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# The influence of read, answer, discuss, explain, and create (RADEC) learning model on the concept mastery of elementary school students on the water cycle topic

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**Abstract.** This study aims to analyse the effect of Read, Answer, Discuss, Explain, and Create (RADEC) learning models on the concept mastery of elementary school students on the topic of the water cycle. The research used a quasi-experimental method and the participants in this study were 38 students of the experimental class and 39 students of the control class. Data was collected using open ended test items. The pretest scores of the experimental and control classes were 48.02 and 45.67, respectively. After the implementation of RADEC model, the posttest scores of the experimental and control classes were 85.85 and 79.05, respectively. Based on the Mann-Whitney test, the significance value was 0.00 meaning  $0.00 < 0.05$ . Thus, it can be concluded that the RADEC model has a positive impact, that is, it can improve the concept mastery of elementary school students on the topic of the water cycle.

## 1. Introduction

The Read, Answer, Discuss, Explain, and Create (RADEC) models are learning models that can encourage students to develop 21st century skills and master the concepts of learning learned. The basic principle of this RADEC model is that all students have the capacity to learn independently and learn more about knowledge and skills [1]. The steps of the RADEC model emphasize students to carry out various activities in learning such as reading, exploring, discussing, explaining, and making work. When students work on various activities in learning, it will give students a sense of ownership, justice, responsibility, and involvement in education [2]. The RADEC model has shown that it can improve mastery of student learning [3, 4].

Mastery of the concept of learning has a history in the fields of psychology and education. Theorists have advanced the concept of mastery in an effort to overcome the knowledge gap between high-achiever and low-achiever students [5-7]. The theorists have the same view that it needs to be given time, clear and precise instructions in the learning process so that students can master the content of the learning material. There is a lot of learning that needs to be mastered by students in elementary schools, one of which is water cycle topic. Water cycle topic is considered as a crucial concept for students and may increase their awareness to the environment. In water cycle concept, students learn the structure, processes, as well as biosphere, atmosphere, hydrosphere and geosphere behaviours. Mastering the concept of water cycle is closely related to understanding the water cycle and the human activities affecting it [8]. Additionally, the water cycle concept involves the analysis on human activities role that may interfere to the water cycle system. Such analysis will increase awareness on how to preserve the



environmental subsystem [9]. Research on this water cycle is not only limited to defining evaporation, condensation, and precipitation but rather understanding the function of water for life, how water can change conditions, and how human can behave towards water preservation [10].

In the elementary school curriculum, students must understand the interactions of the main systems (solid and liquid rocks, soil, and sediment), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in a variety of ways that affect both materials and processes occurring on the Earth. From this explanation, an understanding of environmental literacy is very important for each individual. Research on environmental literacy is important to do. Therefore, the purpose of this study is in addition to providing insights related to the mastery of elementary school students' concepts in the water cycle material, it also provides an overview of how to improve students' mastery of learning in the 21st century on the topic of the water cycle through the RADEC model.

## 2. Methods

The purpose of this study was to determine the mastery of the concepts of elementary school students on the topic of the water cycle through the RADEC model. The method used in this study is a quasi-experimental method. The research design used in this study was the matching pretest posttest control group design. The quasi-experimental method is the method used to investigate the causal relationship of giving treatment to the experimental group and the control group [11, 12]. Participants in this study were 38 students in the experimental class and 39 students in the control class. Students who become participants in this study are students who have various cognitive level. There are students who are cognitively at a high level, there are students who are at an intermediate level and there are students who are cognitively at a low level. The student characteristic data refers to the results of student test scores on the subject matter of science. There are 15% of students included in the high academic level, 10% of students are in the low level, and there are 75% of students in the middle level.

The research instrument were an open ended tests item and an assessment rubric. This essay test has gone through a validation process by experts. This test question consists of 8 questions that are divided into four categories, namely the categories of knowledge, understanding, application and analysis. This test question was developed to direct students to master learning on the topic of the water cycle. The indicators of students' mastery of concepts are: (1) ability to explain the definition of the water cycle; (2) the ability to explain events that occur in the water cycle process; (3) the ability to launch efforts to maintain the water cycle process so as not to be disturbed; (4) the ability to analyze the impact of human activities on the water cycle.

Based on this research procedure, the researcher first conducts a pretest to find out the students' initial mastery of concepts on the topic of the water cycle. Next, the researchers treated the experimental group and the control group. In the experimental group treatment was given using the RADEC learning model while the control group using the traditional model. After the treatment, the researchers conducted a posttest to determine the effect of the treatment carried out. After the data is obtained, the data are analyzed using the normality test, homogeneity test and t test to see the effect of the RADEC model on students' concept mastery on the topic of the water cycle.

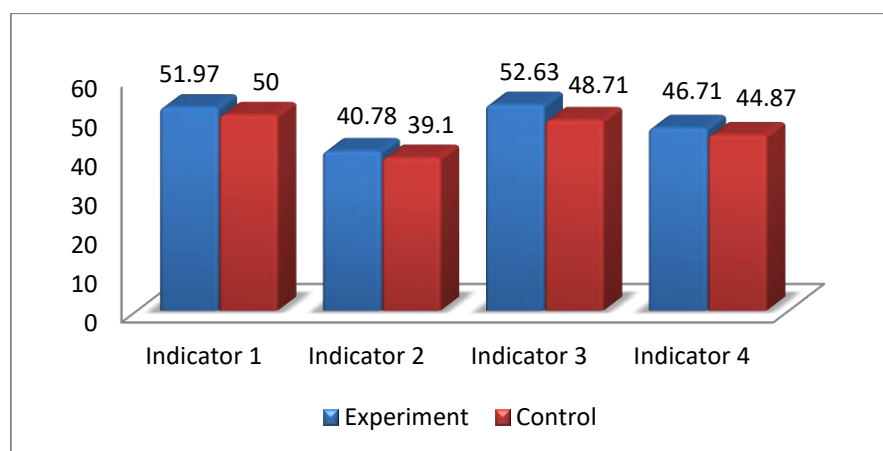
## 3. Result and Discussion

The results show that there are differences in the ability to master students' concepts on the topic of water cycles between the experimental class and the control class. This difference can be seen in the following explanation. Based on table 1, it was found that the pretest score of students' mastery of the concept of mastery in the experimental class was 48.02 while the pretest score in the control class was 45.67. Based on the results of the normality test, the pretest data in the experimental and control classes were both normally distributed so that further analysis was carried out on homogeneity tests. The homogeneity test results show that the significance value is  $0.575 > 0.05$ , meaning that both data are homogeneous. The next analysis is to do the t test. Based on the results of the t test, it was found that the significance value of  $0.19 > 0.05$  means that the initial ability to master students' concepts about the

topic of the water cycle did not have a significant between experiment and control group. To find out the difference in mastery skills of students' concepts seen from each indicator can be seen in Figure 1.

**Table 1.** Differents test of pretest results in experiment and control class

Group	N	Mean	Std. Deviation	Normality Test	Homogeneity Test	T-test
Experiment	38	48.02	7.56521	0.06	0.575	0.19
Control	39	45.67	8.25601	0.07		



**Figure 1.** Early ability to mastery student concepts based on indicators

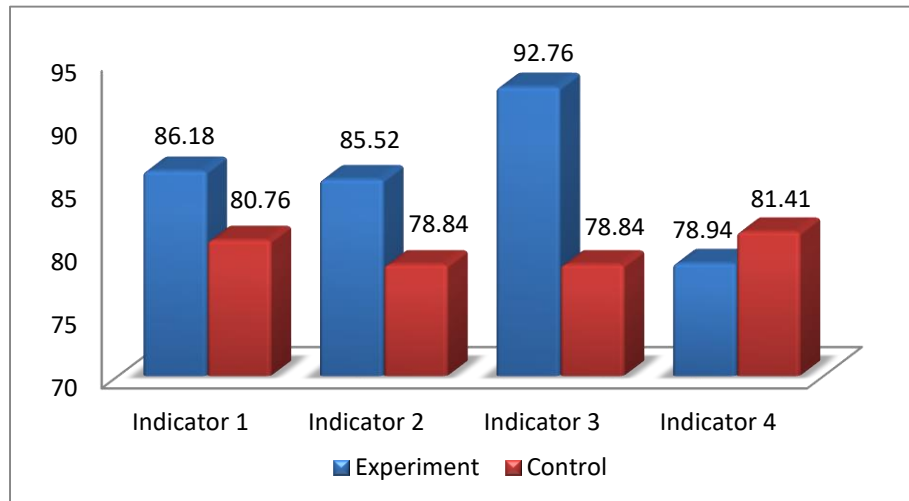
Based on Figure 1, it shows that the initial ability to master the concept of students as a whole is not much different. The thing that is slightly different from the students' initial ability is that in the experimental class the most prominent indicator is indicator 3, namely the ability of students to make efforts so that the water cycle process is not disturbed while the most prominent indicator in the control class is indicator 1, namely students' ability to explain the water cycle definition. To see the ability to master the concept of students after being given treatment, it can be seen in Table 2.

**Table 2.** Different tests of posttest results in experiment and control classes

Group	N	Mean	Std. Deviation	Normality Test	Homogeneity Test	Mann-whitney
Experiment	38	85.85	8.30736	0.011	-	0.00
Control	39	79.05	7.12124	0.138		

Based on table 2, it was found that the posttest score of students' concept mastery in the experimental class after being given treatment used the RADEC learning model of 85.85 while the posttest score in the control class was 79.05. Judging from the results of the normality test, the two data are not all normally distributed so that further analysis is conducted using non-parametric tests using the Mann-Whitney test. Based on the results of the Mann-Whitney test, the results of the significance values were  $0.00 < 0.05$ , meaning that there was a significant difference in the ability to master the concepts of students in the experimental and control classes after being given treatment. Judging from the score, the score results of students in the experimental class were higher than the results of the scores in the control class. Thus it can be concluded that the RADEC learning model is effective in improving the ability to

master students' concepts on the topic of the water cycle. To find out the improvement of each indicator, the researcher described an increase in each indicator of students' mastery of the concept of ability in Figure 2.



**Figure 2.** Indicator of mastery ability in experimental and control classes

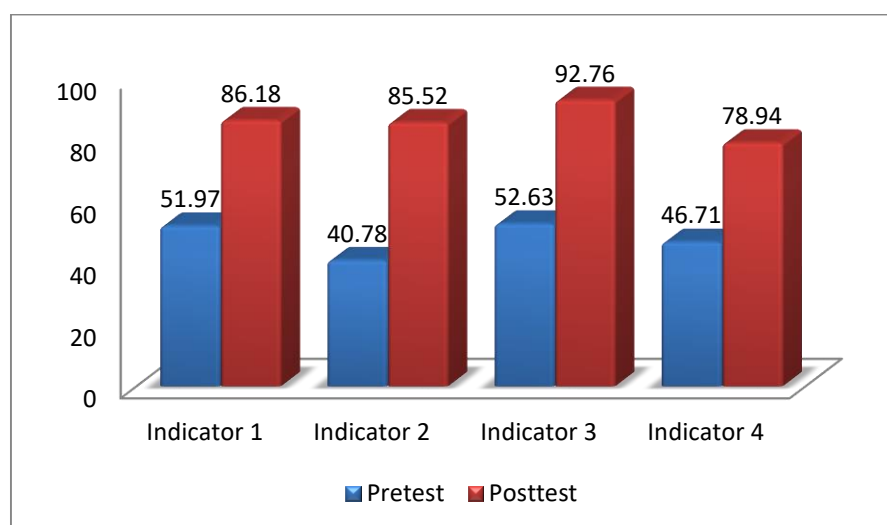
Based on Figure 2, it shows that overall indicators of mastery ability of students in the experimental and control classes have increased. In the experimental class, the most prominent indicator of mastery ability of students is indicator 3, namely the ability to launch efforts to keep the water cycle process from being disturbed. In the control class, the indicator that experienced the most improvement was indicator 4, namely the ability of students to analyze human activities that had an impact on the water cycle process. Based on the results of the scores in the experimental and control classes, it can be concluded that the RADEC learning model is effective in improving students' mastery of the concept of water cycle topics.

To see how the effectiveness of the RADEC learning model in improving the concept mastery of elementary school students, the researchers present the results of the students' pretest and posttest (Table 3).

**Table 3.** Pretest Posttest Experiment

Group	N	Mean	Std. Deviation	Normality test	Homogeneity test	Paired Sample test
Pretest	38	48.02	7.56521	0.06	0.811	0.00
Posttest	38	85.85	8.30736	0.11		

Table 3 shows that the ability to master concepts has increased significantly. This can be seen from the average pretest score obtained at 48.02 and posttest results at 85.85. The average difference is 37.83. The t-test results using paired sample test also showed that the significance value was 0.00 meaning that there was a significant increase in the average pretest and posttest of students' concept mastery ability. To see the difference in the mastery of the concept of elementary school students based on each indicator, the researchers explain in the Figure 3.



**Figure 3.** Pretest Posttest Experiment

Figure 3 shows that overall the ability to master the concepts of students has increased overall on each indicator. The RADEC learning model can improve students' mastery of concept skills because it has a positive impact on students through learning steps that encourage students to gain high understanding [1]. The RADEC learning steps require students to think scientifically. The impact of scientific thinking activities will strengthen students' understanding of the concepts learned so students can master learning [13, 14]. In its implementation, the RADEC model encourages students to learn independently through pre-learning assignments given by the teacher to students. In pre-learning assignments, students are assigned to read essential materials needed and answer pre-learning questions. Pre-learning assignments that require students to read essential material have a positive impact on improving students' mastery of conceptual skills. This is evident from the reading questionnaire given that the average student who experiences an increase is students who read full from the first meeting to the end. The pre-learning assignments given by the teacher at home will be discussed by students with other friends. Learning that encourages students to learn independently in developing their abilities and facilitates students to interact with their social environment will improve students' cognitive abilities [15]. In the learning process using the RADEC model, students are given the opportunity to decide what problems they want to know or examine. These activities can increase students' motivation and responsibility in doing their learning tasks [16]. From this explanation, RADEC learning is proven to be able to improve students' mastery of conceptual skills. This is reinforced by previous research that through the RADEC model the mastery of students' concepts has evolved [3, 4].

#### 4. Conclusion

Students' concept mastery on the topic of the water cycle increased significantly after implementation of RADEC model. The model is proven effective in improving students' mastery of conceptual skills. The application of the model enhanced the learning process and has helped students to be active and more independent. Additionally, it develops 21st century skills of students, especially the ability to explain, and build a culture of reading students.

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