Promoting the model introducing, connecting, applying reflecting, and extending using Rasch analysis (ICARE-R) to improve students’ critical thinking skills on physics concepts

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Abstract. Critical thinking skills are important in physics learning because in physics learning comparable with examination actions on focuses reaching since detecting, formulating complications, collecting data, processing and considering data, and finishing. This study purposes on promoting of the ICARE model to improve students’ critical thinking skills on physics concepts using Rasch Analysis. The research method used a pre-experimental method with one group pretest-posttest design for 21 eleventh grade students (10 males and 11 females) and using Rasch analysis to measure the person reliability. Data were collected by pretest and posttest to measure of the ICARE model and person reliability on students’ critical thinking skills. The results showed that ICARE model persuaded critical thinking skills by the average score of 0.62, categorized as medium. It can be concluded that the ICARE model as one of the learning models that can influence and enhance students' critical thinking skills.

1. Introduction

Education is one of the alternatives to make someone be accomplished and can compete in a lifetime incoming date. We are in a current lifetime now and positively we need gifted source; counting rational perceptive size, thinking systematic, critical, detailed, and capacity to transfer concepts especially in responding to the problems. The population sizes should be recognized by the education course finished affective, cognitive, or psychomotor features [1].

Education will be progress one of them use the ICARE model (introducing, connecting, applying, reflecting, extending) education highlights the features of: active, inspired, and pleasant [2]. The Introduction action protections a description of the aims and skills that learners will complete afterward the education activities are associated; Connecting actions include students in a technique to make students to be required to complete learning aims associated to realities, ideas, values/rules, concepts, and physics measures [2,3,4]. Learning properties that are associated by students discuss the idea of energetic education besides enjoyable, viewing videos, simulations, and further media; In Applying actions, students comportment experimental actions to show the reality of the perceptions attained since the connecting stage. In Reflecting actions, students offer a description of the scope to which attainments have or have not been attained or understood by students connected to resistant of idea over experimental actions; Extending actions, students can plan experimental actions over simple by the identical values to understand the ideas that have been attained [2,4]
The ICARE model is planned for online learning. There are several complications when the ICARE model that is considered for online learning is not reinforced through the presence of passable gears and structures to admission the internet with the aim of learning by this approach is very hard to implement. Regularly, in learning using ICARE strategy Online learning is done at the connect phase, sense students are supposed orders to attach the topic constituent to the problems discussed in the example with the assistance of recovering the internet [4].

The Rasch analysis was primarily made by Georg Rasch in 1960 to test construction in thinking with two types of censures, a difficulty for a separate item and competence for each person [5,6,7]. Rasch analysis is a statistical method for defines the association of persons with test items that can be understood as a psychometric tool in social science and it has strong measurement possessions [5,6].

Critical thinking skills are vital in physics learning, because in physics learning comparable with inspection actions on subjects reaching since detecting, formulating complications, accumulating data, processing and investigating data, and finishing [1,5]. However, the submission of learning courses is not as much of reassuring in the accomplishment of thinking skills [5]. Critical thinking skills have been clear as a skill of attractive charge and switch of our specific consideration [2], otherwise it as rational and considerate skills supposed which importance on a result in what to receive as true [7].

Critical thinking is to a great extent wanted by students in the future, the essential know-how to sieve the right info as wanted [5]. Critical thinking is one of the most significant skills in real life. Critical thinking mentions to the capability to analyze data, regulate the significance of data collected, and interpret it to answer complications. In critical thinking, student answers are measured as stated by the heading of perceptive essentials explicitly determination, questions, material, position, conventions, ideas, assumptions, and insinuations [8].

Based on that background, the research purposes promoting of ICARE model to improve students’ critical thinking skills on physics concepts using Rasch Analysis. The promoting of ICARE model is very important because indicative to test the students' critical thinking skills are still infrequently to find. This instrument critical thinking skill is developed based on Ennis Indicator are Basic Clarification, Bases for a Result, Interpretation, Development Clarification, Supposition, and Integration [9].

2. Methods
In this study, the utilized method of research pre-experimental design with one group pretest-posttest design. This Research involving 21 students contains 10 males and 11 females of eleven grade of senior high school in Tasikmalaya. Following the scheme of one-group pretest-posttest design is shown in Figure 1.

| O1 | X | O2 |
|---|---|---|
| Pre-test | Treatment | Post-test |

Figure 1. One grup pretest-posttest design

The data analysis method is Rasch model for measure person reliability and the normalized N-gain to realize the upsurge in students’ critical thinking skills. Hake’s description that to regulate the normalized N-gain the resulting calculation can be used [10]:

\[
< g > = \frac{< S_{post} > - < S_{pre} >}{100 - < S_{pre} >} \quad (1)
\]

Then to regulate the level of critical thinking achievement of N-gain students are transformed as in Table 1.
### Table 1. Scoring criteria of N-gain

| Score N-Gain | Interpretation |
|--------------|----------------|
| N-Gain ≥ 0.70 | High           |
| 0.30 < N – Gain < 0.70 | Middle |
| N – Gain ≤ 0.30 | Low           |

The way that used is to analyze the critical thinking indicator based on Ennis’ critical thinking aspect [8], the program that used and thought depth. The critical thinking indicators that applied defined in Table 2.

### Table 2. The relative of critical thinking and indicator that used

| Critical Thinking Domain | Indicator |
|--------------------------|-----------|
| Basic Clarification      | Finding the standards of probable response |
| Bases for a Result       | Finding cause or grounds |
| Interpretation           | Explaining the suggestions |
| Development Clarification| Defining the scientific period and seeing the descriptions |
| Supposition and Integration| Choosing the probable standards as a key to the problems |

Model ICARE was established in 1997 introduced through Bob Hoffman. At first, ICARE model is considered for learning online system. In 2006 ICARE model started selected used as a model of learning in the teaching space. The stages of ICARE model are:

### Table 3. Stage of ICARE model

| Stage of ICARE Model | Explanation |
|----------------------|-------------|
| Introduction         | The teacher presents the students about the phenomenon that have been intended for contextual learning |
| Connection           | The teacher strained to tell the new information through something previously recognized through the students since skill in daily life |
| Application          | The students obtain new information from the connection stage, they must be assumed the chances to implement these data and skills in their daily actions at school |
| Reflection           | This stage of knowledge is a start again of the entire learning activity. The students have the chance to reflect on what they have educated in the classroom |
| Extension            | All students are able to use what they have educated. The extension stage is an action where the teacher presents actions that can do resulting in the lesson to support and extend the learning |

3. Result and Discussion

Student's CT skill sample to get its quality of instrument including person reliability, item reliability, validity, difficulty level, gender item functioning, and Cronbach alpha[5]. Subjects who used the probationary of these things are the 11th-grade students one of the Senior High School at Cibeureum Tasikmalaya city. The resulting charge is associated with a reliability person with the Rasch model in Figure 2.
According to Figure 2, it can be seen of the person reliability .66 and .71, which the reliability for person is involved in the ‘good’ category. Furthermore, the quality of interaction between the person and items showed by Cronbach Alpha value (KR-20) of .71 is involved in the ‘good’ category.

This analysis has done through a Bubble chart on WINSTEPS 4.4.3, as the tools of Rasch analysis. The analysis of these steps can be shown in Figure 3.

According to the figure 3, it can be seen that the students with the ability of 21 person, the symbol ‘L’ (means ‘Laki-laki’ or male) and the symbol ‘P’ (means ‘Perempuan’ or female) shows that the number of the students’ 14 L are the highest critical thinking abilities. While students with the lowest critical thinking are the number 15 P and for the hardest item difficult is S5.
Figure 4. Summary of reliability person with the Rasch Model

On the left side is a feast of subject abilities, while on the right is a distribution of items. From the map, it can be seen that in general the questions in the test are more difficult when compared with the ability of the subject. The most difficult item is item number S5 which is in the top position. Hypothetically with that problem, no subject will have a chance to answer the problem correctly because it has a lower ability than the difficulty level of the problem. The score of students shows the students of 14 L (Laki-laki or Male) have the highest ability and the lowest ability is 15 P (Perempuan or female). However, despite the highest ability of 14 L below S5 (Question 5). While 15 P, their abilities under all questions. The questions with the lowest are S2 and S4, hence students with the ability below are certainly not able to answer all the questions. Critical thinking skills as a whole reached the moderate category with an N-gain of 0.62 is shown in Table 4.

Table 4. The average rate of students’ critical thinking skill based overall

| Average Score | N-Gain | Category |
|---------------|--------|----------|
| Pre-test      | Post-test | 69.90 88.61 | 0.62 | Middle |

N-Gain for aspect critical thinking skills are presented in Table 5.

Table 5. The average value of critical thinking skills per the aspect of critical thinking skills

| Aspect                  | N-Gain | Category |
|-------------------------|--------|----------|
| Basic Clarification     | 0.58   | Middle   |
| Bases for a Result      | 0.53   | Middle   |
| Interpretation          | 0.50   | Middle   |
| Development Clarification | 0.52  | Middle   |
| Supposition and Integration | 0.55 | Middle   |
Based on table 4 it can be seen the cumulative N-Gain results show an improvement in students' thinking skills with an average score of 0.62, categorized as the middle. It means the ICARE model can improve students' critical thinking skills with a pleasing increase category. In accord with what is planned through some investigation which conditions that with ICARE Model can improve students' critical thinking skills.

Based on Table 5, the highest increase is basic clarification with the obtained N-gain value is 0.58. The achievement of the highest indicator increase in this study occurs because the indicators identify/formulate the criteria of answers that may be at the lowest stage in critical thinking skills that is on the aspect of providing basic explanations. Critical thinking skills used by students in learning is still simple and not too complex compared to the other four indicators of critical thinking skills.

4. Conclusion

Utilizing the ICARE model can improve the critical thinking skills Students’ on the work and energy concept in the Medium category with a value of N-gain $g=0.61$. These results show that the ICARE model using Rasch analysis (ICARE-R) can be used as a reference for additional research by researchers as well as by teachers in order to carry out the learning process and measure critical thinking on work and energy concepts.

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