The influence of connecting, organizing, reflecting, and extending (CORE) learning model toward metacognitive abilities viewed from students’ information literacy in physics learning

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Abstract. The term metacognitive behavior describes the habits of students in solving problems which refers to how well they organize their learning systems. This study tried to apply a learning model that can improve metacognitive abilities classified based on students’ information literacy. The research method used was a 2 x 2 factorial quasi-experiment with a non-equivalent control group design. The simple random sampling technique was used as the sampling technique. The experimental class consisted of 30 students taken from class XI MIA 8 while the control class consisted of 30 students taken from class XI MIA 6. The research instrument was a test in the form of essay questions to measure students’ metacognitive abilities. Information literacy questionnaires and observation sheets were employed to see the implementation of the CORE model. Based on the results of the hypothesis test, it was found that there were differences between high information literacy in the CORE learning model and high information literacy in the PBL learning model, there were differences between the low information literacy in the CORE learning model and the low information literacy in the PBL learning model, there were differences between the high information literacy in the CORE learning model and the low information literacy in the PBL learning model, and there was no interaction between the CORE learning model and information literacy on metacognitive abilities.

Keywords: Metacognitive Ability, Information Literacy, CORE Learning Model

1. Introduction
The era of globalization requires the ability to access information wisely [1]. Anyone can access information without limitation of time and space [2]. Finally, it adds to the long list of having the ability to use and utilize information because of the variety of information currently available [3]. It is not
enough to only able to utilize the information without being efficient and ethical [4]. Modern society is required to combine knowledge and abilities to know when and what type of information is needed and to have the abilities to find, evaluate, and use the information [5]. One of the keywords for success in the information era is the mastery of metacognitive abilities. The knowledge in the information era flows rapidly, especially in the context of education which makes the information obtained only from schools is becoming less relevant [6]. Therefore, it is necessary to equip metacognitive abilities that are strongly correlated with the learning success of students. This requires students to not only have cognitive abilities but also soft skills to overcome the rapid progress of science due to the large flow of information [7].

In the learning process, students need the ability to find a variety of information to acquire new knowledge based on their metacognitive abilities [8] so that they know how and what to do, know the prerequisites to ensure the completeness of tasks [9], and know when to do the tasks [10]. Critical thinking, understanding existing concepts and being able to solve problems are the results of mastering these abilities to increase students' learning motivation [11]. This view is based on the theoretical basis of metacognitive, namely by developing metacognitive awareness and training students to design the best strategy for selecting, remembering, re-recognizing, and organizing the information [12].

The results of pre-research conducted at SMA N 2 Bandar Lampung revealed that there were various kinds of problems in learning physics. There, the problem-based learning (PBL) model has been used as the conventional learning model. PBL is a learning environment that uses problems in the learning process. Before the learning begins, students are required to identify problems [13]. The responses of questionnaires distributed to physics teachers and students found that one of the problems was that students did not fully understand the learning strategies and systems due to the lack of reading culture and the willingness to look for information from various trusted sources, especially in the teaching and learning process. The teachers commonly used a model that cannot improve the students’ thinking process in understanding the theory and practice caused by the students’ low ability in processing their learning strategies.

Previous studies have categorized the level of metacognitive abilities into the upper, middle, and lower groups of problem-solving [14]. Problem-solving classification refers to Polya's problem-solving steps which include understanding the problem, devising a plan, carrying out the plan, and looking back [15]. However, there was only one student who was able to review the procedure based on the answers obtained [16]. Unlike previous research, this research aimed to see the level of metacognitive abilities using the CORE model. Besides, the researchers also classified metacognitive abilities based on information literacy skills because, in the 21st-century, students are required to have several abilities, one of which is information literacy skills. The researchers conducted this research that was different from the previous one, namely connecting metacognitive abilities to students’ information literacy skills in physics learning using the CORE model.

2. Research Method
This research employed the quasi-experimental research which is a design that has a control group but does not fully function to control external variables that affect the implementation of the experiment [17]. The research procedure is presented in figure 1.
The quasi-experimental design employed was the non-equivalent control group design. After the pretest had been carried out, the experimental class consisted of 30 students of class XI MIA 8 was given the CORE model as the treatments while the control class consisted of 30 students of class XI MIA 6 was given the conventional learning model (PBL) as the treatment. After each group had been given treatments, posttests to compare the results of the treatments were administered.

The sampling technique used in this study was purposive sampling where the researchers choose the sample based on certain objectives, for example, because of the limited time, energy, and funds so that large and distant samples could not be chosen. To simplify the research process and system, the researchers used the 2 X 2 factorial designs to classify the information literacy skills of the control class and the experimental class. The research design can be seen in table 1.

| Treatments (A) | Information Literacy |
|----------------|----------------------|
| CORE (A₁)      | High (B₁)            |
| PBL (A₂)       | Low (B₂)             |

Description:
- A₁B₁: Groups of students with high information literacy skills given the CORE learning model
- A₁B₂: Groups of students with low information literacy skills given the CORE learning model
- A₂B₁: Groups of students with high information literacy skills given the PBL learning model
- A₂B₂: Groups of students with low information literacy skills given the PBL learning model

The research instruments consisted of a non-test instrument in the form of a questionnaire and observation to measure the information literacy skills and CORE learning model and a test instrument in the form of essay questions to measure students’ metacognitive abilities. The test instrument had been tested to be feasible through the validity test, level of difficulty test, discrimination index test, and the reliability test. The following are the results of the validity test, level of difficulty test, discrimination index, and the reliability test.

| Items | Validity | Level Difficulty | Discrimination Index |
|-------|----------|------------------|----------------------|
| 1     | Invalid  | Difficult        | Poor                 |
The examples of pretest questions, students’ answers, and discussion are available in Table 3.

**Table 3 Pretest Questions and Students’ Answers.**

| Classes    | Questions                                                                 | Students’ Answers                                                                 |
|------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Experimental | 6. Look at the picture below!                                              | Students were still at the stage of declarative and procedural knowledge. The planning skills can be seen from students who wrote what is known, asked, and answered although their answers were wrong and without explanation. |
| Control    | If the wave propagation speed is 1 m/s and within 6 seconds, three densities and three stretches are formed. Determine the wavelength! | The students were only able to write declarative knowledge indicators by writing down what is known and the wrong answer. |

The examples of posttest questions, students’ answers, and discussion are available in Table 4.

**Table 4 Posttest Questions and Students’ Answers.**

| Classes    | Questions                                                                 | Students’ Answers                                                                 |
|------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Experimental | 6. Look at the picture below!                                              | The students were already on the evaluation skills indicator. They were able to describe how many waves are in the density and stretch of the picture. Also, |

Items | Validity | Level  | Difficulty | Discrimination Index |
|-------|----------|--------|------------|----------------------|
| 2     | Invalid  | Difficult | Poor      |
| 3     | Valid    | Moderate | Very Good |
| 4     | Invalid  | Difficult | Poor      |
| 5     | Invalid  | Difficult | Poor      |
| 6     | Valid    | Moderate | Fair      |
| 7     | Valid    | Easy    | Very Good |
| 8     | Invalid  | Difficult | Poor      |
| 9     | Valid    | Easy    | Very Good |
| 10    | Valid    | Easy    | Very Good |
| 11    | Valid    | Easy    | Very Good |
| 12    | Invalid  | Difficult | Poor      |
| 13    | Valid    | Moderate | Very Good |
| 14    | Valid    | Moderate | Fair      |
| 15    | Valid    | Moderate | Fair      |
| 16    | Valid    | Easy    | Very Good |
| 17    | Valid    | Easy    | Very Good |
| 18    | Valid    | Moderate | Fair      |
| 19    | Valid    | Easy    | Very Good |
| 20    | Valid    | Easy Very | Very Good |

Reliability: 0.83 High
If the wave propagation speed is 1 m/s and within 6 seconds, three densities and three stretches are formed. Determine the wavelength!

The students answered the questions correctly using the correct formula but they could not describe the strategy in detail. It confirmed that the students did not yet achieve the evaluation skills indicator.

3. Results and Discussion
The CORE learning model on metacognitive abilities indicators can be seen in table 5.

| The Syntax of CORE Learning Model | Metacognitive Ability Indicators | Students’ Activities |
|----------------------------------|---------------------------------|----------------------|
| Relating the old concepts to the new concepts (CONNECTING) | Declarative knowledge | Knowing factual knowledge required before processing. |
| Organizing ideas to understand the material (ORGANIZING) | Procedural knowledge | Knowing how to apply a learning procedure or strategy. |
| | Conditional knowledge | Determining the right time and reasons to apply the knowledge and skills. |
| | Planning skills | Making plans and setting goals. |
| Rethinking and exploring information that has been obtained in group activities (REFLECTING) | Prediction skills | Sorting the strategies used and skills in processing information. |
| | Monitoring skills | Assessing the meaningfulness of the learning strategies. |
| Develop, expand, use, and discover through individual assignments (EXTENDING) | Evaluation skills | Analyze the effectiveness of the performance or learning strategies used after the learning process. |
Information literacy data for both the experimental class and the control class are in Table 6.

### Table 6 The Frequency of Information Literacy Distribution

| Information Literacy Ability | Experimental Class | Control Class | Total |
|------------------------------|--------------------|---------------|-------|
|                              | Freqs. | Percentage | Freqs. | Percentage |          |
| High                         | 16     | 54%        | 10     | 30%        | 26      |
| Low                          | 14     | 46%        | 20     | 70%        | 34      |
| Total                        | 30     | 100%       | 30     | 100%       | 60      |

Based on table 6, the frequency of students who possessed high information literacy was higher compared to those who possessed low information literacy. Meanwhile, in the control class, the frequency of students who possessed high information literacy was less than students who possessed low information literacy.

The metacognitive abilities data of students in the experimental class and the control class in terms of learning models are presented in Table 7.

### Table 7 Data of Metacognitive Abilities Viewed from the Learning Models

| Classes                  | Data | Max Score | Min Score | Mean | Std. Dev |
|--------------------------|------|-----------|-----------|------|----------|
| Experimental (CORE Model)| 30   | 90        | 55        | 76.6 | 6.95     |
| Control (PBL Model)      | 30   | 82        | 27        | 66.47| 15.22    |

The table shows that the mean value of the experimental class was higher than the control class. When viewed from the standard deviation value, if it is close to zero, it will be more uniform with the average data obtained [22].

The normality test was performed using the IBM SPSS 20.00 with a significance level of 0.05 or 5% [23] The data presented are the results of the pretest and posttest in both classes. The results of the normality test are presented in Table 8.

### Table 8 The Results of One-Sample Kolmogorov-Smirnov

| Classes | Significant | Conclusions |
|---------|-------------|-------------|
| Experimental Pretest | 0.091 | Normal |
| Posttest | 0.92 | Normal |
| Significant Conclusions |
| Control Pretest | 0.18 | Normal |
| Posttest | 0.31 | Normal |

Table 8 shows that the normality test value obtained was >0.05. This indicated that the data were normally distributed.

The homogeneity test was performed using the IBM SPSS 20 with a significance level of 0.05 or 5%. The results of the homogeneity test on metacognitive abilities can be seen in Table 9.

### Table 9 The Results of the Homogeneity Test on Metacognitive Abilities

| Data     | F    | Significant | Criteria |
|----------|------|-------------|----------|
| Pretest  | 0.92 | 0.15        | Homogeneous |
Table 9 shows that both pretest and posttest data were > 0.05. It can be concluded that the experimental and control classes had the same variance or homogeneous.

The results of the two-way ANOVA test performed using the IBM SPSS 20 is presented in table 10.

Table 10 The Results of Two-Way ANOVA Test

| No | The hypothesis with Two-Way ANOVA | Significance | Conclusion       |
|----|----------------------------------|--------------|-----------------|
| 1  | The high information literacy in the CORE model and the high information literacy in the PBL model | 0.000         | There was a difference |
| 2  | The low information literacy in the CORE model and the low information literacy in the PBL model | 0.000         | There was a difference |
| 3  | The high information literacy in the CORE model and the low information literacy in the CORE model | 0.000         | There was a difference |
| 4  | The high information literacy in the PBL model and the low information literacy in the PBL model | 0.000         | There was a difference |
| 5  | CORE Models * Information literacy | 0.000         | No interaction   |

Based on Table 10, the results of the two-way ANOVA test showed that the high information literacy in the CORE model and the high information literacy in the PBL model obtained a significant value of 0.000 which means that \( H_{0A1} \) was rejected or \( H_{1A1} \) was accepted because the significance value was <0.005 so that there was a difference between the high information literacy in the CORE learning model and the high information literacy in the PBL learning model. The two-way ANOVA test showed that the low information literacy in the CORE model and the low information literacy in the PBL model obtained a significant value of 0.000 which means that \( H_{0A2} \) was rejected or \( H_{1A2} \) was accepted because the significance value was <0.005 so that there was a difference between the low information literacy in the CORE learning model and the low information literacy in the PBL learning model. The two-way ANOVA test showed that the high information literacy in the CORE model and the low information literacy in the PBL model obtained a significant value of 0.000 which means that \( H_{0B1} \) was rejected or \( H_{1B1} \) was accepted or there was an effect of metacognitive abilities based on students’ high information literacy. The two-way ANOVA test showed that the high information literacy in the PBL model and the low information literacy in the PBL model obtained a significant value of 0.000 which means that \( H_{0B2} \) was rejected or \( H_{1B2} \) was accepted or there was an effect of metacognitive abilities based on students’ high information literacy. The metacognitive ability test in terms of the relationship between information literacy and the CORE learning model obtained a significance of 0.000 (sig < 0.05) so that \( H_{0AAB} \) was rejected or \( H_{1AAB} \) was accepted or there was no interaction between the CORE learning model and the information literacy in determining students’ metacognitive abilities in physics learning.

The CORE model produced a higher average score because it combines four important constructivist elements, namely connecting learners’ knowledge, organizing the students’ new content (knowledge), providing opportunities for students to reflect, and providing opportunities for students to expand their
knowledge [24]. The CORE model can train students to be able to solve a problem with a common goal because, in this model, the students can work together and discuss in groups [25].

The CORE learning model is designed to build students’ abilities and knowledge in the classroom [26]. However, it was quite difficult for researchers to determine the appropriate design to achieve the objectives of the Core model. Moreover, the researchers must adapt to the subject matter and relate it to everyday life. Thus, the teachers must develop their abilities in creative thinking as well so that the scenarios can be designed to achieve the objectives of the learning model and make it easier for students to understand the learning material. The learning process using the CORE model is centered on students (student-centered) while the teachers only act as facilitators. During the learning process, the teachers should try to develop the abilities and active ness of students.

The CORE learning model encourages passive learners to be active during learning activities by analyzing and communicating problems in everyday life [27]. The students are also required to develop their ability to convey the results of the discussion and dare to convey their arguments in class. Teachers should also add individual assignments to each student to expand and deepen their knowledge. Although the two classes used different learning models, they had the same principle, namely problem-based learning.

Based on the explanation above, it can be concluded that the CORE learning model in the experimental class was better than the conventional learning model (PBL). The CORE learning model is good to be used in increasing the metacognitive abilities in learning physics.

Based on the results of research, both the CORE model and the PBL model affected the metacognitive abilities of students. This can be proven by the results obtained during the test where the high information literacy had a positive effect on the metacognitive abilities. Students with high and low information literacy using the CORE and PBL learning models possessed greater metacognitive abilities than before. It was revealed by this research that the students’ information literacy influenced their metacognitive abilities where students with high information literacy had better metacognitive abilities than students with low information literacy.

4. Conclusion

Based on the research results, it can be concluded that the CORE learning model in the experimental class was better than the conventional learning model (PBL). The CORE learning model is appropriate to be used in increasing the metacognitive abilities in learning physics. The supporting factors for the success of learning to increase the metacognitive abilities can be seen from the implementation of the CORE learning model which can be proven through the observations, in this case, the physics subject teacher who obtained an average of the overall score of 83.33%. It can be concluded that the CORE learning model that had been implemented in the experimental class was appropriate.

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