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Introduction, Connection, Application, Reflection, Extension-Multimedia Based Integrated Instruction (ICARE-U): A Model to Improve Creative Thinking Skills

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Abstract-- *The study is aimed to improve students' creative thinking skills as the impact of the implementation of Introduction, Connection, Application, Reflection, Extension-Multimedia Based Integrated Instruction (ICARE-U). The method that has been used in this research is the 3D+1I model which has four comprehensive steps are Defining, Designing, Developing, and Implementing. The participants of this research are eleven grade students who come from Bandar Lampung (13-man namely "Mekhanai", and 17-women namely "Muli"). The data was obtained from the respondents through pre-test and post-test in order to quantify the effects on the students' creative thinking skills. The results of this study present that the ICARE-U model generally effected the students' creative thinking skills. Furthermore, the score of N-Gain indicates that students' creative thinking skills are affected by the average score of 0.7 characterized as the medium. In addition, trough the scalogram as a product of Rasch analysis, it can be concluded that "Muli" has a greater value than "Mekhanai". This is affected by the implementation of ICARE with the MBI2 (ICARE-U) model to the presentation step.*

Keywords-- *ICARE, MBI2, creative thinking,*

I. INTRODUCTION

Model ICARE (Introduction, Connection, Application, Reflection, Extension) is a learning model that was established in 1997 at San Diego State University introduced by Bob Hoffman [1] [2] [3] . Firstly, this model is a framework pedagogic with an online learning system at San Diego State University. Nevertheless, it is probable to be used at United Stated Agency International Development (USAID) of Indonesia complete the Decentralized Basic Education (DBE) which is in 2006 was announced and using ICARE learning model as a framework for the

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study about teachers and learning process in schools [1] [4] [5]. The most exciting from the ICARE learning model is its suppleness. ICARE learning model can deliver an opportunity for teachers to variation students' learning experience finished stress on every phase. For example, teachers put more stress on the Connection phase, and then the teacher has to use the methods or approaches that might improve the ability to know concepts to the students. Meanwhile, on the Application and Reflection phase, the teachers are required to use an approach that reproduces the constructivism learning, and teachers play the role of the learning facilitators for students. ICARE models also deliver a chance for the teachers to make an unusual module depends on the thought of the students' abilities [6] [7] [8].

The ICARE has been used by researchers to involved in improving creative thinking skills of students and teachers [1] [9], increasing problem-solving skills [5] , promoting student activity [10], and developing cognitive abilities in students [8]. The ICARE phases decide to the scientific approach recommended by the Indonesian 2013 national curriculum. ICARE stands for Introduction, Connection, Application, Reflection, and Extension. and it is also recognized as a student-centered learning model. The ICARE learning model can deliver chances for teachers to modification student learning experiences through different stresses at each phase. The ICARE delivers chances for teachers to make specific modules by seeing students' abilities. The ICARE is very fit to grow literacy assessment of creative thinking because it delivers exercise with a balance between theory and practice [11]. This exercise needs teachers to practice establishing science creative thinking instruments in accordance with the substantial learned. The ICARE learning is simple because the learning phases are applicable and flexible. The ICARE model was exposed to have a positive effect on facilitating teachers to implement more communicative and pleasant learning [12]. Previous researchers are used as a reference for teachers to train students to have skills in the 21st century so that they can support students' careers in the future. The future of students after graduating from school is not only determined by knowledge but also the abilities that are trained by the teacher, one of them is the ability to think creatively. The learning process needs multimedia to create creativity.

Multimedia development is able to facilitate the students to practice creative thinking skills because they are required to think creative and innovative [13] [14] [15]. At present, it has been developed developing Multimedia Based Integrated Instruction (MBI2) to answer problems represented by media consisting of curriculum, learning material, e-books, student project reports, and evaluation tests [16] [17] [18] [19]. Both models are expected to be integrated in terms of the ability students to think creatively. The creation of learning that exercises the ability to think creatively must be with an integrated learning model that is the ICARE learning model with MBI2, thus that is expected to have an impact on students' creative thinking abilities especially in physics learning in high school.

The integrated learning model of ICARE and MBI2 is expected to bring 21st-century skills to 4C abilities, namely critical thinking, creative thinking, communication, and collaboration [20] [21] [22] [23]. The rapid development of technology increases the changes in human life quickly so that we must have creative and innovative abilities to keep up with the times. Creative thinking skills training starts at school. Indonesia is a country that has prepared students who have quality so that they can be globally competent. A strength that leads to this disorder is to apply the new design of the national curriculum such as the curriculum 2013. The objective

of this curriculum certainly replies to the world tests so that the graduates have the services needed, namely competitive, innovative, critical, creative, and collaborative, and also a good character.

Human thinking skills can be categorized into two categories, explicitly Lower Order Thinking Skills (LOTS) and Higher Order Thinking Skills (HOTS) [24]. Teachers must be aware of students' HOTS in order to behaviour quality teaching in science. The evaluation of the skill to think creatively should use creative thinking questions that can support students to think intensely about the topic matter. Creative thinking is an important human ability because it inspires someone to method a problem creatively, so an improved and helpful outcome is gained for life [21] [25] [26]. Creative thinking is a process of thinking that has some characteristics. The first characteristic is fluency that is the ability to express true concepts as obviously as possible. The second is flexibility that is the ability to have different ideas. The third is the originality that is the ability to receive unique and unusual ideas. The last characteristic is an elaboration that is the ability to describe ideas so that they are more appreciated in the actual situation of discussion [27] [28] [29] [30].

According to preliminary research presented in one Senior High School in Bandung shows the result of the creative thinking tests that are assumed is in the amount of 32,5, is still very low. The result is activated by five main issues: (1) learning process is still informative; (2) learning is still dependent on the teacher; (3) learning is a remembering activity; (4) teachers infrequently practicing the understanding ability; (5) teachers infrequently practicing some experiment activities, and learning physics is still the focus on the calculation, thus, many students accept that physics is a hard and complicated subject.

In previous researches that the use of the ICARE model affected the effectiveness of training with the ICARE approach can be seen from the increased post-test results and the importance of the difference between before and after the test as measured by the N-Gain and t-test [4]. The implementation of the ICARE approach can improve secondary school students' creative thinking skills in class X for dynamic electric materials [1]. In other research on the development of MBI2 using Sadiman's research development model that is able to determine the profile of junior high school collaboration skills [16]. Research on IMB2 which aims to encourage students' oral communication skills using MBI2 about earth science [20]. These researches have an impact on the purposes of this research.

This research aimed to to improve students' creative thinking skills as the impact of the implementation of Introduction, Connection, Application, Reflection, Extension-Multimedia Based Integrated Instruction (ICARE-U). The ICARE with the MBI2 (ICARE-U) model was implemented on creative thinking in assessing instruments. Thus, creative thinking can be improving by the implementation of the ICARE-U model.

II. RESEARCH METHOD

1) Research Design

The study method has been applied by the 3D+1I model (Defining, Designing, Developing, and Implementing). This design has been widely used by several researchers in research development [31] [31] [32]. The topic of this

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study is Renewable Energy. The study design of this study is using a one-group pretest-posttest, that showed in Table 1.

Table 1: Pre-experimental research design

Pretest	Treatment	Posttest
O_1	X	O_2

Information:

O1= Pretest and posttest creative thinking skills

X = Treatment ICARE-U Model

2) Participants

The participants of this study are students eleven grade (13-man namely "*Mekhanai*", and 17-women namely "*Muli*") of senior high school in Bandar Lampung. Bandar Lampung located in Lampung Province of Sumatra Island which is about 236 km from Jakarta, the capital of Indonesia. Figure 1 shows a map distance Jakarta-Bandar Lampung.

(Source: https://www.google.com/maps/dir/bandung/Bandar+Lampung)

Figure 1: Map of the Jakarta-Bandar Lampung distance

3) Instrument

Instruments used in this study are the syllabus, lesson plans, e-book, student worksheets, and test items. The instruments had been formerly validated by two experts. The validation was done by giving scores to each component on the validation sheet with the score range of 1–4. A reliability test was also done for the essay test instrument for creative thinking skills. The test instruments of creative thinking skills that were valid and reliable used for collecting data on creative thinking skills. The data collected in this study by pretest and posttest. The scoring rubric of creative thinking skills that showed in Table 2.

Table 2: Scoring rubric of creative thinking skills

Indicator	Criteria	Score
Problem sensitivity	Mentioning/writing five or more ideas, suggestions or different alternative answers	4
	Mentioning/writing three ideas, suggestions or different alternative answers	3
	Mentioning/writing some ideas, suggestions or alternative answers that are not very different	2
	Mentioning/writing one idea, suggestion, or alternative answer	1
	Not answering or giving a wrong answer	0
Fluency	Mentioning/writing five or more ideas, suggestions or different alternative answers	4
	Mentioning/writing three ideas, suggestions or different alternative answers	3
	Mentioning/writing some ideas, suggestions or alternative answers that are not very different	2
	Mentioning/writing one idea, suggestion, or alternative answer	1
	Not answering or giving a wrong answer	0
Originality	Mentioning/writing several interesting unique ideas that are logical, relatively new and relevant to the given problem	4
	Mentioning/writing several interesting unique ideas that are logical, relatively new, but not quite relevant to the given problem	3
	Mentioning/writing quite interesting unique ideas that are quite logical, relatively new and quite relevant to the given problem	2
	Mentioning/writing an ordinary idea that is logical and relevant to the given problem	1
	Not answering or giving a wrong answer	0
Elaboration	Explaining several logical details of an existing idea, so that the formulation of the idea becomes clearer and can be applied more easily	4
	Explaining one logical detail of an existing idea, so that the formulation of the idea becomes clearer and can be applied more easily	3
	Giving several logical details of an existing idea, but not quite relevant with the concept of the main idea, so that not making the idea becomes clearer	2
	Not adding any details of an existing idea, so that the formulation of the idea cannot be applied well	1
	Not answering or giving a wrong answer	0
Flexibility	Writing several alternative answers that are very logical and relevant to the given problem from different points of view	4
	Writing a few alternative answers that are quite logical and relevant to the given problem from different points of view	3
	Writing several alternative answers that are quite logical but less relevant to the given problem from different points of view	2

Indicator	Criteria	Score
	Writing one alternative answer that is quite logical and relevant to the given problem with only one point of view	1

4) Data Analysis

The pre-test and post-test scores of creative thinking were counted by N-gain. The t-test was done to analyze the improving creative thinking skills in senior high school students as the impact of the implementation of ICARE with the MBI2 (ICARE-U) model to Renewable Energy.

III. RESULTS AND DISCUSSION

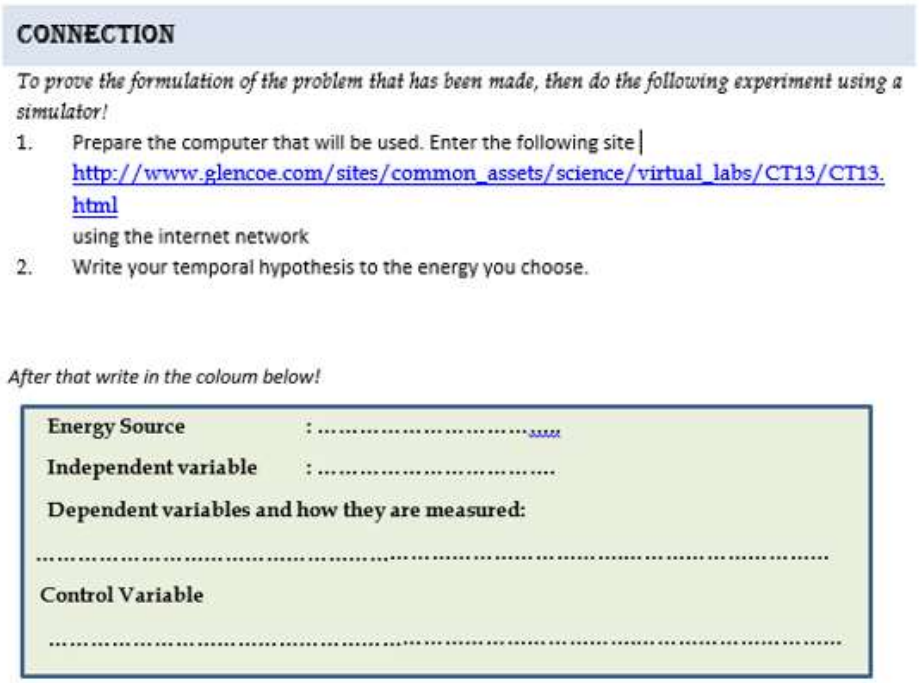
Details on the phases of development by the 3D+1I model (Defining, Designing, Developing and Implementing) and analysis will be deliberated as follows.

1) Defining

The define phase is literature on study creative thinking tests. This phase is used to discover references from the study. After composed, we create instruments based on the references obtained and predictions that might happen later.

2) Designing

This phase is an instrument design that will be used at ICARE-U in lesson plans student worksheets instrument and test item based on creative thinking rubric. Figure 2 shows the Worksheet about Renewable Energy.



CONNECTION

To prove the formulation of the problem that has been made, then do the following experiment using a simulator!

1. Prepare the computer that will be used. Enter the following site http://www.glencoe.com/sites/common_assets/science/virtual_labs/CT13/CT13.html using the internet network
2. Write your temporal hypothesis to the energy you choose.

After that write in the coloum below!

Energy Source : .....

Independent variable : .....

Dependent variables and how they are measured:

.....

Control Variable

.....

Figure 2: The design of Worksheet about Renewable Energy

3) Developing

In the Development stage, we adopted a virtual lab from www.glencoe.com that was developed previously. This virtual lab is multimedia that is integrated with ICARE-U and produces instrument, there is a virtual lab as shown in Figure 3.

Figure 3: The virtual lab renewable energy

4) Implementing

The implementation is an existing stage to apply the instrument that has been made. The N gain score of pre-test and post-test will show in Table 3.

Table 3: N-gain Score

Pretest	Posttest	N-gain	Category
43.7	82..4	0.7	medium

In table 3 shows there is an increase in scores of pretest and posttest so there is n gain score is 0.7 which is categorized as medium. Based on the analysis of data presented that the average score of normalized gain creative thinking skills on Renewable Energy material for each indicator shown in figure 4.

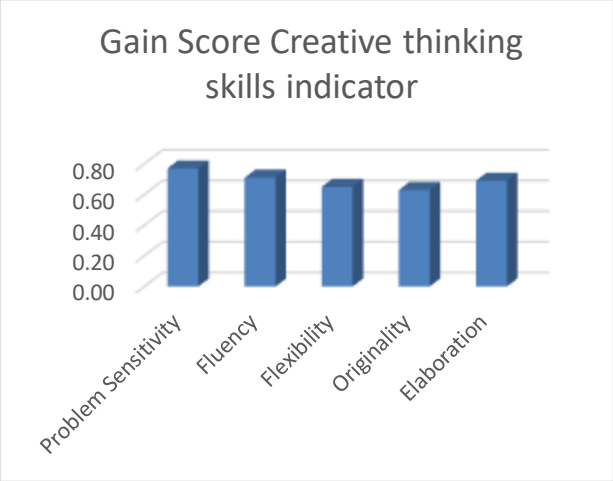


Figure 4: N-gain score for each indicator

After we calculate the N-gain score, we are doing a t-test as a hypothesis analysis. The result of the t-test will show in Figure 5.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRETEST - POSTEST	-39.067	9.645	1.761	-42.668	-35.465	-22.185	29	.000

Figure 5: Hypothesis test (t-test)

Based on the table above, the variable of creative thinking ability obtained a sig on the independent sample t-test of 0.00. In accordance with the criteria for independent sample t-test, if sig <0.05, it can be concluded that H0 is rejected, thus the scores obtained can be said that there are differences in the ability to think creatively after

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using the ICARE-U model. This study also uses the Rasch Model analysis using the scalogram menu on the MINISTEP show in Figure 6.

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GUTTMAN SCALOGRAM OF RESPONSES:
Person |Item
       |12534
       |-----
    26 +78877  26P
    10 +87876  10L
    16 +77787  16P
    24 +68886  24L
    12 +86876  12L
    17 +86678  17L
    23 +77777  23L
    25 +87668  25P
    29 +86876  29P
     1 +77875  01L
     3 +78577  03P
     4 +76777  04P
    14 +78667  14L
    22 +76876  22L
     2 +68676  02P
    11 +77766  11P
    15 +77667  15P
    19 +67776  19L

    27 +86667  27L
     5 +86666  05P
     7 +77567  07P
     8 +86756  08P
    20 +77567  20L
    28 +78665  28P
    18 +86476  18P
     6 +65765  06P
    21 +76556  21L
    30 +66656  30P
     9 +65656  09P
    13 +65656  13L
       |-----
       |12534
```

Figure 6: Scalogram

Figure 6 show the items included indicators of creative thinking with sequential codes 1,2,3,4, and 5 namely "Problem sensitivity, Fluency, Originality, Elaboration, and Flexibility". The most difficult question order indicator 5 (Flexibility) and the easiest indicator 1 (Problem sensitivity) The results obtained are for students with the 26P "*Muli*" to have higher grades. While the lowest value is in students with a 13L "*Mekhanai*".

Using the ICARE-U model affected the effectiveness of training with the ICARE approach can be seen from the increased post-test results and the importance of the difference between before and after the test as measured by the N-Gain and t-test [4]. The implementation of the ICARE approach can improve secondary school students' creative thinking skills in class X for dynamic electric materials [1]. In other research on the development of MBI2 model that is able to determine the profile of junior high school collaboration skills [16]. Research on IMB2 which aims to encourage students' oral communication skills using MBI2 about earth science [20]. But this study must be continued in the future. ICARE-U model improving creative thinking skills in senior high school student in Renewable Energy topic.

IV. CONCLUSION

The ICARE-U model mostly affected the creative thinking skills of the student. Meanwhile, the N-Gain score shows the creative thinking skills students are affected by the average score of 0.7 characterized as the medium. In calculation, manger the scalogram in the Rasch analysis, it can be determined that *Muli* has a better value than *Mekhanai*.

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