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EFFECT OF CREATIVE LEARNING TECHNIQUES AND REASONING ABILITY TOWARD STUDENT ACHIEVEMENT IN PHYSICS

Purwanto

ABSTRACT

This research is aimed at finding out and describing the interaction between instructional technique and reasoning ability in physics studies.The population of this research was the second year students at MTsN 2 Medan, 2009/2010 academic year.The number of population was 375 students distributed in 9 classes. Two classes were taken as the sample of the research was 86 students chosen by cluster random sampling technique. The research used two test instrumentation, they are achievement in physics test and reasoning Ability test. Psycho test which was given to the students for making classification, the reasoning ability that has been owned by the students which formal and concrete reasoning ability. The test used for reasoning ability was Test of Logical Thinking (TOLT). The research method used quasi experiment with factorial design 2x2. The data were analysed by Variance Analysis (ANAVA) two ways within 0.05 level of significance by Lilliefors test to carried out the prerequisite test for the normality and Bartlet test for homogenity variant and post hoc test used Tuckey test. The finding of the research showed at: There was an interaction between instructional technique (creative-divergent or active-convergent) and reasoning ability (formal or concrete) toward achievement in physics studies with Fr = 5.71 > Ft = 4.02 on α = 0.05 with dk (1.56). Based on this research finding that the jigsaw creative-divergent instructional technique are more effective to students with formal reasoning ability, whereas the students with concrete reasoning ability are more effective to used active-convergent instructional technique. This means, that to selection instructional technique should have to considering the students reasoning ability aspect.

***Keywords**:* Creative Learning, Reasoning Ability, Physics studies.

INTRODUCTION

Development of logical thinking, critical, creative, and initiative in education is a national policy. Awareness of the importance of the development of creative thinking policies be authorized to carry out innovations in science education that includes physics lesson. Subjects Physics as the basis of science is one part science that became the backbone of a wide range of applied science and technology such as agro-industry. Given the important role of the subjects of physics, as described above, the teaching of physics that should receive serious attention.

From the preliminary study on the teaching of physics in schools MTs 2 Medan found that the value of physics at MTs Negeri 2 Medan still not as expected because they are relatively low. According to data of the average value obtained during the last four

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years not to reach a value of 4.0. These results can be considered representative to be a reference point for considering MTs 2 field as the parent of Medan's city Madrasah Working Group has established the value of the Minimum Criteria for completeness (KKM) subjects Physics is 6.5. In the preliminary study also found complaints from teachers of physics that in general the students still have difficulty in understanding the physics of matter, especially in solving problems related to the analysis of experimental results or process skills and many of the students did not understand the topic of theoretical physics even as well as a matter of mathematical formulas.

This low yield can not be separated from the implementation of the learning process is done. Despite various efforts in the improvement, development and innovation of physics learning through curriculum revision will always and will continue to be implemented to improve the quality of education in Indonesia. But complaints about the difficulty of learning physics still continue to be found. This will cause negative impacts that affect students' attitudes toward physics lesson. Of the general fact that there is, on the position of physics in everyday life and also the fact mastery of physics, especially for students of MTs Negeri 2 Medan, it appears that there is a gap between expectations and reality. Many students are already considered physics as a subject that is very difficult, difficult, complicated and boring, uninteresting and even frightening and also not very useful in everyday life. This is in line with that expressed Boediono (2004) that: Currently math and science education, including physics is in a dilemma because on one hand there is a strong demand to master both of these subjects as intermediate targets for the master of science and technology, while on the other many the results reported failure to teaching physics at a very alarming level.

According to the observations author one of the causes of failure is due to physics learning strategies and delivery methods that are less precise. This is consistent with that expressed by Suryosubroto (2002) that the weakness of the teaching is done by teachers at the school are: 1) lack of ability of teachers using a variety of learning methods, 2) the ability of teachers to teach limited only to answer the questions, 3) teachers are reluctant to change teaching methods are already considered to be correct and effective and, 4) the teacher uses only conventional learning methods without regard to aspects of student thinking.

Difficulty learning and teaching of physics can be defined as a condition that the process of understanding and solving problems of physics there are certain obstacles to achieving good results. It all can be caused by several factors, both external factors such as student teaching strategies, infrastructure and facilities, the ability of teachers and

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social environment or internal factors of students who are expected to have impacted the results of which are studied physics reasoning abilities of students. In fact, every individual has the ability to think differently, so that the learning that occurs in them is also different. Optimal quality of learning should be able to overcome this difference in achieving the goals set. Therefore how physics should be taught? Of course we need a technique, strategies or approaches that are appropriate for the learning of physics. One of the efforts made to enable student learning is the learning that uses a technique that emphasizes creative learning activity of students in giving opinions, ideas and search for answers. Students learn in a group each member of mutual cooperation and help to understand the learning materials and communicate the results of placement to the students so as to liven up the class. It also can empower students or focus on student to become a productive and enjoyable class.

Creative learning techniques and varied will make students feel interested in what is presented by the teacher. Teachers are able to provide creative learning techniques are likely to be able to manage the classroom well. As noted Hutagaol (1992) that deals with the problem of learning difficulties learning techniques. This is understandable because the ultimate goal is to facilitate the application of learning techniques students learn to achieve the learning objectives appropriate predetermined. Active learning techniques are learning techniques to develop convergent-divergent thinking skills in an integrated manner, while creative learning techniques are learning techniques to develop a convergent-divergent thinking skills gradually. Active-learning techniques are convergent technique physics experiments using student worksheets usual in learning physics teacher at MTs Negeri 2 Medan. Active learning techniques and creative-convergent-divergent is learning together based on process skills approach. The difference there is in the way of implementation of the learning process. Active-divergent techniques focus on the development of analytical thinking towards a concept, while the creative-divergent techniques focus on the development of imaginative thinking to grow the diversity of ideas.

Development of creative learning techniques in physics learning has been applied in the form of "Process Skills", in accordance with the definition of creativity by Torrence (1988). Process skills approach using active learning techniques tend to form students in systematic habits. Budikase and Kertiasa (1995) suggested that physics is a science that requires more understanding than penghapalan and key to the success of students in learning physics is the ability of students to understand the basic physics of three things, namely the concepts (understanding), laws or principles physics, and the physics theories

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that all of the success was grounded by reasoning ability and skill acquisition process. Learning the skills approach aims to overcome the existing differences in student ability. By enabling students in meaningful learning, process skills approach not only provide new knowledge to students, but also enhance the ability of thinking.

Physics learning techniques on the basis of the application process skills approach seems not just a technical issue methodological course, but related to the more fundamental problem, namely socio-cultural with a more specialized psychological factors. Therefore, it would need to be innovative in teaching physics to increase the interest and motivation of students to develop not only think logically and analytically, but also initiatives and creative. Other studies have shown that there is no readiness of teachers to develop skills in teaching physics processes. It gives the sense that the students lack invited to participate actively in the learning process is active both physically and mentally active.

Based on the overall description above, researchers consider it important to conduct research with the title: Influence Techniques Creative Learning and Reasoning Ability Against Learning Outcomes Physics at MTs Negeri 2 Medan. This study was conducted to determine:

1. The difference in the effect of divergent creative learning techniques with active-learning techniques converge towards physics student learning outcomes MTs 2 field in the form of process skills abilities.
2. The difference in the effect of reasoning ability of the student learning outcomes physics MTs 2 field in the form of process skills abilities.
3. The effect of the interaction between engineering students' learning and reasoning ability of the student learning outcomes physics MTs 2 field in the form of process skills abilities.

METHODOLOGY

This research was conducted at the school Madrasyah State Tsanawiyah 2 Medan, Jl. Pratun 3 Medan. The timing of the study from October to December 2009. The timing of treatment in this study carried out by adjusting the schedule of physics lessons at the school. Thus the process of learning to walk appropriately as usual. The treatment was carried out for 8 weeks and for each meeting lasted 2 x 40 minutes.

The target population is the study, all eighth grade students of MTs Negeri 2 Medan 2009-2010 school year in the first semester (odd), totaling 380 students consisting of 9

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classes. Sampling is the study of eighth grade students as much as 2 classes, conducted by the consideration that the age of the child at the time (11-13 years) are at the level of intellectual development with regard to the ability of reasoning, namely concrete and formal levels. The self-test instrument made in 2 (two) classes are defined, namely 1 (one) class is a class that has never received dieksperimenkan subject matter and one more class that has never received a dieksperimenkan subject matter, while the implementation of the treatment carried out in two classes chosen at random, with the drawn (cluster random sampling).

This research was conducted by using a quasi-experimental methods, the independent variables are engineering students' learning and reasoning abilities. The dependent variable is the result of learning such skills mastery learning physics. Experimental research design used is a simple 2 x 2 factorial in this design, each of the two independent variables it has two levels. The independent variable learning techniques, consisting of "creative learning techniques and active learning techniques divergent-convergent". Effect of experimental treatments subject to the dependent variable was assessed every level other variables. Matrix of the design is illustrated in Table 1.

Table 1. : 2x2 Factorial Experimental Design

Technique Learning (A) Reasoning Ability (B)	Learning Techniques creative-divergent (A 1)	Learning Techniques Active-convergent (A 2)
Reasoning ability: Formal Stage (B 1)	I	II
Reasoning ability: Phase Concrete (B 2)	III	IV

Source: Donald Ary, Lucy Cheser Jacobs, Asghar Razavieh Introduction Reserch in Education (New York: Longman, 1989): I = group stage of formal reasoning ability students who receive instruction in physics with divergent creative learning techniques, II = group stage of formal reasoning ability students who receive instruction in physics with active learning techniques-convergent, III = group stage Concrete reasoning ability students who receive instruction in physics with divergent creative learning techniques, IV = group stage Concrete reasoning ability students who receive instruction in physics with active learning techniques-convergent.

Data was collected using a test and measurement. Data obtained reasoning skills using instruments developed by Tobin capabilities and Copie (adapted into Indonesian by Moh. Nur, 1991) and re-test by researchers. Tabulation of the value of the test results were grouped by high scores and low scores. Measurement reasoning abilities of students performed before treatment research goes. This measurement is intended to select students capable of reasoning formal stage (high scores) with reasoning ability students

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concrete stage (low scores) in order to obtain a group of students in accordance with the treatment.

Data on student learning outcomes in the form of skills acquired the skills to use the test results developed Learning Physics researcher. Measurement of student learning outcomes physics research conducted after the treatment is completed. Initial tests are not performed in this study, assuming prior knowledge of students who studied in a homogeneous state, because it is in the same class and level. The results of these tests are then analyzed variance testing the effect of learning techniques for physics learning outcomes, as well as the interaction between engineering students' learning and reasoning skills to the learning outcomes of physics.

Instruments used to collect the data consists of two instruments, namely: (a) Test Results Learning Physics, and (b) Formal Reasoning Ability Test.The type of instrument used to measure learning outcomes is Test Results Learning (achievement test) which measures the ability of a particular individual. The shape of the tests used are essays by some of the statements and calculations for each test item. Therefore for each item have different weights. But even so for each correct answer was given an average score of 2 (two). Score physics student learning outcomes defined as the sum score of correct answers divided by the overall score test items multiplied by 100%. Grating test learning outcomes in the form of process skills are shown in Table 2.

Table 2. Grille physics achievement test

No	Process skills	Indicator	Taxonomy	Nbr. Problem
1	Observation	1.1. Mentioned equation	C_1	1, 2
		1.2. Observe the relevant	C_4	
2	Interpretation of data	2.1.Mention pattern of a number of data	C_1	3, 4
		2.2.Mention similarity of someinformation	C_1	
3	Application/ applying the concept of	3.1. Explaining the events with the concept of interconnected	C_3	5, 6
		3.2. Applying the concept in a new situation	C_3	
4	Communi cate	4.1. Stating table or graph verbally	C_3	7, 8
		4.2. Explaining based trend	C_2	and 9
		4.3. Translate statements based on criteria	C_4	
5	Hypothesize	Explain the relationship that may occur	C_2	10

Specification: C1= Remember, C2 = Understand, C3 = Apply, C4 = Analyze

Measurement instruments used formal reasoning ability in the study was "Test of Logical Thinking" (Tolt) developed by Kenneth Tobin and William Capie. Tolt tangible paper-and-pencil test that uses the format of choice with a selection of answers and reasons. Piaget has shown the presence of four different levels of cognitive development are arranged in a hierarchical structure. The fourth level is: sensorimotor (birth - 2 years);

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preoperational (2-7 years); concrete operations (7-11 years); and formal operational (11 years and over).

The first two levels pleased with sensory-motor capabilities, the development of symbolic functions and language. The next two levels pleased with the development of reasoning. In terms of age, the first secondary school students for the last two levels. There are similarities between the level of concrete operations and the level of formal operations, which both use the logical operation. However, both qualitatively different levels of the reasoning. There are five characteristics that distinguishes them is, proportional reasoning, control of variables, probability reasoning, correlational reasoning, and combinatorial reasoning.

In 1991 Prof. Dr Mohamad Nur adapting Tolt into Formal Reasoning Ability Test (TKPF). Tolt adaptation into Indonesian done by translating and adjusting the condition of Indonesia. The result of this adaptation is used to measure the ability of formal reasoning student in this study. Because the adaptation has been done for a long time (1991) there will be tested again to see full-laden good measuring tool.

Table 3. Lattice Instruments Formal Reasoning Ability

No	Indicator	Number of Item Problem
1	Proportional Reasoning	1 and 2
2	Control variables	3 and 4
3	Probability Reasoning	5 and 6
4	Reasoning correlations	7 and 8
5	Reasoning Combinatorial	9 and 10

The answer to the test items are justified only if the two of them, both the answer and the reason is selected correctly. Tobin and Capie give meaning scores (range of values) are achieved as Table 4.

Table 4. Range Value Level Reasoning

Score	Level Reasoning
0 – 1	Concrete
2 – 3	Transition
4 – 5	Early Formal
6 – 10	Formal

For research purposes as proposed by Nur (1991), a group of students level concrete reasoning can be taken from students who scores his TKPF between 0 (zero) up to 3, and formal reasoning level student groups taken from students who scored 4 to 10.

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Tests that have been prepared, previously tested in other subjects to see if the test is standard and meets the requirements for use as a means of collecting student data. The test is done in two different classes with the respondents are students of class IX and class VII of the two classes are included in the population but outside of each sample of 40 students. Analysis of the terms of the validity or the validity of test items using techniques with t test (Mehren in Badiran, 1998). To determine the internal coefficient consistensy Reliability essay tests used formula Alpha (Arifin, 1991) which is then converted to r table. While the analysis of item difficulty levels used to find the formula proportions and distinguishing about the difference in the proportion of the formula above and below (Arikunto: 2005), with the purpose to see the characteristics of each item, which includes the level of difficulty of questions, distinguishing features, reliability measurement and dissemination answers .

To analyze the data that has been collected in this study used the technique Analysis of Variance (ANOVA) 2x2 factorial two-lane, before first tested the requirements of data analysis and hypothesis testing. Statistical hypothesis testing in this study using the technique of analysis of variance (ANOVA) and two lines for each of the variables and their interactions, as well as significance testing between cells with Tuckey technique at a significance level of 0.05.

RESULTS AND DISCUSSION

*Data Description Reasoning Ability***.** Data on students' reasoning ability scores obtained from the Formal Reasoning Ability Test (TKPF). Tests performed on the entire student sample, namely class VIII.6 and VIII.7 MTs 2 field with the number of students 68 people. Scores obtained range between 0 to 8, the average score of 2.85 and a standard deviation of 1.63, 2.00 mode and median of 3.00.

Table 5. Deskripsi Data Reasoning Ability Students MTsN 2 field.

Parameter Startistik		A-1	A-2	∑
	n	15	15	30
B-1	$\bar{x}$	4,40	4,81	4,58
	s	0,82	0,75	0,94
	n	15	15	30
B-2	$\bar{x}$	2,21	1,83	1,78
	s	1,10	1,05	0,80
	n	30	30	60
∑	$\bar{x}$	2,83	2,67	2,85
	s	1,56	1,50	1,50

A-1 = group of students studying physics with creative learning techniques-divergent, A-2 = group of students studying physics with active learning techniques-convergent, B-1 = student group

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capable of reasoning formal operations, B-2 = group of students capable of reasoning concrete operations, n = Many of the samples in each group, x = The average score learning outcomes, s = Standard deviation

*Student Formal Reasoning***.** Based on the data obtained, the students are capable of learning outcomes of formal reasoning in class taught by creative-divergent learning techniques, the highest value of 72 and the lowest value of 38. The average value was 57.20 and standard deviation of 8.96, while the median 55, 85 and 65.5 mode. From the calculations in the table below were obtained frequency distribution as in the following:

Table 6. Score Frequency Distribution Student learning outcomes are capable of formal reasoning techniques taught by creative-divergent learning

No	Class Interval	Absolute Frequency	Relative Frequency
1	38 – 44	2	13.33%
2	45 – 51	3	20.00%
3	52 – 58	4	26.67%
4	59 – 65	4	26.67%
5	66 – 72	2	13.33%
	Total	**15**	**100%**

Furthermore, from Table 3.2 above, it appears that students are capable of learning outcomes of formal reasoning taught by creative-divergent learning techniques that are above average as many as 6 people (40%), which is at an average of 4 people (26 , 67%) and under an average of 5 people (33.33%). Histogram learning outcomes of formal reasoning ability students who are taught by creative-divergent learning techniques can be seen in the image below:

Learning Outcomes Students. Based on the data obtained, the students are capable of learning outcomes concrete reasoning taught by creative-divergent learning techniques, the highest value of 54 and the lowest value of 25. The average value was 41.10 and the standard deviation of 8.01, while the median 41.75 and 48.5 mode. It appears that students are capable of learning outcomes concrete reasoning taught by creative-divergent learning technique which is above the average of 7 people (46.67%), which is at an average of 4 persons (26.67%) and under an average of 4 people (26.66%).

Active Learning Techniques-convergent. Based on the data obtained, the students are capable of learning outcomes of formal reasoning taught by active learning techniques-convergent, the highest value of 56 and the lowest value of 37. The average value was 47.30 and the standard deviation of 4.59, while the median 44.3 and 48.16 mode. It appears that students are capable of learning outcomes of formal reasoning taught by active-learning techniques that are converging on average as many as 6 people (40%), which is at an average of 5 people (33, 33%) and which is below the average of 4

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people (26.67%). Histogram learning outcomes of formal reasoning ability students who are taught by active-learning techniques can be seen converging on the image below:

Learning Outcames Student who Capable concrete reasoning in Class taught by Active Learning Techniques-convergent. Based on the data obtained, the students are capable of learning outcomes concrete reasoning taught by active learning techniques-convergent, the highest value of 58 and the lowest value of 29. The average value was 44.30 and standard deviation of 8.13, while the median 33.25 and 45.5 mode. **I**t appears that students are capable of learning outcomes concrete reasoning taught by active-learning techniques that are converging on an average of 3 people (20%), which is at an average of 5 people (33 , 33%) and under an average of 7 people (46.67%).

Research Hypothesis Testing. To test the three hypotheses of the study using a 2x2 factorial Analysis of Variance (2 lanes). For statistical data required in the ANOVA test with two lines are presented in Table 4.12 which covers a number of subjects per group (N), the total amount of data (ΣX), the sum of squares of data (ΣX2), and the average value of the subject group. The average value of each group were analyzed statistically to determine whether the average values are significantly different or not. The values of this statistic is used as the basis for the decision to test the research hypothesis. Digunaan testing criteria is if F count is greater than the F table (F-count> F-table) at significance level 0.05, then Ho is rejected and vice versa if F count is smaller than F table (F-count <F-table) then Ho is accepted.

Table 10. Table Statistics Research

Reasoning Ability	Statistik	Technique Kreatif-Divergen	Technique Aktif-Konvergen	TOT
FORMAL	**N**	15	15	30
	$\sum X$	858	717	1575
	$\sum x^2$	50310	34637	84947
	$\bar{x}$	57.20	47.80	52.50
CONCRITE	**N**	15	15	30
	$\sum X$	638	646	1284
	$\sum x^2$	28098	28892	56990
	$\bar{x}$	42.53	43.07	42.80
TOTAL	**N**	30	30	60
	$\sum X$	1496	1363	2859
	$\sum x^2$	78408	63529	141937
	$\bar{x}$	49.87	45.43	47.65

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The following is a summary table which presents the ANOVA calculations two lines of research.

Table 11. Summary of Results of ANOVA 2 x 2

Variation	JK	dk	RJK	F_{hitung}	F_{tabel} (0.05)
Resioning Ability	1411,35	1	1411,35	21,78	4,02
Learning Techniques	294,82	1	294,82	4,54	4,02
Interaction between reasoning ability and learning techniques	370,02	1	370,02	5,71	4,02
Galat (KP x TP)	3629,47	56	64,81		

These results are in accordance with the basic theories have been put forward in chapter II, but if there is data obtained explored more deeply, then by using the provisions of reasoning ability grouping stage of Tobin and Capie (in Nur, 1991), the average student who studied are at a transitional stage the majority (95.64%) were in the range of concrete stage to the early stages of the formal, the mode and median concrete reasoning stage in the transition phase and only 5 people (5.33%) which is at the stage of formal reasoning true .

The unification of the student group berpenalaran early stage of formal into formal stage in this study, may cause weakness second hypothesis of this study. Merging 31 students early stage of formal reasoning ability in a formal student group stage, giving the sense that 86% of the student group stage of formal reasoning. This is what may cause the results of analysis of variance were performed showing the results of a group of students studying physics formal reasoning ability. To prove this conjecture should be held reflikasi studies with subjects that clearly demonstrate the ability of reasoning certain stage. The third hypothesis testing showed that the interaction between learning techniques reasoning with reasoning ability of students who give different effect on learning outcomes physics.

Students are capable of reasoning concrete stage tend to have a mindset that is limited to a concrete object. In this student, what you want to think that is limited to a concrete object. In this student, what you want is expressed on a limited or more objects in the physical nature of the object, as well as in states similarities, differences, or the relationship will be sourced on the properties of the object. For this group of students is more appropriate given the learning techniques that preceded the development exercise flexibility and freedom of thought. With these exercises students are accustomed to receiving a wide range of alternative possibilities. Only then given exercises analytical and logical thinking.

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In contrast to the formal stage berpenalaran students who have a systematic pattern of thought and reflective, the activities in the form of divergent thinking exercises do not give great meaning. Students at the stage of formal reasoning more in line with the learning that has been systematic. This thought clarify results of this study, which reported an interaction between learning and reasoning techniques for physics learning outcomes.

From the results of further tests showed that acquisition, learning outcomes physics student groups capable of reasoning formal stage of learning with creative-divergent learning techniques, together with a group of formal reasoning ability students who learn by active learning techniques-convergent. This acquisition proves that divergent thinking exercise in creative-divergent learning techniques are not particularly helpful for the formal berpenalaran, in mastering the science process skills.

Students who have been at the stage of formal reasoning used to think analytically and logically, so that when the learning process is faced worksheets that have systematic, they can follow it. Unlike the students berpenalaran concrete stage yet so logical thought patterns, learning with student worksheets passes without a deep significance. This proved to earn a further test which showed that the physics student learning outcomes berpenalaran formal learning stage with active-convergent technique is better than concrete berpenalaran students who learn by active-convergent techniques, rather than formal stage berpenalaran students learn the techniques of creative-divergent . Likewise, the results of studying physics students learn concrete stage with creative techniques-divergent better better than students who studied the same berpenalaran active-convergent technique. These results provide evidence that the creative-divergent learning techniques give students the best if used at the stage of reasoning is concrete. Thus it can be said that the practice of divergent thinking is the foundation and a means for students to master the physics lesson to the charge process skills.

CONCLUSIONS

Based on the data acquisition, test hypotheses, and discussion of the results, it can be concluded as follows:

1. Learning techniques applied in teaching and learning physics in MTs 2 field in this study, affect learning outcomes in the form of skill acquisition process. Application-divergent creative learning techniques provide higher physics learning outcomes, compared with the application of active learning techniques-convergent.

2. The results showed that, the proceeds of reasoning ability students learn physics formal stage proved to be different with the acquisition of learning outcomes physics reasoning ability students concrete stage. It can be concluded that the differences in students' reasoning abilities significant impact on the acquisition of physics learning outcomes in the form of skill acquisition process.
3. There is an interaction between engineering students' learning and reasoning abilities that give a different effect on the results of the process of learning physics in the form of skills. The difference in effect are: (a.) For students reasoning formal stage, creative-divergent learning techniques produce the same physics learning acquisition with active learning techniques-convergent.(b). For students reasoning concrete stage, creative-divergent learning techniques produce better learning gains than active learning techniques-convergent.(c). Application-divergent creative learning produces acquisition physics learning outcomes for students better than students reasoning concrete stage reasoning formal stage.(d). The application of active learning-convergent generate acquisition physics learning outcomes for students better than students reasoning formal stage reasoning concrete stage.

REFERENCES

Arikunto.S. 2005. *Dasar-dasar Evaluasi Pendidikan.* Penerbit Bumi Aksara. Jakarta.

Ary, Donald. 1989. *Introduction Research in Education*. New York: Longman.

Bloom, B.S. et all. 1956. *Taxonomy of Education Objectives: The Classification of Educational Goals*. Handbook I: Cognitive Domain. New York: Longman Inc.

Budi. S. 2008. *Fisika Untuk Sekolah Menengah Pertama dan MTs Kelas VIII.* Jakarta : PT. Gramedia Widia Sarana Indonesia.

Dick, W. & Reiser R.A. 1989. *Planning Effective Instruction*. Boston: Allyn and Bacon.

Druxes, H ., Born B. & Siemsen F. 1983. *Kompendium Didaktik Fisika***.** Bandung: Remadja Karya.

Gagne, Robert M. 1985. *The Conditions of Learning*. New York: Holt Rinehart, and Winston.

Munandar, S.C. Utami 1981. *Creativity and Education*: *A Study of The Relationships Between Measures of Creative Thinking and a Number of Educational Variabels in Indonesian Primary and Junior Secondary Schools*. Jakarta: Direktorat P3M, Dikti Depdikbud.

Nur, Muhamad. 1991. *Pengadaptasian Test of Logical Thinking (TOLT) dalam Seting Indonesia*. Laporan Penelitian, Pusat Penelitian IKIP Surabaya.

Piaget, J. & Inhelder, B. 1958. *The Growth of Logical Thinking from Childhood to Adolescience*. London: Routledge & Kegan Paul LTD.

Proceeding: The First International Seminar on Trends in Science and Science Education 2014 – ISBN 978-602-9115-37-6

Semiawan, Conny et al. 1988. *Dimensi Kreatif Dalam Filsafat Ilmu*. Jakarta: Remaja Karya CV.

Treffinger, Donald J. 1980. *Encouranging Creativa Learning For Gifted and Talented. Ventura.* California: Ventura Cauntry Superintendent of Schools Office.

Torrance, E. Paul. 1988. *The Nature of Creativity as Manifest in is Testing*. *Dalam: The Nature of Creativity: Contemporary Psycological Perspective. Ed. Robert J Stenberg*. New York: Cambridge University Press.

Trianto. 2008. *Mendesain Pembelajaran Kontekstual (Contextual Teaching and Learning) di Kelas.* Jakarta: Cerdas Pustaka Publisher.

Wardiman, D.1992. *Pengajaran IPA di Sekolah Dasar dan Menengah Menyongsong Keperluan IPTEK di Masa Depan*. FMIPA Universitas Pendidikan Indonesia. Bandung.

Washton, Nathan S. 1974. *Teaching Science in Elementary and Middle Schools*. New York: David Mc. Kay Company, Inc.