Implementation Of Fun Learning Through Mind Mapping Method In History Of Physics Course In Physics Education Department, Universitas Negeri Gorontalo

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Abstract: The present study is aimed to identify the difference between the implementation of conventional method and mind mapping method towards students' learning outcomes in the History of Physics Development course. The sample in this experimental study was selected using a *simple random sampling* method. Moreover, a test of students' learning outcomes was employed as the research instruments. The data were analyzed by applying validity, normality, homogeneity, and hypothesis tests. The results show that 8 question items were stated as valid, while the normality test (with chi-square) generated X^2_{count} at 7.3582 for the experiment class and $X^2_{count} = 7.4959$ for the control class ($X^2_{table} = 11.1$). The numbers indicate that both of the classes were normally distributed and the data were homogenous, as the $X^2_{counts} = 0.2302 \leq X^2_{table} = 11.1$. Further, the hypothesis t-test generated that $t_{count} = 79.9237 > t_{table} = 1.6752$; the numbers indicate a significant difference between the learning outcomes in experiment and control class. All in all, this study concludes that the mind mapping method yields higher performance than the conventional method; in other words, there is a significant difference between the experimental class and the control class.

Keywords: History of Physics, Mind Mapping, Learning Outcomes

INTRODUCTION

History of Physics course is a course taught in the Department of Physics Education in Universitas Negeri Gorontalo. It involves several topics, such as essence and theoretical backgrounds, concepts of physics law and theory, and correlation between physics and technology.

The learning process of such a subject requires a fun and enjoyable approach in order to generate optimal learning outcomes. However, History of Physics is considered by most students as the most boring course, especially because they are demanded to take notes and memorize every slightest detail of the material.

Andi Wira Gunawan in the book "Genius Learning Strategy" states that boring topics or courses do not exist; instead, it is the teacher or the learning atmosphere that is boring to the students. Such problems blame the monotonous and repetitive learning process; variations in approaches to learning rarely occur. The learning process is merely a one-way information delivery process, while students being on the receiving end are passive in receiving the lecture material (http:// www.hendryrisjawan.com).

Contrary to such approaches, the mind mapping method is a new method designed to adjust the natural processing mechanism of the human brain. The mind mapping method involves images with shapes that are adjusted to the students' preferences; this method balances the work of the two brain hemispheres and stimulates the enjoyable feeling during the learning process.

RESEARCH METHOD

Research Methods

The experimental study aimed to explore the difference between the mind mapping method and the conventional method towards the students' learning outcome in the focused course.

Research Site and Duration

The study was conducted in the Department of Physics Education in even semester of 2013/2014 academic year.

Research Design

This experimental study employed Posttest-Only Control Group Design (Sugiyono, 2009:112). It is displayed in the following table.

TABLE 3.1 RESEARCH DESIGN

Group	Treatment	Post-test
Experiment class	X_1	Y_1
Control Class	X_2	Y_2

Population and Sample

Population

The population was all students who enrolled in the History of Physics course in the 2013-2014 academic year.

Sample

A simple random sampling technique was employed to obtain students from Class A and Class C as the research samples.

Further, Class C was selected to be the experiment class in which the mind mapping method was implemented, while the A class was selected as the control class with conventional learning method.

Research Variables

Independent Variable

The present study employed treatment as the independent variable, in which the experiment class applied the mind mapping method, while the control class applied the conventional method.

Control Variable

The experimental class applied several indicators of control on the following aspects:

a. Teaching lecturer(s)
   Both classes were taught by the researcher as the class lecturer.
b. Topic(s) taught
   Both classes involved similar learning topics/materials.
c. Time allocation
   Both classes were taught within the same time allocation
d. Learning Outcomes Test
   Both classes employed the same test of measurement of students' learning outcomes.

Dependent Variable

The dependent variable was the students' learning outcomes in the topic of the history of physics from 1950-now.

Data Collection Technique

The present study employed data of students' learning outcomes obtained by post-learning essay test as the research instrument. Prior to the treatment, a test trial was conducted in class not involved as the research sample. From the trial, the study only included valid instruments as the data collecting instruments.

Questions Validity Test

The test questions are stated valid if they are able to measure the items that they intend to measure. A validity test can be conducted by observing the correlation between question items by referring to the product-moment correlation formula as follows:

$$\mathbf{r_{xy}} = \frac{n(\sum XY)-(\sum X)(\sum Y)}{\sqrt{\{n\sum X^2-(\sum X)^2\}\{n\sum Y^2-(\sum Y)^2\}}}$$, (Sugiyono, 2010:228).

Where:

r_{xy} = product moment correlation coefficient
Σ_x = Total score per item
Σ_y = Total score of all items
n = Number of respondents

Moreover, the test criteria comprise:

With the degree of significance at $\alpha = 0.05$, r is valid if $r_{count} \geq r_{table}$

Reliability Test

A test's reliability can be measured by an Alpha Cronbach reliability test with the following formula:

$$\mathbf{r_{11}} = \left[\frac{k}{(k-1)}\right]\left[1-\frac{\sum\sigma_i^2}{\sigma_t^2}\right]$$, (Arikunto, 2006:196)

where:

r_{11} = Test reliability

k = Number of items
$\Sigma\sigma_b^2$ = Total score variance per item
σ_b^2 = Total variance

The following formula was employed to obtain item variance and total variance:

$$\sigma_b^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N} \; ; \; \sigma_i^2 = \frac{\sum Y^2 - \frac{(\sum Y)^2}{N}}{N}$$, (Arikunto, 2006:184)

where:

X = Question item
Y = Total question items

The classification of the reliability correlation, according to Guilford (in Sulistiawati, 2009: 70) is as follows.

$0.00 < r_{11} \geq 0.20$: Very low reliability
$0.00 < r_{11} \geq 0.20$: Low reliability
$0.00 < r_{11} \geq 0.20$: Moderate reliability
$0.00 < r_{11} \geq 0.20$: High reliability
$0.00 < r_{11} \geq 0.20$: Very high reliability

Learning Outcomes Test Instruments

a. Conceptual Definition

The learning outcomes referred to in this study are the set of abilities owned by students as a result of the learning process; in this context, the students also undergo a change in their knowledge, skills, and attitudes towards the desired indicators. The set of abilities involve knowledge, comprehension, application, analysis, synthesis, and evaluation.

b. Operational Definition

Learning outcomes refer to the total score of students' ability in the focused topic. Such score is obtained by employing a test with a set of questions. The learning outcomes, as Bloom's cognitive domain suggests, consist of: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Data Analysis Technique

The research employed descriptive and inferential data analysis techniques.

Descriptive Data Analysis

A descriptive data analysis technique was used to describe the students' learning outcomes in statistical quantities (mean, median, mode, deviation standard) and describe them in the form of a frequency distribution table.

Statistical Hypothesis

Inferential Data Analysis

The research hypothesis was tested by inferential data analysis, i.e., a statistical technique to analyze the samples and generate the results to the population under which the samples are extracted (Sugiyono, 2009: 209). The data normality and homogeneity test were conducted before the hypothesis t-test.

Variance Homogeneity Test

The variance homogeneity test aims to test the average similarity of several variances to generate whether or not the two groups studied are homogeneous. The variance homogeneity test employed F-test with the formula of:

$$F = \frac{Variance_{greatest}}{Variance_{lowest}}$$, (Sugiyono, 2010: 140)

The tested hypotheses involve:

$H_0 : \sigma_1^2 = \sigma_2^2$
$H_1 : \sigma_1^2 \neq \sigma_2^2$

The test criteria involve:

H_o is accepted if $F_{count} < F_{table}$; H_o is denied if $F_{count} > F_{table}$, with a significance rate of $\alpha = 0.05$.

Normality Test

Data normality test is conducted to identify whether or not the data are normally distributed. The Lilliefors test was used to examine the data normality. The tested hypotheses were:

H_o : data are normally distributed
H_1 : data are not normally distributed

The test criteria involve:

H_o is accepted if $L_o \leq L_{table}$; H_o is denied if $L_o > L_{table}$, with a significance rate of $\alpha = 0.05$.

Statistical Hypothesis

T-test was employed as the statistical test, with the formula of:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

and

$$s^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$, (Sudjana, 2002:239).

Description:

t : transformation value or count value for T-test
$\bar{X}_1$: average score of experiment class
$\bar{X}_2$: average score of control class
n_1 : total sample of experiment class
n_2 : total sample of control class.
s : combined deviation standard
s_1 : deviation standard of experiment class
s_2 : deviation standard of control class

The statistical hypotheses are as follows:

H_0: $\mu_1 = \mu_2$: The learning outcomes of students taught by the mind mapping method are lower than those taught by a conventional method.

H_1: $\mu_1 \neq \mu_2$: The learning outcomes of students taught by the mind mapping method are higher than those taught by a conventional method.

The research selected $\alpha = 0.05$ where $dk = (n_1 + n_2 - 2)$ with the following criteria:
H_0 is only accepted if $t_{count} < t_{(1-\alpha)}$ and denied if otherwise.

RESULTS AND DISCUSSION

Results

The study employs a post-test-only control design on the data of students' learning outcomes as extracted from the learning outcomes test. It involves two randomly-selected classes; the experiment class was taught by the mind mapping method, while a conventional method was applied in the control class. After the treatments, the students were given the same post-test. The post-test results of the control class and experiment class are as follows:

Table 4.1 Students' Learning Outcomes Score

No.	Learning Outcomes Score	
	Experiment	Control
1	85	77
2	100	85
3	90	95
4	95	75
5	95	79
6	85	77
7	90	100
8	95	85
9	71	87
10	85	82
11	90	62
12	80	62
13	90	62
14	70	80
15	90	64
16	95	75
17	80	95
18	85	67
19	85	62
20	85	69

21	95	60
22	95	82
23	100	62
24		67
25		67
26		62
27		67
28		90
Mean	88.30	74.89

As suggested by the previous table, the average score of students' learning outcome in experiment class arrived at 88.30, higher than that of the control class at 74.89.

Analysis of Results

Instrument Validity and Reliability Test

The validity and reliability of the instrument were conducted in the Department of Physics Education in even semester of 2013/2014 academic year. The results are presented in the appendix. The validity test employs the product moment correlation coefficient test, while Cronbach's Alpha formula is applied to measure the instrument's reliability. Based on the results, eight question items are regarded as valid and are incorporated into the post-test.

Normality Test

Data normality test is conducted to identify whether or not the data are normally distributed. Data normality is an essential indicator in a parametric statistical analysis; in non-parametric analysis, it is employed if the data are not normally distributed. The normality test employs a chi-square statistical test; its numerical process is displayed in the appendix. The results indicate that the $X^2{}_{count}$ yielded for the experiment class arrived at 7.3582, while that of the control class was at 7.4959. Moreover, the X^2 distribution value shown for both classes was at 11.1, with significance degree of 0.05 and df of k-1. That said, the data are considered to be normally distributed if $X^2{}_{count} \leq X^2{}_{table.}$ As based on the results, the data of learning outcome scores of both classes are normally distributed.

Data Homogeneity Test

The data homogeneity test employs a statistical chi-square test and a Bartlett test. The numerical process of this test is provided in the appendix. The data are considered to be homogenous if $X^2{}_{count} \leq X^2{}_{table.}$ As based on the results, it is generated that $X^2{}_{count}$ = 0.2302, while the value shown by the distribution table is X^2(l-α)(k-1) = X^2(1-0.05)(5) X^2 0.95:5 = 11.1. Such data indicate that they are homogenous. A homogeneity test is aimed to determine which technique of hypothesis test to be employed. In this regard, the study employed a t-test.

Hypothesis Test

A hypothesis test intends to determine the difference between the learning outcomes between the control class and the experiment class. The present study employs a t-test with significance level at 1- $^1/_2$ (0.05). The results generate that $t_{count} > t_{tabel}$, or 79.9237 > 1.6752. This signifies that there is a difference between the learning outcomes of the experiment class and the control class. Therefore, H_o is rejected and H_1 is accepted. In other words, there is a significant difference in learning outcomes between the mind mapping method and the conventional method. The numerical process of the hypothesis testing is provided in the appendix.

Discussion

It has been stated previously that the purpose of this study is to identify the differences in students' learning outcomes between mind mapping and conventional learning methods on the topic of the History of Physics. A test is given as the controller for both classes, as both classes have the same form of test.

A validity and reliability test on the question items is conducted prior to applying it in the class. Further, the treatment of the mind mapping method is given to the experimental class (class C), while the control class (class A) applies the conventional learning model.

Following the process, a post-test is carried out. The results of the analysis show differences in students' learning outcomes using mind mapping and conventional learning methods, or X > Y. This data is presented in Figure 10.

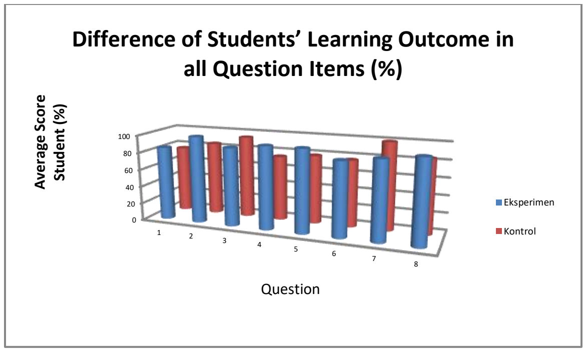

Figure 4.1 Correlation of Class and Average Score of Learning Outcomes

The average score of the experiment class is higher than the control class; therefore, the hypothesis: "There is a very significant difference between the learning outcomes of students who are taught using the mind mapping learning method conventional method on History of Physics" is accepted. That is to say, proper implementation of the mind mapping method is positively influential towards the students' learning outcomes.

After the evaluation, the collected data are used to test the hypotheses proposed. Prior to hypothesis testing, a normality test of the data is conducted.

The normality test results indicate that the experiment class generates X^2 = 7.3582, while the control class yields X^2 = 7.4959; from the chi-square, it is acquired that X^2_{list} = 11.1 for significance level of α = 0.05. For both classes, the value of X^2_{hitung} is smaller than X^2_{list}. Such data indicate that they are normally distributed.

Following the normally distributed data, a two-average similarity test is employed. The results of the calculation reveal that the value of t_{count} is 79.9237. As based on the t_{count} value, and with the t_{list} = 1.6752, it is concluded that both values are located at the rejection area of H_0. Therefore, H_o is rejected and H_1 is accepted. In other words, there is a significant difference in learning outcomes between the mind mapping method and the conventional method.

The application of mind mapping learning method is expected to improve the students' learning outcomes in the Physics History course. With this method, every student has the opportunity to discover the material being taught by themselves; this has an impact on students' memories regarding the material.

CLOSING

Conclusions

As suggested by the findings, the author draws several conclusions: 1) there is a significant difference between mind mapping and conventional learning methods in students' learning outcomes; 2) students taught with the mind mapping learning method generate higher learning outcome scores compared to those taught with the conventional method. This is indicated from the average score of the experiment class ($\bar{X}_1$ = 90,1) that is higher than control class ($\bar{X}_2$ = 76,14). Therefore, the method is deemed as effective to be applied in the learning process, particularly in the History of Physics course.

Implications

The study's findings are expected to be influential in the learning Physics History course, in which students are given the freedom to find their own meaning from what they learn. Such conduct is the process of adjusting new concepts and ideas with a frame of mind that already exists in their minds. In that regard, students are responsible for their learning outcomes. Students adapt pre-existing understanding to new learning situations. Through group work, they will make reasoning for what they have learned by looking for meaning, comparing it with what they already know and what they need in a new experience.

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