The Use of Conceptual Change Text toward Students’ Argumentation Skills in Learning Sound

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Abstract. This research aim is to investigate the effect of Conceptual Change Text toward students’ argumentation skills in learning sound concept. The participant comes from one of International school in Bandung, Indonesia. The method that used in this research is a quasi-experimental design with one control group (N=21) and one experimental group (N=21) were involves in this research. The learning model that used in both classes is demonstration model which included teacher explanation and examples, the difference only in teaching materials. In experiment group learn with Conceptual Change Text, while control group learn with conventional book which is used in school. The results showed that Conceptual Change Text instruction was better than the conventional book to improved students’ argumentation skills of sound concept. Based on this results showed that Conceptual Change Text instruction can be an alternative tool to improve students’ argumentation skills significantly.

1. Introduction
Conceptual Change Text is such as an effective teaching strategy that it can be used throughout the teaching-learning process mainly because of its practical aspects. It has been observed that most of the studies concerning the effects of Conceptual Change Text on learning and some affective variables such as attitude, motives, and learning approaches [1]. Conceptual Change Text, concept cartoons, concept mapping, mind maps, and analogies are some of the many conceptual change strategies used in physics education. This study analyzes the effect of using Conceptual Change Text, which are believed to be very efficient [2].

One of the perspective from which researchers have investigated the role argumentation in science education is the effectiveness of argumentation on students’ conceptual understanding of scientific concepts [3]. Some research explored that argumentative discourse develops students’ conceptual understanding in the fields of science. There have been numerous studies to investigate the effect of Conceptual Change Text on students’ understanding in science education. Conceptual Change Texts are one of the powerful tools in science education. Conceptual Change Text based instruction increases the students’ science achievement [2].

One of the efforts to improve students’ conceptual understanding and overcome the misconception is by using Conceptual Change Text. Conceptual Change Text is a written piece that can identify misconceptions, improve student understanding, and then provide scientifically acceptable concepts [4]. Conceptual Change Texts are designed to make students aware of their inaccurate preconceptions and help them change their non-scientific conceptions toward more scientific ones through the use of explanations and examples [5]. Conceptual Change Text, concept cartoons, concept mapping, mind...
maps, and analogies are some of the many conceptual change strategies used in physics education. This study analyzes the effect of using Conceptual Change Text, which are believed to be very efficient [2].

Many studies use Conceptual Change Text in learning because this text can effectively be used in both small and large classes to facilitate conceptual change and understanding of student concepts [6]. In some studies, Conceptual Change Texts were prepared concepts such as “solutions” [7]; “cellular respiration” [8]; “heat and temperature” [9]; “electric” [6]; “electrochemical cells” [10]; “cell” [11]. These studies show that the use of Conceptual Change Text can improve students’ conceptual understanding. Conceptual Change Texts are designed to make students aware of their inaccurate preconceptions and help them change their non-scientific conceptions toward more scientific ones through the use of explanations and examples [5].

A look into the previous research about Conceptual Change Text on sound concept [12] the researchers only provided two teaching materials about sound, those are properties of sound and musical sound with descriptive research method. However, in this research are presents an example of Conceptual Change Text that has been specifically prepared of sound in four concepts material which are sound waves, properties of sound, sound reflection, and musical sound. This research aim is to investigate the effect of Conceptual Change Text toward students’ argumentation skills in learning sound concept.

2. Experimental Method

2.1. Research design and sample

A quasi-experimental design was used in the study. The study utilized a pre-test and post-test design. Quasi experiment provides the researcher which the opportunity to assess the effects of interventions or treatments. By applying this method, there were two groups which are control and experimental group [13]. The research design can be shown on Table 1.

| Select Control Class | Select Experimental Class | Pre-test | Conventional Book | Conceptual Change Text | Post-test |
|----------------------|---------------------------|---------|-------------------|------------------------|----------|

The location of this research was in one International school in Bandung in the school period of 2016/2017. The school used Cambridge Curriculum. This school use English as main language in the teaching and learning process. The population in this research was 8th grade students. The sample for the research consisted of a total 42 eight grade students (25 female, 17 male). One control group (21 students, 12 female, 9 male, with an average age of 13-14) and one experimental group (21 students, 13 female, 8 male, with an average age of 13-14) were involved in the study. Students in both group come from similar educational and socio-economic backgrounds. The sample was taken by cluster random sampling technique. Cluster random sampling is defined where one is obtained by using groups as the sampling unit rather than individuals [14]. The data of the sample can be seen on Table 2.
Table 2. Data of the sample

| Group   | Population | Sample | Percentage (%) | Total (%) |
|---------|------------|--------|----------------|-----------|
| Control | 8th grade  | Male   | 9              | 42.86     | 100       |
|         |            | Female | 12             | 57.14     |           |
| Experiment | 8th grade | Male   | 8              | 38.10     | 100       |
|          |            | Female | 13             | 61.90     |           |

2.2. Procedure

In this research, experimental group learn with Conceptual Change Text, while control group learn with conventional book. The learning model that used in both classes is demonstration model which included teacher explanation and examples, the differences only in teaching materials. The research was done in six meetings. The first meeting and last meeting was for pre-test and post-test. Pre-test was held on March 23th 2017 while post-test held on April 11th 2017. The instructional process was done in four meetings which the duration of each meeting was 75 minutes. Both control group and experimental group have same duration. The implementation Conceptual Change Text conducted in the beginning of class activities, students are asked to read the Conceptual Change Text in experiment group while control group read conventional book. In the end of the class, students do the argumentation section. The learning activity can be shown in Table 3.

Table 3. Learning activity

| Date             | Group                  | Topic             | Teaching Materials       |
|------------------|------------------------|-------------------|--------------------------|
| Wed, 29th March  | Control                | Sound Waves       | Conceptual Change Text   |
| Thu, 30th March  | Experiment             |                   | Conventional Book        |
| Mon, 3rd April   | Control and Experiment | Properties of Sound | Conceptual Change Text   |
| Wed, 5th April   | Control                | Sound Reflection  | Conventional Book        |
| Thu, 6th April   | Experiment             |                   | Conceptual Change Text   |
| Mon, 10th April  | Control and Experiment | Musical Sound     | Conventional Book        |

In the implementation of Conceptual Change Text, the students are interest in using Conceptual Change Text as teaching material. By using conceptual Change Text as teaching material, could give positive impact on the students’ argumentation. There are four questions for argumentation test of sound concept that involve in this research. Those are sound waves, properties of sound, sound reflection, and musical sound. Each subtopic has one question to measured students’ argumentation skills. There are six aspects of argumentation skills, but in this research, the researcher only used four aspects of argumentation skills, which are; Claim, Data, Warrant, and Backing. In this research, students’ argumentation skills is measured after students read the Conceptual Change Text on experiment group and after students read the conventional book on control group.

2.3. Data analysis

In the analysis of the Argumentation Writing Test, the statistic tests were done in order to knowing the difference students’ argumentation skill between control group and experiment group. The total score of each student in both groups as well as the mean score of each group were computed. The pre-test scores of the groups were compared by using Kolmogorov-Smirnov determine whether a statistically significant difference in the means existed between the control group and experimental group. The post-test results were also compared using the independent sample t-test to see the effects of intervention on students’ argumentation skills of the target concept.
3. Result and Discussion
In the analysis of Argumentation Writing Test, the n-gain scores from control group and experimental group were computed. This shows in Table 4, the results of independent sample t-test showed significant main affects for treatments on students’ retain their knowledge (Sig. 2-tailed = 0.000).

| t-test for Equality of Means | Mean | Std. Error Difference | Std. Error Difference |
|------------------------------|------|-----------------------|-----------------------|
| Equal variances assumed      | -6.288 | 40 | .000 | -23.333 | 3.711 |
| Gain                         | -6.288 | 39.950 | .000 | -23.333 | 3.711 |

Based on the result above is obtained the sig. = 0.000. Then the comparison of the sig. = 0.000 < α = 5%, which means that there is difference in students’ argumentation skill in learning sound concept between using Conceptual Change Text and conventional book and there is positive and significant effect of the method of students’ argumentation skill in experiment group. In the analysis of argumentation writing test, the scores from pre-test and post-test on control group and experiment group were computed. The result of N-Gain score is shown in Figure 1.

![Figure 1. Results of N-Gain Argumentation Writing Test in control and experiment group](image)

As it is shown in the results of N-Gain score in figure 1, the score of each aspect is come from four concepts of sound which are sound waves, properties of sound, sound reflection, and musical sound. For claim aspect in control group is 0.14 categorized as low while experimental group is 0.33 categorized as medium, which means the students in experimental group, can give their opinion in the form of statements better than the control group. And also for data aspect, the N-Gain score in control group 0.24 categorized as low and 0.51 categorized as medium for experiment group, which means the students in experimental group, can give the evidence better than control group. For warrant aspect, the experimental group performed better than control group, with the score of N-Gain is 0.04 categorized as low and 0.44 categorized as medium it means that the students in experimental group can linked the claim with data in the form of statements better than the control group. Last is from backing aspect, shows the score of N-Gain in control group 0.31 which categorized as medium and...
0.71 categorized as high from experimental group, it means that students in experimental group can give their statements that support the warrant better than control group.

It was seen that the lowest aspect of argumentation come from claim aspect in both groups. It is because the students in both groups only state the generalizations that are related to the proposition, but the assertions lack specificity or offer unclear. However, the greatest score of argumentation come from backing aspect. And significant improvement clearly shows in experiment group with the higher score than control group. It is because the students in experiment group can give correct and complete statements if compare with students in control group which get lowest score. Some students in control group only makes the statements with correct and complete explanations but the sources are very general not specific. A significant improvement in experiment group occurs because the experiment group learns with Conceptual Change Text, students in experiment group can easily understand the concept of sound because content that is in the Conceptual Change Text added more pictures that can be easily understood by students if compare with conventional book which lack of figure. So it can be conclude that, students in experiment group which learn using Conceptual Change Text really understand the concept correctly, so that the students could give the argument in the form of reason completely.

As evident in the results of Argumentation Writing Test, students have different ideas related to the sound waves, properties of sound, sound reflection, and musical sound. The experimental group students are more successful than the control group ones and this improvement is likely caused by the conceptual change texts instruction. This is in line with the previous research which found out that the used of Conceptual Change Text may help students to understand sound concepts and also can improve in all aspects of argumentation. The result also related with the study which state that Conceptual Change Text can improving science teaching and learning [15] and enhanced students’ understanding [16].

4. Conclusion

Students have different ideas related to the sound concept, specifically in the concept of properties of sound and musical sound. While introducing the properties of sound, teacher and/or textbook generally say that sound travels fastest through the medium in solid, liquid than gas. Also, particles are not often depicted in pictures showing in textbook. We now that traditional sciences teaching are not effective in increasing students’ understanding also argumentation skills in learning sound concept.

In conclusion, that Conceptual Change Texts instruction can be an alternative tool to improve students’ argumentation skills especially in backing’s aspect of argumentation improve significantly.

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