Application of jigsaw type cooperative learning to improve student creative thinking skills

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Abstract. Based on the observation results at one of the senior high schools in Banda Aceh, it showed that the critical thinking of learners is not accustomed to train. This research aimed to investigate the enhancement of creative thinking skills of students of grade ten at senior high school in Banda Aceh by using jigsaw type cooperative learning on straight-motion material. The research method used was quasi experiment with the design of “control group pretest-posttest design” and it the research used purposive sampling technique. The sample in this study was the grade ten-two as the experimental class and grade ten-four as the control class with 60 students. Data collection was done by pretest-posttest to measure students' creative learning skills. The result of the analysis in the experimental class showed that N-gain creative thinking skills were 0.74% while the control class was 0.68%. Significance testing is done using the t test after the data were normally distributed and became homogeneous. The results of the N-gain t test for creative thinking skills $t_{\text{control}} > t_{\text{table}} \ (2.048 > 2.045)$, so that there were significant differences. The conclusion in this study is the application of jigsaw type cooperative learning can improve students’ creative thinking skills.

1. Introduction
In accordance with the times, people with high creativity have an important role in advancing a nation. The right mastery of concepts can also enhance creative thinking, especially in physics subjects [1]. However, the problems that occur now were more emphasized on memorizing and looking for one correct answer so that the thinking process is rarely trained [2]. The process of thinking in learning guides the teacher in order to create pleasant learning. Teachers must also have skills in teaching in class so that they can achieve optimal results and can stimulate and grow students' motivation to the maximum.

Thinking skills need to be integrated in subjects. Thinking skills are the ability to manipulate and change the experience that is already owned to think critically and creatively in an effort to solve problems in new situations [3]. Creative thinking should be applied to learning, so that creative thinking skills can develop [4] and can produce a creative generation with ideas obtained from several methods applied [5].
The results of observations of researchers at senior high school in Banda Aceh found that students had not able to think systematically, linked concepts that had been studied with existing problems and were not flexible in solving problems yet. Creative thinking skills were still relatively low [6, 7] most of them were still focused on memorizing concepts [8]. The students had not used to solving problems in their own way [9].

One alternative that can be used to answer these problems is by using jigsaw type cooperative learning. Some research results showed that students' thinking skills have not shown satisfactory results. In the type of jigsaw the teacher must give many opportunities to students to process information and improve communication skills [10], help to create a student-centered classroom atmosphere [11], capable to increase responses and self-confidence such as cooperation, familiarity and communication [12] and able in taking active part in learning created a more fruitful learning environment [13] Based on the description above, the researcher was interested in applying jigsaw learning to improve student creative thinking skills.

2. Research Aim and Question

2.1. Methods and research design
The research method used was quasi-experimental through pretest-posttest control group design. The research was done to find out the influence of the treatment that be controlled. The research subjects were two groups, specifically as the experimental class and the control class.

2.2. Population and sample
The population of this research was taken from students of class X of senior high school in Banda Aceh of academic year 2018/2019, which consisted of 196 students divided into 6 classes. The samples in this research were two classes determined by using purposive sampling technique, so the two classes selected were grade ten-two as the experimental class with was given the treatment with jigsaw type cooperative learning and grade ten-four as the control class which was taught with conventional approach.

2.3. Data collection technique
Data collection was done in accordance with the research techniques. The type of instrument used in the study was a test of creative thinking skills in the form of a reasoned multiple choice. Before the instrument was applied, it was first validated by experts. The results of instrument were validated in the test to the learners who have studied the straight motion material. To obtain a good test then the questions were assessed in the level of difficulty item, different power, validity and reliability. The results of the trial analysis were obtained with the reliability index of 0.614 with the high category.

2.4. Data analysis technique
The data analysis technique used in this study was a prerequisite test consisted of a test for normality and homogeneity. While for hypothesis testing was using the test and for testing the increase in creative thinking skills was using N-gain.

3. Results and Discussion

3.1. Creative thinking skills
The data gained to creative thinking skills test are analyzed using normality testing and homogeneity. In testing normality, the researchers used Lilliefors (L) test whereas Levene test was used in testing homogeneity. Testing the testing results of the normality and homogeneity for pretest and posttest in the experimental class and the control class can be seen in Table 1.
Table 2 shows that the average score of pretest in the experimental class is 34.22 and the posttest average score is 83.33. While in the control class the average score of the pretest is 30.89 and the posttest average score is 77.89. After the testing of normality and homogeneity, further steps were determining the hypothesis test (t-test) of the experimental class and the control class. Based on the pretest calculation the value obtained was $t_{count} < t_{table}$ (1.800 < 2.045) it can be concluded that there is no difference between the two classes. Whereas based on posttest calculations, value was $t_{count} > t_{table}$ (2.828 > 2.045) then it can be concluded that there were differences in creative thinking skills of the students who were taught with the jigsaw type cooperative learning

\textbf{Table 1. Testing normality and homogeneity in creative thinking skills}

| Classes  | Creative thinking skill | Average score | Normality* | Homogeneity** |
|----------|-------------------------|---------------|------------|--------------|
| Experiment | Pretest                 | 34.22         | $L_{count} < L_{table}$         | $F_{count} < F_{table}$ |
|          |                         |               | (0.098) < (0.161) (normal)      | (3.678) < (4.004) (homogeneous) |
|          | Posttest                | 83.33         | $L_{count} < L_{table}$         | $F_{count} < F_{table}$ |
|          |                         |               | (0.149) < (0.161) (normal)      | (3.855) < (4.004) (homogeneous) |
| Control  | Pretest                 | 30.89         | $L_{count} < L_{table}$         | $F_{count} < F_{table}$ |
|          |                         |               | (0.097) < (0.161) (normal)      | (3.678) < (4.004) (homogeneous) |
|          | Posttest                | 77.89         | $L_{count} < L_{table}$         | $F_{count} < F_{table}$ |
|          |                         |               | (0.147) < (0.161) (normal)      | (3.855) < (4.004) (homogeneous) |

Descriptions: *) =Lilliefors Test (normal, value $L_{count} < L_{table}$=0.05); **) =Test F (homogeneous, value $F_{count} < F_{table}$ = 0.05)

3.2. Increase creative thinking skills

The increase in creative thinking of the experimental class and the control class differed significantly, it was necessary to do an N-gain analysis test to see the difference in the average of the two classes. For clearer information, the increase in both classes can be seen in Table 2.

\textbf{Table 2. The score improvement of student creative thinking skills}

| Classes  | KBK data | Average score | N-gain |
|----------|----------|---------------|--------|
| Experiment | Pretest  | 34.22         | 0.74   |
|          | Posttest | 83.33         |        |
| Control  | Pretest  | 30.89         | 0.68   |
|          | Posttest | 77.89         |        |

Table 2 shows that the average pretest value experimental class is 34.22 and the posttest average value is 83.33. While in the control class the average pretest value is 30.89 and the posttest average value is 77.89. The results of data analysis are also showed a difference between the two classes which can be seen from the percentage of N-gain, namely the experimental class of 0.74 in the high category and the control class of 0.68 in the medium category. After testing hypotheses on the value of the pretest and posttest, the N-gain value was done. The t-test results of the N-gain value of the experimental class and the control class can be seen in Table 3.

\textbf{Table 3. Recapitulation of t-test based on N-gain}

| Classes  | Average | $t_{count}$ | $t_{table}$ | Interpretation | Conclusion   |
|----------|---------|-------------|-------------|----------------|--------------|
| Experiment | 0.74    | 2.048       | 2.045       | $t_{count} > t_{table}$ | Significant difference |
| Control   | 0.68    |             |             |                |              |

The hypothesis test of the second N-gain class obtained a value of (2.048 > 2.045) it can be concluded that there was a significant distinction between the experimental class and control class.
The experimental class value was higher than that of the control class, it demonstrated the influence of learning with the application of jigsaw type cooperative learning.

The results of jigsaw type cooperative learning were able to make students active in the learning process by answering questions during the learning process. The students did certain activities in finding specific information in the expert group. Those activities were analyzing, evaluating, creating and then they were integrated in every learning [15,16,17] and able the increased activity of learners in the discussions [18].

3.3. Creative thinking skills in each indicator

Creative thinking skills can be reviewed from every aspect developed. The percentage of the average N-gain score in each aspect can be seen in Figure 1.

Figure 1. Average improvement of creative thinking skills in each indicator for experiment and control class

Figure 1 shows differences of creative thinking skills improvement in the experimental class taught by jigsaw learning and the control class which is taught by conventional approach in term of different categories in each indicator. Students who understood the concepts conveyed by peers gave a positive response to the material presented.

3.3.1. Fluency. From the data obtained it is showed that the experimental class had an increase with an average N-gain of 0.78 in the high category and the control class with an average N-gain value of 0.73 in the medium category. In this stage, students were able to determine one way of problem solving and provide examples relating to the material. The purpose of problem solving is not merely focused on finding one right answer, but how all possible correct answers can be made, along with possible procedures and arguments, and why those answers make sense.

3.3.2. Flexibility. In this indicator, in which a problem can be viewed from a different perspective, the experimental class had an increase with an N-gain average of 0.69 in the medium category and the control class with an N-gain average of 0.64 also in the medium category. Aspects of flexibility were the ability of students to solve problems not only in one way but also in two or more different and correct ways [19].

3.3.3. Originality. In the originality indicator, in which students were able to make unusual combinations of parts or elements, the experimental class had an increase with an average N-gain of 0.76 in the high category and in control class with an average value of N-gain of 0.68 in the medium category. The authenticity of the answers or methods of settlement was related to how many students provide answers or ways to resolve them. The less often students gave the same answer or the same solution, the higher the authenticity of the answer.
3.3.4. **Elaboration.** In the elaboration indicator, where students able to enrich and develop an idea, the experimental class had an increase with an average N-gain of 0.60 in the medium category and the control class with an average N-gain value of 0.55 in the low category. In the experimental class the percentage was good enough, but they still felt difficulty in describing the problem and were confused about where to start from, but then the students paid attention to the steps taught by the teacher and follow them. The low level of skills in this indicator was due to the inability of students to determine the truth of a question [20].

4. **Conclusions**

Based on the data obtained it can be concluded that there was an increase in students' creative thinking skills by using jigsaw type cooperative learning. This can be seen in the height of the N-gain experiment class score compared to the control class.

5. **References**

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