

## **The Comparison of Science Education Record in Life and Environment Subject Using The 7 Steps Learning Cycle Using Multiple Intelligences and Metacognitive Techniques with a Teacher Handbook Learning That Affecting to Learning Achievement, Critical Thinking and Environmental Preservation Behavior of Secondary School Students, Year 2 Who Have a Different Learning Results**

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**Abstract:** This research aims to study science education record in life and environment using the model of 7 steps learning cycle using multiple intelligences and metacognitive technique with a teacher handbook learning that affecting to learning achievement, critical thinking and environmental preservation behavior of secondary school student, year 2 in the amount of 82 students who come from 2 different class rooms with Cluster Random Sampling and divided them into 2 groups as the experimental students group in the amount of 41 students who would be learned with 3 parts of the 7 steps learning cycle using multiple intelligences and metacognitive as Intelligibility, Plausibility, wide-applicability which was in the total amount of 7 plans in case of another divided group was 41 students who were in the controlled student group using 7 plans of teacher handbook learning management plan, 3 h/plan/week, totals of 7 weeks. The used instrument for testing the learning results were 40 sections of learning achievement test form, 54 sections of 5 aspects of critical thinking and 40 sections of 4 aspects of environmental preservation behavior questionnaire and the used statistic in hypothesis test was F-test (Two-way MANCOVA and Two-way ANCOVA). The research result has shown as following): The experimental group has critical thinking in generally and each of 5 aspects and environmental preservation behavior in the aspects of seeing environmental and natural values and using resources economically and valuably more than students who are in the controlled group statistically at the significant rate of ( $p < 0.0001$ ), Students with a high record of science education have critical thinking generally and aspectively of 2 aspects which are interpretation and argument evaluation more than students with a low record of science education statistically at the significant rate of ( $p < 0.0001$ ), There was no interaction between the science education record and the learning model of science education achievement and environmental preservation behavior generally and aspectively but the science education record and critical thinking education model were interacted in each 2 aspects statistically at the s significant rate of 0.05 which were deduction and argument evaluation aspects.

**Key words:** 7 steps learning cycle, management plan using multiple, intelligences, metacognitive techniques, critical thinking, environmental preservation behavior, statistically

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### **INTRODUCTION**

Nowadays, global situations have been changing so quickly which causing all development aspects as well as environment and natural resources especially the global warming effect that we are facing has caused us a human living negatively. For this reason there is a try of solving the happened environmental problems with possibly scientific and technological methods. Importantly, to solve the environmental problems efficiently would take quite a time and directly to its cause which is us as a human by making them understandable, aware,

appreciated of its value and begin to solve environmental problems by themselves. Importantly, there must be a study of life and environment for everybody with every education background.

Learning cycle is a learning management model that aims to make learners to be capable of using the method of scientific knowledge searching (Inquiry Approach). Knowledge discovery is based on constructivism and knowledge development theory of Piaget which is the 7 steps learning cycle previous knowledge verification step, interest stimulation step, observation and research step, explanation step, thinking expansion step, assessment

step and the step of using knowledge in each teaching stages would be inserted a high grade thinking skill of multiple intelligences theory and metacognitive techniques, in order to help students in looking for knowledge being able to control their thinking system that related to a learning materials supporting learners to be aware of things that they know (Knowledge about Knowledge), thinking about self-thinking and others (Thinking about Thinking) by using 3 techniques of Intelligibility, Plausibility and Wide-Applicability which causes learners to be able to construct knowledge meaningfully and correctly.

With the strong point of 7 steps learning cycle management plan using multiple intelligences and metacognitive techniques helps students to practice their thinking, reasoning usage and start doing things which lead to a new learning and be able to solve problems systematically that emphasizing on personal differences and each aspects of capability encouragement in order to produce an education according to educational reformation method. An appropriately combining education development was analyzed and synthesized by researcher in order to be a permanent development and researching in the subject of life and environment for developing a learning achievement continually.

#### **The research's purposes:**

- For educating and comparing the after learning records of students learning achievement, critical thinking and environmental preservation behavior who have science education record differently and learned with a different model

### **MATERIALS AND METHODS**

#### **Research method and statistical experiment planning:**

The used population in this research was 178 students from Seeharak Wittaya Municipal School 5, year 2, 1st semester, Buddhist era 2552, Mueng District, Udonrtanee Province in the total of 4 class rooms.

The used example group in this research was the year 2 students, Seeharak Wittaya Municipal School 5, Mueng District, Udonrtanee Province in the total numbers of 82 students from 2 classrooms which were class 2/1 in the amount of 41 students and another 41 students from class 2/2 who are acquired from Cluster Random Sampling by drawing lots method.

This research is an Experiment Design using 2×2 Factorial Experiment with experimental model of Completely Randomized Design: CRD (Fixed Effect Model type) with 2 factors of science education record and education model.

The used instruments in this research were The 7 Steps Learning Cycle Management Plan using multiple intelligences and metacognitive techniques, the scientific education group, content 2 (Life and Environment) in the number of 7 models, 3 h/model for using for the experimental group and teacher handbook learning management plan in the amount of 7 models, 3 h/plan, using for the controlled group. Three sets of test model are learning achievement test model, critical thinking test model in the total number of 54 sections, 5 aspects of inference, recognition of assumptions, deduction, interpretation and evaluation of argument have each sections item-total correlation rate in range of 0.23-0.72, whole issue of reliability rate (KR20) of 0.84 and the environmental preservation behavior test model in the total number of 40 sections, 4 aspects that are the aspects of seeing environmental and natural values using resources economically and valuably, preserving natural resources and participating in social and self interests protection which have an item-total correlation rate in range of 0.39-0.80 and reliability rate (and-Coefficient) of 0.84.

#### **Experiment and informative collection**

**Preparation step:** Researcher has brought books from university students, Mahasarakham University in order to get a cooperative agreement from the Seeharak Wittaya Municipal School 5 to use those books for experimenting a learning management plan and information collection. Classrooms were drawn lots to be an experimental students group which are controlled group and experimental group diving each classroom students with their differential capability of high and low science education records ( $p < 0.05$ ).

**Teaching operation step:** To have a pretest with the experimental group of students by using a learning achievement test model and have a test record checked and scored. The learning management was brought into a teaching experimentation according to a normal teaching schedule, studying by the use of the 7 steps learning cycle management plan using multiple intelligences and metacognitive techniques during June till July, Buddhist era 2552.

**The final teaching step:** When the teaching finished determinately, researcher has done a posttest with the experimental group and control group by using the previous learning achievement, critical thinking and environmental preservation behavior test models and

lastly having them checked and scored. Finally having the acquired scores analyzed by using statistical and hypothetical methods. Information analysis has steps as following:

- The acquired scores from learning achievement, critical thinking and environmental preservation behavior test were brought to find means, percentage and standard deviation
- The acquired scores after learning the test models of learning achievement, critical thinking and environmental preservation behavior were brought to analyze primary agreement of Two-way multiple change analysis (Two-way MANCOVA) and (Two-way ANCOVA) by experimenting information of normality, homogeneity of regression stops, homogeneity of variance and homogeneity of variance-covariance matrices that appeared to be according to the said primary agreement
- The learning achievement, critical thinking and environmental preservation behavior have been brought to statistically analyze for hypothesis experimentation with F-test (Two-way MANCOVA; One-way ANCOVA)

## RESULTS AND DISCUSSION

The experimental students group has a learning achievement, critical thinking in general and each of all 5 aspects and environmental preservation behavior in the aspects of seeing natural and environmental values and using resources economically and valuably more than the controlled students group statistically at the significant rate of ( $p < 0.0001$ ) (Table 1-3).

The reason of this research result may has been caused from the experimental students group has received learning activities that support an intelligent capability development in almost all of learning steps such as intelligent skill practice, intelligent capability usage according to multiple intelligences theory as well as

Table 1: Results comparison of learning achievement, critical thinking and environmental preservation behavior after of students learning who have a different science education achievement and learning model. (Two-way MANCOVA)

Source	DV	Hypothesis df	Error df	F	p-value
Learning record	3	3.00	73.00	5.582	0.002*
Model	-	3.00	73.00	28.793	<0.000*
Learning record*	-	3.00	73.00	2.673	0.540
Model	-	-	-	-	-

\*Statistically has a significant rate of 0.05

argument practice and co-interpretation in producing group knowledge and understanding according to the theory of Social Constructivism (Ernest, 1996) which is in line with the practical rule and learning transference rule (Thomdike, 1939) which is capable of improving learning achievement, critical thinking and environmental preservation behavior more than the controlled students group who learned with the investigative form of scientific operation skill usage unlimitedly and constantly.

The controlled students group have more learning opportunities that achieving in learning as well as learning transference because there was a practice of intellectual capability development in the aspects of scientific operation skills, multiple intelligences and critical thinking which cause more achievement motivation, concentration and self-confidence in learning (Atkinson, 2006) causing

Table 2: Results comparison in each aspect of learning achievement, critical thinking and environmental preservation behavior of students after learning, who learned with a different learning model (Univariate test)

Source	SS	Df	MS	F	p-value
<b>Achievement</b>					
Contrast	8.209	1	18.209	3.328	0.027
Error	410.332	75	5.471	-	-
<b>Thinking</b>					
Contrast	128.554	1	128.554	14.375	<0.0001*
Error	8.943	75	8.943	-	-
<b>Behavior</b>					
Contrast	3.673	1	3.673	0.027	0.870
Error	10141.847	75	135.225	-	-

\*Statistically has a significant rate of 0.017

Table 3: Comparison in each aspect of environmental preservatio behavior of students who have a different science education result and learning model (Two-way ANCOVA)

Critical thinking	SS	df	MS	F	p-value
<b>Seeing natural and environmental values</b>					
Before learning	1.920	1	1.920	23.383	0.001*
Group	0.146	1	0.146	1.778	0.186
Model	0.613	1	0.613	7.463	0.008*
Group x model	2.601	1	2.601	0.317	0.575
Deviation	6.323	77	8.212	-	-
<b>Using resources economically and valuably</b>					
Before learning	1.908	1	1.908	11.293	0.001
Group	0.205	1	0.205	1.216	0.274
Model	0.888	1	0.888	5.257	0.025*
Group x model	6.495	1	6.495	0.038	0.845
Deviation	13.010	77	0.169	-	-
<b>Natural and environmentally preservation</b>					
Before learning	2.673	1	2.673	17.613	0.001*
Group	4.633	1	4.633	0.305	0.582
Model	0.423	1	0.423	2.785	0.099
Group x model	5.410	1	5.410	0.004	0.953
Deviation	11.686	77	0.152	-	-
<b>Participating in social and self interests protection</b>					
Before learning	2.608	1	2.608	31.786	0.001*
Group	0.181	1	0.181	2.205	0.142
Model	0.234	1	0.234	2.850	0.095
Group x model	6.625	1	6.625	0.081	0.777
Deviation	6.318	77	8.205	-	-

Table 4: Comparison in each aspect of critical thinking of students who have a different science education result and learning model (Two-way ANCOVA)

Critical thinking	SS	df	MS	F	p-value
<b>Inference</b>					
Before	1.693	1	1.693	1.358	0.2480
Learning	4.103	1	4.103	3.291	0.0740
Group	143.644	1	143.644	115.195	<0.0001*
Model	1.653	1	1.653	1.325	0.2530
Group x model deviation	96.016	77	1.247	-	-
<b>Primary agreement acceptance</b>					
Before	6.206	1	6.206	3.640	0.0600
Learning	1.389	1	1.389	0.814	0.3700
Group	18.815	1	18.815	11.034	0.0010*
Model	0.357	1	0.357	0.209	0.6490
Group x model deviation	131.303	77	1.705	-	-
<b>Deduction</b>					
Before	28.881	1	28.881	23.545	0.0010*
Learning	3.307	1	3.307	2.696	0.1050
Group	92.422	1	92.422	75.346	<0.0001*
Model	17.594	1	17.594	14.343	<0.0001*
Group x model deviation	94.451	77	1.227	-	-
<b>Interpretation</b>					
Before	45.613	1	45.613	43.997	0.0010*
Learning	4.384	1	4.384	4.229	0.0430*
Group	5.483	1	5.483	5.289	0.0240*
Model	1.979	1	1.979	1.909	0.1710
Group x model deviation	79.829	77	1.037	-	-
<b>Agreement evaluation</b>					
Before	8.680	1	8.680	7.358	0.0080
Learning	16.166	1	16.166	13.704	<0.0001*
Group	27.816	1	27.816	23.579	<0.0001*
Model	9.037	1	9.037	7.660	0.0070*
Group x model deviation	90.837	77	1.180	-	-

\*Statistically has a significant rate of 0.05

the said learning result more than the controlled students group. The controlled students group was received the 7 Steps Learning Cycle using multiple intelligences and metacognitive techniques which are an investigative learning and intellectual procedures (Welch, 1981). Apart from that learning operation, students also have a chance to practice on metacognition all the time by practicing on their known question usage or self-thinking for improving Intelligibility, Plausibility and Wide-Applicability (Beeth, 1998) affecting students to be able to improve environmental preservation behavior and critical thinking better than learning from teacher handbook.

Students with high record of science education have critical thinking in general and each of 2 aspects which are interpretation and argument evaluation more than students with low record of science education statistically at significant rate of 0.05 (Table 2 and 4). The reason that make research result appeared like this may has been caused from, students with a high science education record have Mental Structure (Phillips, 1976) and

Knowledge Structure (Ivie, 1998) better than students with a low science education record. Then they are able to learn a better abstract (Phillips, 1976) interested, motivated in learning (Fish, 1994), self-controlled (Heins, 1980) in order to reach target goal and achievement motivation better than students with a low science education record (Rabideau, 2005). Students with a high science education record have achievement motivation and self confidence more than students with a low science education record (Jakobson, 2006) because they always achieving their goal in learning which causing them all 3 aspects of learning result with a better concentration and motivation.

There was no interaction between the science education record and the learning model of science education achievement and environmental preservation behavior generally and aspectively but the science education result and critical thinking education model were interacted in each 2 aspects statistically at the significant rate of ( $p < 0.007$ ) which were deduction and argument evaluation aspects. It may has been caused from students with a different science education record have received science education management emphasizing on investigation model which able to improve intelligent capability indifferently. Moreover, teaching in the model of 7 steps learning cycle using thinking technique, mostly have learning activities similarly to teacher handbook learning which emphasizing on investigative teaching which also use scientific operation skills. Therefore, having more learning record does not need a variable of science education works together with a variable of learning model.

## CONCLUSION

Students who learned the 7 steps learning cycle using multiple intelligences and metacognitive techniques have learning achievement and critical thinking in general and each of all 5 aspects more than students who learned with a teacher handbook statistically have a significant rate of ( $p < 0.0001$ ). Students with a high science education record according to the 7 steps learning cycle using multiple intelligences and metacognitive techniques have critical thinking in general and each of 2 aspects more than students who have a low learning result statistically at a significant rate of ( $p < 0.0001$ ).

There was no interaction between the science education record and the learning model of science education achievement and environmental preservation behavior generally and aspectively but the science education result and critical thinking education model were interacted in each 2 aspects at the statistically significant rate of ( $p < 0.0001$ ) which were deduction and argument evaluation aspects.

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