



DOI:

10.22301/IJHMCR.2528-3189.217

Article can be accessed online on:

<http://www.ijhmcr.com>

**INTERNATIONAL JOURNAL
OF HEALTH MEDICINE AND
CURRENT RESEARCH**

SCIENTIFIC ARTICLE

THE INFLUENCE OF COOPERATIVE LEARNING MODEL AND FORMATIVE TEST TOWARD THE CHEMISTRY LEARNING ACHIEVEMENT BY CONTROLLING THE INITIAL COMPETENCY

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ARTICLE INFO

Article History:

Received 19th September, 2016

Received in revised form

27th October, 2016

Accepted 13th November, 2016

Published online 30th December, 2016

Key words:

cooperative learning model, formative tests form, Chemistry achievements, initial competence.

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ABSTRACT

This study was aimed to determine the influence of cooperative learning and formative tests toward chemistry achievements with controlling the initial competence. This experimental study employed a 2 x 2 factorial design. Data for the study was collected by means of questionnaires and test instruments. Covariance Analysis (ANCOVA) was then employed in the analysis of obtained data. Subjects of the study were one-hundred-forty students who were selected by means of multistage random sampling. Findings reveal after controlling initial competence indicate: 1)The chemistry achievements students of treatmentstudyingmodels two Jigsaw is higher than the of treatment model NHT, 2)The chemistry achievements students with treatment of structured description is higher than the treatment of multiple-choices tesassociations, 3) There is an interaction effect between the use of models of learning and the use of formstest, 4)The chemistry achievements students with treatment learning model two Jigsaw with structured description of the testis higher than treatment with test learning models NHT with structureddescriptions, 5)The chemistry achievement students with treatment learning model two Jigsaw with a multiple-choices test associations lower than treatment NHT models with multiple-choices tests of association, 6)The chemistry achievements student with treatment learning model two jigsaw with structured description of the testis higher than two jigsaw treatment with multiple-choices test associations, and 7)The chemistry achievements students with treatment learning model NHT with structured description of the testis lower.

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Citation: Agus Rokot, 2016 "The Influence Of Cooperative Learning Model And Formative Test Toward The Chemistry Learning Achievement By Controlling The Initial Competency", *International Journal of Health Medicine and Current Research*, 1, (02), 217-225.

INTRODUCTION

Effort to educate the nations as stated in mandate of UUD 1945 was the responsibility of societies and government, especially education ministry. Through the arrangement and structuring of teachers who implement teaching-learning process by using appropriate method, therefore it will get high grade education, moreover it is the starting point to get additional of science and technology and encourage the realization of human resources with better quality.

Based on the data and observation result, it was found a fact that generally, students' achievement of chemistry was still low with highly varied values. This was reflected from the National Examination result of SMA Negeri in Manado, North Sulawesi for Education Year of 2012/2013 with the lowest mean 2,25 (Education Department of Manado, 2012). The low of chemistry achievement could be presumed as effect of implementation of learning model which still used learning model that did not highlight the chemistry material content that must be implemented cooperatively. The old learning model was fully implemented in the classroom without other creativities, even the assessment system was still done unilaterally by a teacher who less involved students roles in giving their critical thinking as creativity review and improvement in learning.

In line with the positive progression, in order to get maximum learning achievement, therefore it needs to improve appropriate learning model and assessment system so that it doesn't harm the students to grow, moreover to achieve maximum learning achievement. Learning model which was adapted in this study was cooperative learning model of *Jigsaw II* type and ccooperative learning model of *Numbered Head Together* type with assessment system of formative test in the form of structured essay and association multiple choices that was hoped it could stimulate the students to improve their maximum learning achievement. According to Harjanto (2008: 110), learning model is a series in order to realize a process, such as need assessment, media selection, and evaluation. Whereas according to Tuerah dkk (2010:1), learning model is as planning guidance or a model that is used in arranging curriculum, planning the learning, manage the lesson material, and giving direction to the students in the classroom at the teaching setting or other setting. Rusman (2010:134) stated that view and success in learning were not apart from consideration of learning

model selection, condition, situation of someone who was learning. Considerations for selecting the learning model were: the objectives that will be achieved, learning substance or material, the existence of learners or students, and other non technical things. Trianto (2010:25) explained that learning model is always linked to the needs in achieving the success in learning, so that there are six learning models that are often and practically used by the teachers in teaching, they are: Presentation, direct teaching, concept teaching, cooperative learning, problem based teaching, and class discussion. Whereas, Hanafi dan Suhana (2010:41) stated that learning model is an approach in order to manage the students behavior adaptively and generatively.

Whereas, some experts said that formative test was functioned to support in achieving the learning achievement. Djaali and Pujo Muljono (2008:6) said that test was a systematical procedure to observe or describe one or more of someone's characteristics by using numeric standard or category system. Yamin (2007:140) stated that formative test was intended as Assessment tool, that is getting good information, therefore formative test was an integral part of learning process. Assumption, which related to test, gave a view that test held very important role in assessing and evaluating someone's characteristic from the performance so that it was possible to draw a conclusion which could be used in determining the decision.

Besides learning model and formative test model, achievement of chemistry learning was also influenced by the students' initial knowledge about chemistry. The high and low of students' initial competency gave positive and significant influence toward the students' competency to solve the problem related to chemistry lesson.

In the education field, initial competency (basic knowledge) of a lesson, such as basic knowledge of chemistry, was aone variable which was influenced toward the learning achievement, this stated by (Sarwiji Suwandi 2011:53), that initial competency test was intended as test that was done before the students getting the teaching learning process. Thereby, the initial competency in this research was decided as control variable (co-variable). Generally, this research was aimed to know the influence of learning model and formative test form toward the achievement of chemistry learning at the students of grade X-IPA in SMA Negeri 1 and IX of Manado, Province of North Sulawesi, by controlling the initial competency.

METHODS

The research used quasy experiment method by using two lines covariant analysis design with one co-

variable, by using experiment planning of *Treatment by Subject Design* factorial 2x2 (Kerlinger, 2009:496), with the design as seen in table 1.

Table 1. Design of Experiment Factorial 2 x 2 *Treatment by Subject Design*

Test Form (B)	Learning Model (A)	
	Jigsaw (A ₁)	NHT (A ₂)
Essay Test (B ₁)	[X, Y] _{11k} k = 1,2,..., 35 A ₁ B ₁	[X, Y] _{12k} k = 1,2,...,35 A ₂ B ₁
Multiple Choices (B ₂)	[X, Y] _{21k} k = 1,2,...,35 A ₁ B ₂	[X, Y] _{22k} k = 1,2,..., 35 A ₂ B ₂

The research was conducted in grade X-IPA SMA Negeri 1 and IX in Manado, Province of North Sulawesi, during September until December in odd semester of school year 2012/2013. Sample were taken by using *multistage random sampling* of 140 students. In order to get the data, this research developed two instruments: (1) achievement test of chemistry learning and (2) test of initial competency. Each test consisted of 35 questions of multiple choices and 7 questions of structured essay, and it was standardized through try out process, validity test, and reliability test. Data analysis

included descriptive analysis, analysis to the regulation test, and inferential analysis. The three analysis were done based on the initial competency score and score of achievement of chemistry learning after getting the treatment of learning model and formative test.

RESULTS

Based on the data of students' score of basic competency of chemistry which taken before and after learning process can be resumed in the following table:

Table 2. Recapitulation of Students' Initial Competency Score and Achievement of Chemistry Learning

A B		A ₁		A ₂		Total	
		X	Y	X	Y	X	Y
B ₁	N	35	35	35	35	70	70
	Mean	25,30	52,40	20,14	34,74	22,70	43,57
	Median	24	52	21	34	22	41,50
	Modus	30	52	19	34	22	52
	St. Dev	7,26	11,12	5,21	3,08	6,78	13,44
	Minim	12	35	10	20	10	20
	Maks	42	76	32	52	42	76
	N	35	35	35	35	70	70
B ₂	Mean	22,37	48,40	18,34	49,50	20,36	48,94
	Median	21	49	18	50	20	49,50
	Modus	22	55	20	50	20	50
	St. Dev	6,44	11,22	6,22	9,48	6,60	10,31
	Minim	12	23	9	28	9	23
	Maks	42	73	33	62	42	73
	N	70	70	70	70	140	140
	Mean	23,81	50,40	19,24	42,11	21,53	46,26
Jumlah	Median	22,5	51	19	41,50	21	48
	Modus	22	52	21	51	22	50

A	A ₁		A ₂		Total	
B	X	Y	X	Y	X	Y
St. Dev	6,96	11,27	5,76	11,82	6,77	12,23
Minim	12	23	9	20	9	20
Maks	42	76	33	62	42	76

Description:

A₁ : Group of students who were taught by using Jigsaw II model

A₂ : Group of students who were taught by using NHT model

B₁ : Group of students who were given structured essay test

B₂ : Group of students who were given association multiple choices test

N : Number of sample in each group

x : Chemistry initial competency score of students grade X of school year 2012/2013

y : Achievement score of chemistry learning of students grade X of school year 2012/2013

Result of Hypothesis Test

A. Test Result by using application SPSS version 20

1. Result analysis of hypothesis test showed, influence of learning model (A1) was higher than learning achievement (Y) of learning model (A2) by

controlling the students' chemistry initial competency (X)

This analysis examined hypothesis 1, by using design XA with value **11.844**. (as shown in the following table)

Table 3. Tests of Between-Subjects Effects

Dependent Variable: Y

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7732.342 ^a	4	1933.086	19.969	.000
Intercept	13977.816	1	13977.816	144.395	.000
X	1245.828	1	1245.828	12.870	.000
A	1146.560	1	1146.560	11.844	.001
B	1425.316	1	1425.316	14.724	.000
A * B	2900.159	1	2900.159	29.959	.000
Error	13068.400	135	96.803		
Total	320362.000	140			
Corrected Total	20800.743	139			

a. R Squared = .372 (Adjusted R Squared = .353)

2. Analysis Result of Hypothesis Test showed, influence of formative test in the form of structures essay (B1) was higher (y) than formative test in the form of association multiple choices (B2) by controlling the initial competency (X)

This analysis examined hypothesis 2 by using design XB with value **14.724** (as shown in the table above)

3. Analysis Result of Hypothesis Test showed, influence of interaction of learning model (A) and formative test (B) toward the achievement of chemistry learning by controlling the initial competency.

This analysis examined hypothesis 3 by using design A*B with value **29.959** (as shown in the table above)

4. Analysis Result of Hypothesis Test showed, influence of difference of chemistry learning achievement of the students who were taught by using learning model (A1) and (A2) with formative test (B1) by controlling the initial competency

This analysis examined hypothesis 4 by using design X. A=1,A=2, A=1*B=1 with value **1.099** (as shown in the following table)

Table 4. Parameter Estimates

Dependent Variable: Y

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval
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					Lower Bound	Upper Bound
Intercept	40.702	2.960	13.751	.000	34.848	46.556
X	.479	.133	3.587	.000	.215	.743
[A=1.00]	-3.015	2.413	-1.250	.214	-7.786	1.757
[A=2.00]	0 ^a	.	.	.	.	.
[A=1.00] * [B=1.00]	2.618	2.383	1.099	.274	-2.095	7.332
[A=1.00] * [B=2.00]	0 ^a	.	.	.	.	.
[A=2.00] * [B=1.00]	-15.605	2.364	-6.601	.000	-20.280	-10.929
[A=2.00] * [B=2.00]	0 ^a	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

5. Analysis Result of Hypothesis Test showed, influence of difference of chemistry learning achievement of the students who were taught by using learning model (A1) and (A2) with formative test (B2) by controlling the initial competency

This analysis examined hypothesis 5 by using design X, A=1,A=2, A=2*B=1, with value **-6.601** (as shown in the table above)

6. Analysis Result of Hypothesis Test showed, influence of the difference of chemistry learning achievement of students who were taught by using learning model (A1) with formative test (B1) was higher than group of students who were given formative test (B2) by controlling the initial competency (Xi)

This analysis examined hypothesis 6 by using design X.B=1 B=2, A=1* B=1 with value **6.210** (as shown in the following table)

Table 5. Parameter Estimates

Dependent Variable: Y

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	40.702	2.960	13.751	.000	34.848	46.556
X	.479	.133	3.587	.000	.215	.743
[B=1.00]	-15.605	2.364	-6.601	.000	-20.280	-10.929
[B=2.00]	0 ^a	.	.	.	.	.
[A=1.00] * [B=1.00]	15.208	2.449	6.210	.000	10.365	20.051
[A=1.00] * [B=2.00]	-3.015	2.413	-1.250	.214	-7.786	1.757
[A=2.00] * [B=1.00]	0 ^a	.	.	.	.	.
[A=2.00] * [B=2.00]	0 ^a	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

7. Analysis Result of Hypothesis Test showed, influence of the difference of chemistry learning achievement of students who were taught by using learning model (A2) with formative test in the form of structured essay (B1) was higher than group of students who were taught by using model (A2) with formative test (B2)

This analysis examined hypothesis 7 by using design of X. B=1 B=2, A=1* B=2 with value **-1.250** (as seen in the table above)

DISCUSSION

1. Chemistry Learning Achievement Of The Students Who Were Given Jigsaw II Model And NHT Model

Result of hypothesis test which stated that there was difference of chemistry learning achievement at group of students who were given learning model of Jigsaw II and group of students who were given learning model of NHT, was accepted. It meant, after controlling the students' initial competency, chemistry learning achievement of the students who were given learning model of jigsaw II was higher than they who were given learning model of NHT.

According to Karbela (2012:1), in learning model of jigsaw II, every student got chance to learn in total concept (*scan read*), it's specialization became

expert. In the implementation, learning model of jigsaw was related with group or cooperative, they, each other, would show competition and positive competency, they would give positive argument aimed at solving the lesson material, which was competition among the groups that could give benefit in learning.

In NHT learning, generally, it's characteristic was cooperative with numbering at every student, but it's traditional, as stated by Trianto (2010: 82) that NHT learning model or numbering of collective thinking, was type of cooperative learning which was designed to influence students' interaction system and as alternative to the traditional class structure. While, in the Jigsaw II learning, the students were competed to find their own creativity as named of experts group, of course the students were more dominant in solving the lesson material than students of NHT model.

Thereby, based on the finding above, it could be explained that the chemistry learning achievement of the students who were given learning model of Jigsaw II was better than they who were given NHT model, after controlling toward the initial competency.

2. Chemistry Learning Achievement of the Students who were Given Structured Essay Test and Association Multiple Choices Test

Result of hypothesis test which stated that there was difference of chemistry learning achievement of the students who were given structured essay test and students who were given association multiple choices, was accepted. It meant that after controlling students' chemistry initial competency, chemistry learning achievement of the students who were given structured essay test was higher than they who were given association multiple choices.

Thereby, in chemistry lesson, it could be stated that the learning achievement of giving formative test in the form of structured essay was higher than the giving of formative test in the form of association multiple choices. Winata Putra and Sutardi (1998: 24) stated that structured essay test was also called definite essay with questions that had been directed to certain thing or there was a limitation of the scope, point of view of answering and it's indicators. Whereas, Education National Standard Board/BNSP (2006: 2) explained that structured essay test could measure all cognitive aspects such as memory, comprehension, application, analysis, and evaluation with difficulties level of the questions that could be determined from easy to difficult.

Basically, the structures essay test was designed as essay test, where the students give answer for open questions, optimally they get chance to show their

knowledge for the competency asked. Even though it is open questions, but certain competency substance limits the answer, so the students don't wholly explore their competency through their best work. However, this test was assessors' guidance which was long time used in assessing the learning achievement.

By comparing the weaknesses and strengthens and characteristics of structured essay test and association multiple choices test, the formative test in the form of structured essay test had higher superiority potential than formative test in the form of association multiple choices test. Thereby, it was significant if the giving of structured essay test resulted learning achievement or learning result that was higher than the giving of formative test in the form of association multiple choices.

3. Interaction of learning Model and Formative Test Form

Based on the result of third hypothesis test, it showed that there was influence of interaction between learning model and formative form toward chemistry learning achievement, by controlling the initial competency. The research showed that there was influence of interdependence interaction between learning model and formative test form toward chemistry learning achievement. This was shown by data where analysis result $F_{\text{counting}} (29,959) > F_{\text{table}} (3,910)$. This finding gave information that this research support the validity of the hypothesis proposed. The conclusion was reinforced by the score achievement which showed that there was influence of interaction between learning model and formative test.

This hypothesis was in line with the theory, that in the learning process, the important thing that must be highlighted by the teacher is learning material given to the students should be explained creatively by using appropriate learning model. It was also important to conduct formative test as part of learning feedback and functioned as monitor tool in teaching process.

Based on the hypothesis and discussion of the theory above, it could be stated that the chemistry learning achievement would be effectively and maximally achieved if the selection and implementation of learning model given to the students was appropriate with knowledge development and learning process habit conducted by the teacher by using appropriate learning model and assessment system by controlling the students' initial value or competency.

4. Chemistry Learning Achievement of Jigsaw II an NHT Model, Specially for Group with Structured Essay Test

Research hypothesis stated that especially for the students who were given Structured Essay Test, the chemistry learning achievement of students who were given Jigsaw II model was higher than students who were given NHT model. The statement was supported by the achievement of corrected average statistic score, especially for students who were given structured essay test, the average of chemistry learning achievement of students who were given Jigsaw II model (52,4) was higher than the average of chemistry learning achievement of students who were given NHT model (48,4).

Assessment with structured essay test encouraged the students to compete in comprehending all main problems because the relevance of one question to others could encourage the students to learn more so that trained the students to learn more careful and responsible.

From the explanation above, therefore the empirical finding and theoretical review concluded that especially for the students who were given structured essay test, it was significant with the chemistry learning achievement of the students who were given Jigsaw II model which was higher than the students who were given NHT model, after controlling the initial competency.

5. Chemistry Learning Achievement for Jigsaw II and NHT Model, Specially for the Group with association multiple choices test

Result of hypothesis test stated that, especially for the students who were given association multiple choices test, the chemistry learning achievement of the students who were given Jigsaw II model was lower than students who were given NHT model, after controlling the initial competency. Based on this finding, especially for the students who were given association multiple choices test was more appropriate with giving the NHT model than giving the Jigsaw II model. This was seen from the difference of corrected average of students' achievement.

Based on the theoretical review, association multiple choices test had limitation of questions range if it was compared with all material's scope. Therefore, for the students who were given association multiple choices test, NHT model was more appropriate than Jigsaw II model.

Based on the hypothesis and explanation of the theory above, it could be stated that, especially for the

students who were given association multiple choices test, the chemistry learning achievement of the students who were given Jigsaw II model was lower than students who were given NHT model, after controlling the initial competency.

6. For jigsaw II Learning Model, Chemistry Learning Achievement of the Students who were Given Structured Essay Test and Association Multiple Choices Test

Research hypothesis stated that, especially for the students who were given Jigsaw II model, the chemistry learning achievement of the students who were given structured essay test was higher than the students who were given association multiple choices test. That statement was empirically examined by the data and supported with corrected average statistic score, that especially for the students who were given Jigsaw II model, the chemistry learning achievement of the students who were given structured essay test was higher than the average of the students who were given association multiple choices test

The finding could be explained based on the theoretical review that structured essay test trained the students to comprehend the relevance of problems in range of questions, so in solving the problems, the students were more accurate, careful and responsible with the works given. The students who were given structured essay test would always try to make optimal interaction with any sources and people in the classroom or out of the classroom, so it could be planted inside the students, the critical, sensitive, and accurate habits in doing a work. The students who were given this structured essay test were appropriate to be given Jigsaw II model because the students had been familiar with critical habit and sensitive toward certain problem. On the contrary, association multiple choices was less training the students in building the optimal interaction with any sources and other people because this test doesn't give chance to the students to be creative or open minded to perform the best work because the answer of the question of this test had been framed in certain situation.

Referred to the hypothesis result and theoretical explanation above, it could be stated that significantly, for the students who were given Jigsaw II model, the chemistry learning achievement of the students who were given structured essay test was higher than the students who were given association multiple choices test, after controlling the initial competency.

7. For NHT Learning Model, Chemistry Learning Achievement of the Students who were Given Structured Essay Test and Association Multiple Choices Test

Result of research hypothesis which stated that especially for the students who were given NHT model, the chemistry learning achievement of the students who were given Essay Test was lower than the students who were given the association multiple choices test, by controlling the initial competency, was accepted. According to the corrected average score, especially for the students who were given NHT model, the corrected average of chemistry learning achievement of the students who were given Essay Test was lower than the students who were given the association multiple choices test, by controlling the initial competency

That finding was in line with theoretical review, that especially for the students who were given NHT model, teaching learning process tended to be intervention or teacher centered, because the teacher would call the students' number to give the answer, whereas the students' activities were mostly listening to the teacher's explanation so the students were less of critical habit. As the result, the students who were given essay test were less motivation and even tended to conservative. It was different with the students who were given association multiple choices test, they would be more directed and focus with the material that potential to be the part of assessment. The students who were given association multiple choices test didn't too much thinking because they relied on the teacher's explanation, or more comfort to be given explanation by the teacher and they only wrote the material without active interaction from the teacher or students themselves. This habit made the students became more passive, although they were grouped cooperatively with dominant role of teacher. This students' habit with association multiple choices test was more appropriate with NHT model. By doing that treatment, the students of this group would be easier in doing their works without changing the habits.

From the explanation above, based on the empirical condition from research finding and theoretical review, it could be stated that significant for the students who were given NHT model, the chemistry learning achievement of the students who were given Structured Essay Test was lower than the students who were given the association multiple choices test, by controlling the initial competency.

CONCLUSION

1. Chemistry's achievement of students who were taught by using cooperative learning of Jigsawll type was higher than chemistry's achievement of students who were taught by using cooperative learning of NHT type by controlling the initial competency.
2. Chemistry's achievement of students who were taught and given the assessment by using formative test in the form of structured essay would be higher than the students who were taught and given assessment by using formative test in the form of association multiple choices by controlling the initial competency.
3. There was influence of interaction among the students who were taught by using learning and assessment model by using formative test toward the achievement of chemistry learning by controlling the initial competency.
4. At the group of students who were given the formative test in the form of structured essay, the chemistry achievement of the students who were taught by using cooperative learning model of Jigsawll type was higher than achievement of the students who were taught by using cooperative learning of NHT type by controlling the initial competency.
5. At the group of students who were given the formative test in the form of association multiple choices, the chemistry achievement of the students who were taught by using cooperative learning model of Jigsawll type was lower than achievement of the students who were taught by using cooperative learning of NHT type by controlling the initial competency.
6. At the group of students who were taught by using cooperative learning model of Jigsawll type, the chemistry achievement of the students who were given formative test in the form of structured essay was higher than the achievement of the students who were given assessment in the form of association multiple choices by controlling the initial competency.
7. At the group of students who were taught by using cooperative learning model of NHT type, the chemistry achievement of the students who were given formative test in the form of structured essay was lower than the achievement of the students who were given assessment in the form of association multiple choices by controlling the initial competency.

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