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Inquiry Learning Based Multimedia Towards the Student's Achievement and Creativity on Topic Chemical Bonding

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The research had the purpose to know: (a) the effects of inquiry learning based multimedia towards student's achievement; (b) the effects of student's creativity level towards student's achievement; and (c) the interaction between inquiry learning based multimedia and the creativity levels to influence students' achievements. The population of this research are all students from the first grade class in Dharma Bakti Senior High School at the academic year 2012/2013. The research used quasi experiments method. This research results showed that the data are normal distribution and samples are homogeneous. Experimental class, which was taught by inquiry learning based multimedia, can increased the students' achievements by an average gain of 0.69. However, in the control class, which was taugh by conventinal, it increased by 0.52. The statistic data of student's achievement showed the significance different (p = 0.017, which is below the value 0.05). The creativity levels showed that the p is below the value 0.05 (p = 0.041) and the interaction between inquiry learning based multimedia and the creativity levels showed that p is higher than the value 0.05 (p = 0.367). The hypothesis concluded that: 1. The inquiry learning based multimedia influenced the students achievements; 2. The creativity levels influenced the student's achievement; and 3. There was no interaction between inquiry learning based multimedia and the creativity levels to influence students' achievements.

Keywords : inquiry learning, multimedia, creativity levels, student's achievement, chemical bonding

Introduction

The essence of education is essentially human interaction, coaching and developing human potential, lasting a lifetime, in accordance with the capacity and level development of students, and improving the quality of human beings. The quality of human resources (HR) can be improved by education. Improvement of HR through education objectives is clear, so that each generation can follow the development of science and technology and be able to anticipate changes.

As professional educators, surely the problems faced are not an obstacle, but a challenge to be more creative and innovative. For that various attempts have been made to improve student learning outcomes in the study of Chemistry, including by maximizing the use of multiple media learning. According to Suyanti (2010), "Teacher, as professional workers, should be facilitate with a set of experience, skill, and knowledge of how to conduct learning process."

In addition to the utilization of instructional media, another thing that is not less important in the learning

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process is the selection of learning strategies. Using of media needs to consider the information amount obtained by students through sense of sight, which normally is around 75%; as well as through sense of hearing, around 13%; and through other sense, around 12% (Dale, 1996). Learning outcomes, including students' achievements, are also seen as direct benefit for accrediting students, who learn outside of the class, by providing a clear indication of what students are expected to achieve in relation with a specific awards (Joyce, Weil, & Calhoun, 2009). The essence of good thinking is the ability to solve problems. The basis of solving the problem is the ability to learn in the situation of the process of thinking, therefore, students should be taught on how to learn covering what is taught—the type and condition of learning, and gain new insight, one that is included in the model is the processing of inquiry learning model (Maher, 2004).

The results of field observations and interviews with subject teachers assumed that temporary factors caused poor performance. Class X-Science students were part of the students in the research and claimed that the Chemistry was a lesson that was new to them, because when in junior high, they did not get any subject of Chemistry. Partially students assumed that the chemical subjects were difficult and could not be imagined (abstract) as well as unappealing. This inability caused a fatal consequence that most students concluded and declared that they preferred social studies in the election of Class XI majors later, by reason of fear of not being able to master the subjects of science, especially Chemistry.

Inquiry learning is a strategy where the discovery process is a core component, that is, the discovery process is contained in meaningful activities to produce the findings obtained by students, and no longer on the results given a set of facts. For discovery to be meaningful, the process that make up the empirical cycle should take place by using processes like collecting and classifying information, stating hypotheses, making prediction, and intepreting outputs of experiments. Thus, learners infer knowledge from the information given (Swaak, Jong, & Jolingen, 2004). Nakhleh (1992, p. 191) stated, "Misconception means any concept that differs from the commonly accepted scientifict understanding of the term." The misconception can occur for long time, nevertheless if "essential concept related" be integrated into students conceptual frame through such multimedia, it mention "misconception" punished.

Intrinsic motivation can be stimulated from students themselves without any compulsion from other people. This type of motivation stimulate student's creativity effectively (Daryanto, 2013).

Based on the above, the authors proposed the research Inquiry Learning Based Multimedia Towards the Students Achievement and Creativity on Topic Bond Chemistry.

Method

Research Location and Time

This research was conducted in Dharma Bakti Senior High School in Lubukpakam, Deli Serdang City, North Sumatra Province. It started from November 2012 in the Class X on Semester 1 of the academic year 2012/2013.

Research Population and Sample

The study population was all students of Class X in Dharma Bakti Senior High School at the 2012/2013 academic year. Samples were selected randomly from the study population. In this case, the samples were taken only from the Grade 10 high school students at academic year 2012/2013.

Research Variables

There are three variables in this research, which were together used to reach the goal of the research.

Independent variable. Using Inkuiri learning model based on multimedia in experiment class and applying conventional model in control class for the same topic chemical bonding.

Dependent variable. Date of the students' achievements in colloid topic were gotten by giving pre- and post- test.

Control variable. Learning material that was used in both experiment and control classes was chemical bonding topic. The time allocation and teacher competence for experiment and control classes were same.

Research Instrument

Instrument tests were used to determine the level of the student's understanding of the material that has been taught by the researcher. Then, the data obtained from the instrument tests were analyzed to determine the improvement of student's achievement.

The instrument tests that were taken in the form of written tests and were held in the beginning and the end of study. Each test consisted of 30 questions of multiple choice about chemical bonding. Before giving the post-test, the questions were standardized based on the standardization process. The questions on the evaluation tests were tried out to senior high school students, and the items on the tests were assessed to investigate the normality, homogeneity, validity, reliability, and difficulties level of the instruments. Finally, researcher obtained the students achievement.

Instrument Tests

The instrument was tested before using to analyze the quality. The tests for instrument included validity test, reliability test, difficulty level test, different index test, and testing by using statistic.

Validation test. Validity relates to the ability to measure exactly something to be desired. "The validity of the tool is with respect to the accuracy of the assessed valuation of the concepts that really judge what should be judged" (Sudjana, 2010).

The correlation coefficient item can be declared to be an invalid matter if $r_{count} > r_{table}$. r_{count} value matches with r_{tabel}, when product moment is at significance level 5% ($p = 0.05$).

Reliability test. Reliability test relates to the problem of trust. To test the reliability of the test, we used Kuder Richardson formula 20, which is better known as KR-20. If the propotion or p value is less than 0.05, the matter states reliable.

Difficult level of item test. To determine the difficult level of each test item, the formula is applied:

$$p = \frac{\text{The average of item test}}{\text{maximum score of each item}}$$

To intercept difficult index of item, criterion is applied as follow:

p: 0.00-0.30 is difficult test

p: 0.31-0.70 is medium test

p: 0.71-1.00 is easy test

Different index of the item test. To determine different index of each test, formula is applied as below (Silitonga, 2014, p. 144):

$$DP = \frac{S_U - S_L}{SM} \text{ x } 100\% \quad (3.5)$$

Note. S_U: The total score of upper group students; S_L: The total score of lower group students; and SM: The total of score maximum (with the reference of Table 1).

Table1

Classification of Different Index (DP)

Different index	Criteria of different index
Negative-9%	Very bad (drop)
10%-19%	Bad (drop)
20%-29%	Enough
30%-49%	Good
Upper 50%	Excellent

Research Design and Research Procedure

There were two sample-classes derivated from the Class X-Science in Dharma Bakti Senior High School with the first sample Class X-Science serving as experiment class and the second sample Class X-Science serving as control class. Table 2 shows the design of this research.

Table 2

Research Design

Parameter	Learning strategy	
	Inquiry based multimedia (Experiment class)	Conventional (Control class)
High creativity	A_1B_1	A_2B_1
Low creativity	A_1B_2	A_2B_2

Note. A_1B_1 = Score gained in experimental class with students who have a high degree of creativity; A_2B_1 = Score gained in control class the students who have a high degree of creativity; A_1B_2 = Score gained in experimental class with students who have a low level of creativity; and A_2B_2 = Sore gained in control class with students who have a low level of creativity.

For the first treatment, both classes were given pretests, which intended to measure the cognitive aspects of students before and after action. After doing pretest, experiment class was taught by Inkuiri learning model based multimedia, whereas the control class was taught by conventional model with the same topic of chemical bonding. After teaching treatment, both classes were given post-tests in order to know the achievement of students who had done teaching treatment as an evaluation of the study. Then, we tested the hypothesis to get a conclusion (see Figure 1).

Technique of Data Analysis

Techniques of data analysis that were used are normality test, homogeneity test, normalized gain, and hypothesis. Data was analyzed by statistic calculation as well.

Normality test. Kolmogorov-Smirnov normality was used in this test. Data is said to be normally distributed if a significant probability value (2-sided) is higher than the significance level 0.05 (see Table 4).

Homogeneity test. Homogeneity test aims to determine whether the dissemination of data in the population is homogeneous. Homogeneity test was performed by Chi-Square. When the probability value (2-sided) is higher than the significance level 0.05, data is homogeneous significant (see Table 5).

Hypothesis test. To test the hypothesis of the research used to test the general linear model (GLM) univariate, Statistical Product and Service Solutions Version 15 (SPSS 15) for Windows was used. If the

value is a significant probability of learning outcomes by the level of creativity (below significance level 0.05), then, H_o is rejected. And if significant probability value of inquiry-based interaction learning multimedia strategy with a level of creativity in affecting learning outcomes is below the significance level 0.05, then, H_o is rejected (see Table 6).

Normalized gain. To calculate the student's achievement, formula gain normalization or gain score normalized (g-factor) was applied (see Table 3).

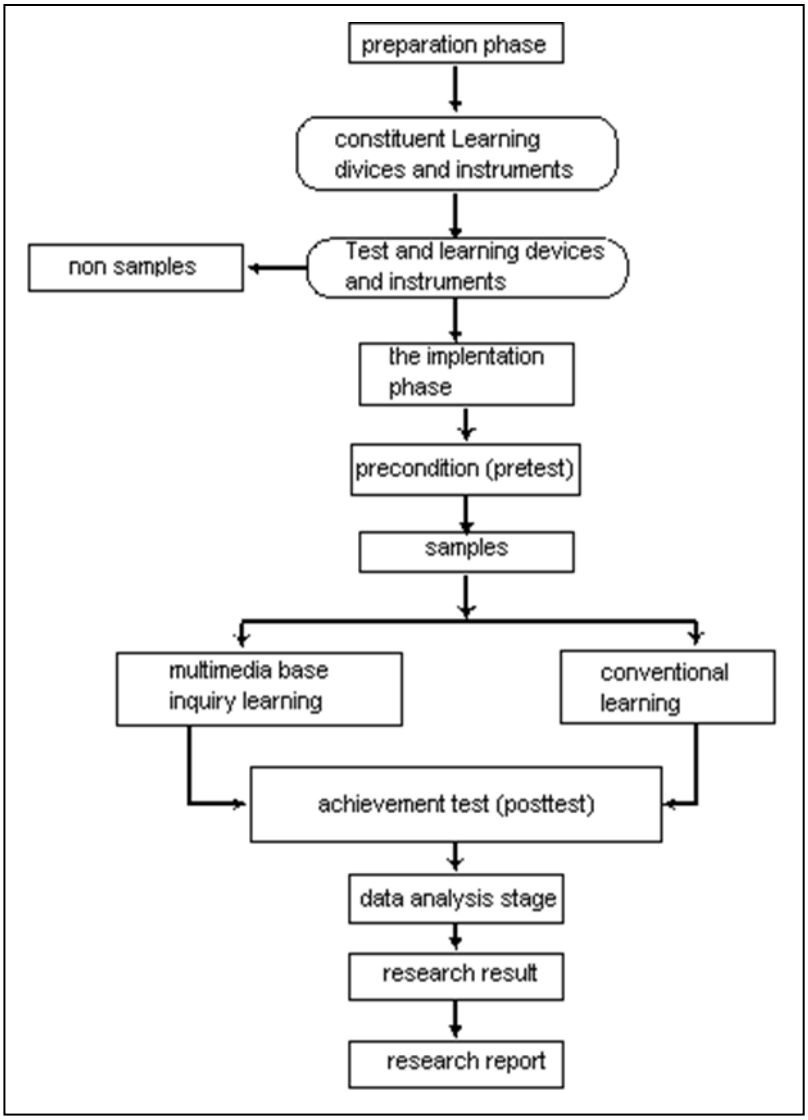

Figure 1. The overview of research design on the implementation of inquiry learning model based multimedia to increase student's achievement in chemical bonding topic.

Table 3

Normalized Gain (N-Gain)of Student's Achievement in Experiment and Control Groups (Source: Hake, 1998)

Class	*N*	Minimum	Maximum	Average	*S.D.*
Gain control group	30	0.33	0.74	0.52	0.10
Gain experimental group	30	0.50	0.96	0.69	0.13

Tabel 4

Normality of Student's Achievement in Experiment and Control Groups

One-sample Kolmogorov-Smirnov test							
		Pre-test inquiry	Post-test inquiry	*N*-gain inquiry	Pre-test conventional	Post-test conventional	*N*-gain coventional
N		30	30	30	30	30	30
Normal parameters[a]	Mean	6.8000	22.8333	0.6963	9.0667	20.0333	0.5261
	SD	2.73420	3.37418	0.13103	2.67728	2.70992	0.10472
Most extreme differences	Absolute	0.196	0.107	0.090	0.165	0.139	0.165
	Positive	0.097	0.107	0.090	0.122	0.107	0.165
	Negative	-0.196	-0.102	-0.067	-0.165	-0.139	-0.090
Kolmogorov-Smirnov ZAsymp.		1.073	0.584	0.495	0.903	0.763	0.903
Sig. (2-tailed)		0.200	0.885	0.967	0.388	0.605	0.388

Notes.[a] Test distribution is normal.

Table 5

Test of Homogeneity of Variances

Levene statistic	*df*1	*df*2	*Sig.*
1.952	1	58	0.168

Table 6

Hypothesis Test Result of Multifactor Analysis of Variance (ANOVA)

	Sum of squares	*df*	Mean square	*F*	*Sig.*
Between groups	0.435	1	0.435		
Within groups	0.816	58	0.014	30.911	0.000
Total	1.251	59			

Result and Discussion

This research divided Class X-Science students in Dharma Bakti Senior High School into two classes: experimental class that were taught by using inquiry learning model based multimedia and controlled class that was taught by using conventional learning model. The instrument used to measure student's achievement was tested by validity test, difficulty level test, different index test, and reliability test. The results of this research were taken by observing data of pre-test and post-test. The results of pre-test and post-test were analyzed by homogeneity test, normality test, hypothesis test, and g-factor from both the experiment class and control class. Data of this experiment were analyzed by using statistic calculation by SPSS 15 for Windows.

From Table 4, Kolmogorov-Smirnov value significances (p) are 0.967 and 0.388, which are more than 0.05. Terms of the data is called normal, if the proportion of significance or p is higher than the value 0.05 at Kolmogorov Smirnov. Table 4 shows that the value of p is higher than 0.05, which indicates that variable data result of learning students at the top is a normal distribution, or meet the requirements of normality test (see Table 5). The calculation of homogeneity test used SPSS software to test Levene statistics. The data show that Levene statistic is 0.168, which means that the data variation is homogeneous (Levene statistics > 0.05). According to Table 6, significant probability value of learning outcomes by the level of creativity is below 0.05, and then, H_o is rejected. And the value of the probability of a significant interaction learning inquiry-based multimedia strategy with a level of creativity in affecting learning outcomes is below 0.05, and then, H_o is rejected.

Conclusions

Student's achievement in experiment class that was taught by inquiry learning model based multimedia is significantly higher than control class that was taught by conventional method in chemical bonding topic.

Experimental class, which was taught by inquiry learning model based multimedia, can increased the students' achievements by average gain of 0.69, and in control class, which was taught by conventional, 0.52. The statistic data of students' achievements showed the significance different (p = 0.017, which is below the value 0.05). The creativity levels showed the significance level is 0.041, which is below the value 0.05, and the interaction between inquiry learning based multimedia and the creativity levels showed significance level is 0.367, which is higher than the value 0.05. The hypothesis concluded that: 1. The inquiry learning based multimedia influenced the students achievements; 2. The creativity levels influenced the student's achievement; and 3. There is no interaction between inquiry based multimedia and the creativity levels to influence students achievements.

References

Dale, E. (1996). *Audio visual method in teaching* (3rd ed.).New York, N.Y.: The Dryden Press.

Daryanto, R. M. (2012). *Models of inovatif learning.* Malang: Gava Media.

Hake, R. (1998). Interactive engagement versus traditional methods: A six thousand student survey of mechanics test data for introductory physics courses. *American Journal of Physics, 66*(1), 64-74.

Joyce, B., Weil, M., & Calhoun, E. (2009). *Models of teaching.* Englewood Cliffs, N.J.: Person Education Inc..

Maher,A. (2004). Learning outcomes in higher education: Implementation for curriculum design and student learning. *Journal of Hospital, Leisure, Sport, and Tourism Education, 3*(2), 47.

Silitonga, P. M. (2014). *Statistic: Theory and the aplication in research.* Medan: Medan State University (Unimed) Press.

Suyanti, D. R. (2010). *Chemical learning strategy.* Yogyakarta: Graha Ilmu.

Swaak, J., Jong, T. D., & Jolingen, V. R. W. (2004). The effect of discovery learning and expository instruction on the acquisition of definition and intuitive knowledge. *Journal of Computer Assisted Learning, 20*(4), 225-234.

Sudjana, T. B. (2010). *Statistic method.* Bandung City: Tarsito.