Effectiveness of Cooperative Learning Instructional Tools With Predict-Observe-Explain Strategy on the Topic of Cuboid and Cube Volume

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Abstract. This study aims to develop instructional tools and implement it to see the effectiveness. The method used in this research referred to Designing Effective Instruction. Experimental research with two-group pretest-posttest design method was conducted. The instructional tools have been developed is cooperative learning model with predict-observe-explain strategy on the topic of cuboid and cube volume which consist of lesson plans, POE tasks, and Tests. Instructional tools were of good quality by criteria of validity, practicality, and effectiveness. These instructional tools was very effective for teaching the volume of cuboid and cube. Cooperative instructional tool with predict-observe-explain (POE) strategy was good of quality because the teacher was easy to implement the steps of learning, students easy to understand the material and students' learning outcomes completed classically. Learning by using this instructional tool was effective because learning activities were appropriate and students were very active. Students' learning outcomes were completed classically and better than conventional learning. This study produced a good instructional tool and effectively used in learning. Therefore, these instructional tools can be used as an alternative to teach volume of cuboid and cube topics.

1. Introductions
Instructional tool is a collection of learning resources used by teachers and students in conducting learning activities. Slavin stated that in the cooperative learning model, students will sit together in groups of four to understand the material that presented by teacher [1]. In cooperative learning, students were situated to work in small groups consisting of 4-6 people who have different achievement, race, cultural and gender capabilities in a collaborative to achieve the goals learning. According to Dalziel [2], that predict-observe-explain (POE) strategy was developed by White and Gunstone in 1992 which aims to reveal the ability of students in making individual predictions. The POE strategy is based on constructivism learning theory which assumes that with activities of prediction, observation, and explain the observation result, the students are able to build their knowledge. In addition, POE strategies can be used to detect and correct students\' misconceptions about a concept [3] [4] [5].
Treagust, and David state that POE strategy is effectively used to express students' abilities and ideas [6] [7].

Indriana, Arsyad, Mulbar in his research stated that learning with POE strategy can improve students' creative thinking ability and give positive response from students. However, this study does not explain the effectiveness of learning using the POE strategy [8]. Jannah in her research said that POE strategy can increase student activity, teacher activity and student learning outcomes consisting of three aspects attitude, knowledge, and skill. Esra Kele and Pınar Demirel [5] in their research said that the strategy of POE can be used to detect and overcome students' misconceptions about a learning material. However, this study does not explain the improvement of student learning outcomes.

2. Methods
This research aims to develop a good cooperative instructional tools with predict observe explain (POE) strategy and know the effectiveness of learning with instructional tools were developed. This research method consists of development research and experimental research. The developmental research carried out two stages, the instructional tools design and the development stage. In this research, the development model used was based on the design of learning according to Morrison, et al in their book “Designing Effective Instruction”. Then, the instructional tools that has been designed, then developed by performing expert validation and revision based on input from the validator. Then, the instructional tools was implemented in the classroom to know the quality of the instructional tools was good. Instructional tools were said to be of good quality if meet the criteria of validity, practicality, and effectiveness [8].

The experimental research was conducted by using two-group pretest posttest design, that was implementing instructional tools in the experimental class which aimed to compare students' learning outcomes in control class to know the results of student learning in the experimental class was better. To know the effectiveness of learning, the developed instructional tools with good quality will be applied to experimental research. While the effectiveness of learning according to Slavin, consists of four indicators that are: quality of instruction, appropriate levels instruction, incentive, time [1]. Thus learning was said to be effective when the implementation of learning by the teacher was well, the implementation of learning was active in student activities, students' responses to the learning were positive, learning completeness was achieved in classical and student learning outcomes were better than the student learning outcomes on conventional learning.

The subjects of this experimental research were 8th grade of Junior High School. This experimental research method was two-group pretest post-design, one experimental class and one control class. In the experimental class, learning used instructional tools that have been developed. While in the control class, learning used instructional tools designed by the teacher of mathematics itself. The data of learning effectiveness analysis were obtained from the experimental class. The better learning outcomes were obtained by comparing the students learning outcomes on 'experimental class' with students' learning outcomes on control class.

3. Results and Discussion
3.1. Developmental Research
The developmental research was carried out in two phases: design stage and development stage. The development research process as follows.
3.1.1. Design stage
The design stage was done in accordance with Morrison et al design by doing the design process elements that are: Instructional Problems, Learner Characteristics, Task Analysis, Instructional Objectives, Content Sequencing, Instructional Strategies, Designing the Message, Development of Instruction, and Evaluation Instrument. Based on the data analysis, it was concluded that students had difficulties about the material of cuboid and cube volume as they saw the cuboid and cube in two dimensions. So it needs the right strategy so that students can understand the volume of the cuboid and cube well. Thus, the designed instructional tools was a cooperative instructional tool with predict observe explain (POE) strategy for cuboid and cube volume. The instructional tools consist of Lesson plans, POE Task, and Learning Tests. Lesson plans and POE task consist of two meetings, and the learning Tests used are Pretest dan posttest.

3.1.2. Development stage
Instructional tools that have been designed, then developed for a good quality instructional tool by performing expert validation and testing of instructional tools in the classroom. Based on the validation of experts obtained that instructional tools were valid and can be used in learning. Further, instructional tools applied to the classroom to determine the practicality and effectiveness of instructional tools. Based on the results of the experiment, it was found that instructional tools practical and effective to be implemented in learning. The result of learning test that has been designed was valid, reliable and sensitive. The data of development of instructional tools can be seen in Table 1.

| No | Criteria                          | Information                          | Conclusion |
|----|----------------------------------|--------------------------------------|------------|
| 1  | Expert validation                | Valid                                |            |
| 2  | The Learning Test                | Valid, Reliable, and Sensitive       | Valid      |
| 3  | Implementation of learning by teachers | Good                             | Practice   |
| 4  | Students activities              | Active                               |            |
| 5  | Completily learning outcomes     | Complete                             |            |
| 6  | Students responses               | Positive                             |            |

Based on Table 1, Expert validation is valid from the validation of experts, and based the pretest and posttest results show that the test designed was valid, reliable and sensitive criteria. Thus, the designed instructional tools in valid category. Instructional tools that are applied in the classroom show practical use both by teacher and student have caused implementation of learning by teachers is good and students are active. Learning in the classroom is also effective, because of student learning outcomes is complete classically and and students give a positive response. It was found that instructional tools developed were in good quality because they met criteria of valid, practical and effective. This was in accordance with the statement of Nieveen that the instructional tools were said to be of good quality if meet the criteria of validity, practicality, and effectiveness [12].

3.2. Experimental Reasearch
Experimental research was conducted to determine the effectiveness of learning using the developed tools. The effectiveness of learning according to Slavin, consists of four indicators that are: quality of instruction, appropriate levels instruction, incentive, time [3]. The results of all data in the experimental study were collected and analyzed descriptively. The data in question was the implementation of learning by the teacher in managing the class was well, based on the observation sheet with a minimum
value of 3 (good) and activities and time in accordance with the expected in the instructional tool, student activity has been active in accordance with the expected and follow the activities that were on POE task. The result of students’ respond show that 87.91% of students tend to enjoy the learning process, while the students’ learning outcomes classically reaches 85.7%.

Students' learning outcomes in the experimental class and students' learning outcomes in control class were analyzed by covariance analysis (anacova). This analysis was conducted to find out whether the students' learning outcomes in the experimental class were better than the students' learning outcomes in the control class. The result of covariance analysis were: experimental class regression model was $Y_E = 62,343 + 0.471X$ and control class regression model was $Y_K = 47,570 + 0.686X$. The regression model both experiment and control class shows there is significant influence of students’ initial ability with students’ learning result. Both regression models satisfied the linear regression model, and both of them were parallel. This showed that there were differences in students’ learning outcomes in cooperative learning with POE strategy (experimental class) with students’ learning outcomes in conventional learning (control class). Based on regression model for each experiment class and control class it was shown that regression line constant for experiment class was 62,343 bigger than control class that was 47,570, so geometrically regression line for experiment class was above control class. This meant that students’ learning outcomes that follow cooperative learning with POE strategy was better than students’ learning outcomes used conventional learning. Thus, students’ learning outcomes used cooperative learning with POE strategy on topic of cuboid and cube volume show better improvement.

Thus the result data from the implementation of learning in the experimental class and inferential analysis results can be seen in Table 2.

| No. | Criteria                        | Information |
|-----|---------------------------------|-------------|
| 1.  | Implementation of learning by teachers | Good       |
| 2.  | Students activities              | Aktive      |
| 3.  | Students responses               | Positive    |
| 4.  | Completily learning outcomes     | Completed   |
| 5.  | Inferential Analysis Results     | Better      |

Based on Table 2, in the experimental class shows that It was found that learning using developed instructional tools can be said to be effective. Implementation of learning by teachers

4. Conclusion

Based on the results and discussion, it can be concluded that the developed instructional tools was cooperative instructional tools with POE strategy that are: Lesson plans, POE Task, and Learning Tests. Developed instructional tools were good quality because it met the criteria of valid, practical and effective. Instructional tools were said to be valid because of the validation results by the expert obtained valid and the learning test of met the criteria valid, reliable and sensitive. Instructional tools were said to be practical based on the implementation of learning by teachers and students were in accordance with the expected. Instructional tools were said to be effective based on positive student responses to instructional tools and completeness of students’ learning outcomes that were achieved classically. Implementation of learning using developed instructional tools very effectively. The effectiveness of learning based on the ability of teachers in managing learning was well, student activity during the learning process was active, student responses on learning was positive and completeness of students’ learning outcomes achieved in classical. Based on the results of inferential statistical analysis of covariance analysis (anacova), it was found that the students' learning outcomes in the experimental class using cooperative learning with predict observe explain (POE) strategy in the topic of cuboid and
cube volume was better than the result of the students’ learning in the control class. This suggested that cooperative learning with a predict observe explain (POE) strategy was effectively used in teaching the topic of cube and cuboid volume.

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