The effect of multiple intelligence theory based teaching towards students’ achievement on electrical circuit topic

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Abstract. The research aims to identify the effect of implementing multiple intelligences theory based teaching towards students’ achievement on electrical circuit topic. Totally 66 of 8th grade junior high school students were selected through convenience sampling technique as experimental group subjects of this research. The experimental group was instructed to learn through multiple intelligences theory based teaching as the treatment in learning electrical circuit topic. This experimental study lasted for 6 meetings in 6 weeks and conducted using one group pre-test and post-test design. To evaluate the effect of the treatment on students’ achievement, an achievement test about electrical circuit topic which consisted of 24 items was distributed and analyzed using SPSS. The result showed that normalized gain value was 0.28 which categorized as a low improvement. In other word, students’ achievement on electrical circuit topic improved after being taught by multiple intelligences theory based teaching.

1. Introduction

Students are generally diverse on one another in terms of their gender, ethnicity and economics condition. In further, the ways in which students can learn best also come to be one of those different aspects that can influence students’ learning. Students have different way in learning, so students can not be evaluated in a same way [1]. Howard Gardner in 1993 argued that there are no individuals can define as intelligent or not, but individuals have their own intelligence in different field [2]. The intelligences that Howard Gardner intended recently are visual-spatial, verbal-linguistic, logical mathematical, bodily-kinesthetic, musical-rhythm, intrapersonal, interpersonal, naturalist, and Howard conferred the possibility of a ninth intelligence which is existential intelligence in 1999. Therefore, teacher should ponder many teaching and learning strategies to aide students to learn best and encounter successfully learning outcome with those different intelligences.

In fronting these facts, multiple intelligences theory can be practiced as teaching and learning strategies to students. Learning theory that has a powerful effect to solve the dissimilarities of students in the way of their learning is multiple intelligences theory [3]. In addition, science learning will be successfully accomplished better if teachers identify about the multiple intelligence theory as the part of thinking style in teaching and learning process [4]. Multiple intelligences boost the idea that every student is able to learn through different types of intelligences [5]. Instead of explaining about the theory, multiple intelligences theory gives the significant effect for practical teaching [6]. The application of Gardner’s intelligences theory will not burden teachers in conducting teaching and learning process [7].
From those nine multiple intelligences theory, one of them is visual-spatial intelligence. Students having this intelligence are sensitive to image, color, shape, line and relationship among them so that students can receive any information much better through a visualization [8]. Students which are able to use words and language in writing, reading, and speaking skills are those who have verbal-linguistics intelligence [9]. Meanwhile, students which have mathematical-logical intelligence tend to think logically and use numbers often [10]. In further, learning activities such as hands-on activities, role playing and others physical activities refer to students who have bodily-kinesthetic intelligence [11]. One of students’ characteristics having musical-rhythm intelligence was indicated by turning the concept materials into such kind of lyrics [12]. Reflective activities or independent study is becoming the characteristics of students with intrapersonal intelligence [13]. Different with intrapersonal, interpersonal intelligence in students is indicated by applying social relationship such as discussing or working in a group [14]. Other intelligence is naturalist, which those who are able to classify, categorize, and comprehend something exist in nature [15]. The last type of these nine intelligences is existential intelligence. Different with previous type, this intelligence is related to spiritual questions such as questioning the meaning of life [16].

The pluralism methods of the treatment by applying multiple intelligence based teaching have been done in this research, which becomes one of multiple intelligence theory based teaching that is rarely done in its realm. This has a purpose to aide students in experiencing all types of multiple intelligence theory in overall activities implemented in classroom. So that students can explore and improve more their tendency of intelligence.

2. Methods

The research was a quasi-experimental study with one group pretest-posttest design, which only includes experimental group without control group [17]. Three classes of 8th grade students which consisted of higher and lower achiever class from one of International Junior High School, in Bandung Barat, selected as the subjects of this study. Students were instructed to learn about electrical circuit topic through multiple intelligences theory based teaching as a treatment. Eight types of multiple intelligences theory based teaching were implemented during 6 meetings in 6 weeks. An achievement test which consisted of 24 multiple choice items were given to 66 students as participants of experimental group before and after the treatment conducted. The content of achievement test was validated by two expert judgement and one science teacher. Due to the data did not meet normal distribution, the data was then analysed using Wilcoxon test through IBM SPSS 23. In further, normalized gain test for all students and comparison between higher and lower achiever class as well was also identified in this research to see whether or not the treatment is implemented effectively.

3. Result and Discussion

3.1. implementation of multiple intelligences theory based teaching

Eight types of multiple intelligences theory based teaching have been implemented in this research are visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, musical-rhythm, intrapersonal, interpersonal, and naturalist intelligence as shown in Table 1. These eight were integrated and applied in physics topic of electrical circuit during 6 meetings in 6 weeks.

Table 1 represents the activities done by students during learn electrical circuit topic integrated with the theory of multiple intelligences. There would be more than one type or at least two of MI theory applied in one day meeting. In addition, there is an adjustment with current condition to the treatment, such as implementing a virtual experiment rather than hands-on experiment. This virtual experiment implementation was a bit same in result with real experiment because it was done using PhET simulation software which could visualize better as it was in the real experiment and also could improve students’ understanding as well as students’ achievement [18]. Another adjustment was observing something through a video given rather than observing it directly in nature or outside of the class. Researcher also did not put the existential intelligences as one of teaching strategy conducted. It was due to this type of intelligence was too rigid to implement compared to others intelligences. This intelligence was related to spiritual things inside individuals [11].
Table 1. Learning Activities Multiple Intelligences Theory based Teaching

| Type of Intelligence | Concept | Activities |
|----------------------|---------|------------|
| Visual-Spatial Intelligence | Electric Charge, Ohm’s Law | Paying attention to power point presentation about Electric Charge and Ohm’s Law. |
|                       | Electrical Circuit Symbols | Drawing the symbols of eight electrical components. |
|                       | Ohm’s Law Graphic | Drawing the graph of Ohm’s Law based on its equation. |
|                       | Circuit Diagram | Drawing circuit diagrams containing sources, switches, resistors and lamps. |
| Logical-Mathematical Intelligence | Electric Charge Equation | Calculating the electric charge passing through the lamps using the formula of Q = I.t. |
|                       | Ohm’s Law Equation | Calculating the current, voltage and resistance using the Ohm’s Law equation. |
|                       | Resistance | Finding out the resistance and combined resistance in given circuit diagram. |
|                       | Electric Charge, Ohm’s Law and Resistance Exercises | Calculating about Electric Charge, Ohm’s Law, and Resistance. |
| Bodily-Kinaesthetic Intelligence | Resistance in Resistor | Doing a virtual experiment to check the magnitude of resistance in a resistor using PhET simulation software. |
|                       | Series Circuit | Doing a virtual experiment to construct the series circuit using PhET simulation software. |
|                       | Parallel Circuit | Doing a virtual experiment to construct the parallel circuit using PhET simulation software. |
| Naturalist Intelligence | Electric Eel | Watching a video on Youtube about Electric Eel. |
| Musical-Rhythm Intelligence | Fruit Battery | Watching the video given about fruit battery. |
| Intrapersonal Intelligence | Electrical Circuit | Watching a Song Lyric on Youtube about Electrical Circuit. |
| Verbal-Linguistic Intelligence | Electrical Circuit | Writing the essence of what is explained on the video. |
| Interpersonal Intelligence | Connecting Ammeter and Voltmeter in Circuit | Reading the article given and explained directly by teacher about the way of connecting ammeter and voltmeter in electrical circuit. |
|                       | Series and Parallel Circuit | Paying attention to teacher’s presentation using power point about series and parallel circuit. |
|                       | Electrical Circuit | Answering some questions regarding the topic delivered. |

3.2. students’ achievement result

The problem of this research is in the form of “is there any significant difference in students’ achievement after being implemented by multiple intelligences based teaching on electrical circuit topic?” below is the result table of a Wilcoxon test depicted in Table 2.
Table 2. Recapitulation of Students’ Achievement Result

| Component        | Pre-Test | Post-Test |
|------------------|----------|-----------|
| Average Score    | 52.20    | 65.71     |
| Standard Deviation | 15.40    | 17.82     |
| Highest Score    | 74.16    | 95.83     |
| Lowest Score     | 20.83    | 16.66     |

Kolmogorov-Smirnov Normality Test

| Signification (sig.\(\alpha\) = 0.05) | Not normal | Normally Distributed |
|----------------------------------------|------------|----------------------|

Wilcoxon Test

| Conclusion                        | H\(_0\) = rejected, H\(_1\) = accepted |
|-----------------------------------|----------------------------------------|

| Ranks                | Pre-test < Pre-test | Pre-test > Pre-test | Pre-test = Pre-test |
|----------------------|---------------------|--------------------|---------------------|
| Negative Ranks       | 8                   |                    |                     |
| Positive Ranks       | 51                  |                    |                     |
| Ties                 | 7                   |                    |                     |
| Total                | 66                  |                    |                     |

Table 2 indicates that the data did not meet normal distribution so that a Wilcoxon test was applied. The result of achievement test applied shows that there is significant difference between the score of experimental group in pre-test and post-test with signification value of 0.00. In addition, several informations were presented such as negative ranks, positive ranks, and tiers. Negative ranks in this research means that students’ achievement was decreased because of the post-test score result was lower than pre-test. Positive ranks means in opposite way with the negative one which students’ achievement was increased because of the post-test score result was higher than pre-test. Meanwhile, tiers means stable which students’ achievement was not increased or even decreased because the post-test score result is the same as pre-test.

3.3 normalized gain result

To see the effectiveness of treatment implemented in this research, average normalized gain score for all students and students in higher and lower achiever class separately was presented in Table 3.

Table 3. Recapitulation of Normalized Gain Value

| Type of Class | Number of Questions | Number of Participants | Average Score Pre-test | Average Score Post-test | G | \(<g>\) | Category |
|---------------|---------------------|------------------------|------------------------|-------------------------|---|--------|----------|
| Higher Achiever | 24                  | 25                     | 61.66                  | 79.49                   | 17.83 | 0.44   | Average  |
| Lower Achiever  | 24                  | 41                     | 46.43                  | 57.31                   | 10.88 | 0.18   | Low      |
| All Participants| 24                  | 66                     | 52.20                  | 65.71                   | 13.51 | 0.28   | Low      |
Table 3 presents the normalized gain value for higher achiever class which consisted of 25 students and lower achiever class which consisted of 41 students. In total, there are 66 students participated in this research with 24 questions given as pre-test and post-test. All information about means pre-test and post-test, gain value and normalized gain value were presented in Table 3 above. Too see clearly the difference of normalized gain value of those three perspectives: higher achiever class, lower achiever class and all students which is a combination of both, Figure 1 is presented.

Figure 1. The normalized gain for students in higher achiever class

Figure 1 shows the normalized gain for students in higher achiever class and it was categorized as in average or medium, it means that the effectiveness of treatment applied to higher achiever class was in medium level. Meanwhile, the normalized gain in lower achiever class was categorized as low which means that the effectiveness of treatment applied in this class was in low level effect. Overall, the average normalized gain for all students participated in this research was categorized as low. This categorization is based on the modified interpretation of normalized gain by Hake [19].

4. Conclusion
From the research result, it can be concluded that multiple intelligences theory based teaching on electrical circuit topic on students’ achievement enhanced. In details, normalized gain value of higher achiever class has an average or medium level, while it is in low level for lower achiever class. It means that multiple intelligences based teaching as treatment in this research is more effective implemented in higher achiever class compare to its effectiveness in lower achiever class. However, in overall the normalized gain value of all students as participants are in low level which means that the effectiveness of the treatment applying multiple intelligences based teaching on students’ achievement is in low level.

5. References
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Acknowledgments

The author praises gratitude to Allah SWT for His Mercy so that the author could finish this research right in time. The author would like to thank and express the gratitude to all parties such as families, supervisors, science teachers, and friends who have helped, guided and accompanied the author during the time of making this research. Especially for 66 students in International Junior High School Bandung who have been willing to participate as the subjects in this research.