.Pd. and Siti Rohmah Rohimah, S.Pd., M,Si. for warm support, inspirations, and thoughtful guidance.

6. References


