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RC4 (READING, CONSTRUCTING, COLLECTING, CHANGING, CONCLUDING) LEARNING MODEL TO ENHANCE STUDENTS' SCIENTIFIC LITERACY SKILLS: IS IT EFFECTIVE?

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Abstract: *This study aims to identify the level of effectiveness of the application of the RC4 learning model on students' scientific literacy skills in science learning at junior high school. The participants involved in the present research consisted of 30 students from 7B class at SMP Negeri 1 Jember, East Java, Indonesia. The current research employed One Group with Pre-Test and Post-Test Research Design. Two trial sessions on Environmental Pollution and the Solar System material were administered. Data obtained from students' scientific literacy tests were analyzed using the Normalize Gain (N-Gain) formulation. The average N-Gain value in the small group trial showed a result of 0.53 and in the large group trial, it showed a result of 0.54. It can be concluded that the level of effectiveness of applying the RC4 learning model to students' scientific literacy skills was in the moderate category.*

Keywords: *Scientific literacy, learning model, natural science, junior high school.*

Abstrak: *Penelitian ini bertujuan mengidentifikasi tingkat keefektifan penerapan RC4 terhadap kemampuan literasi sains siswa pada pembelajaran IPA di SMP. Subjek pada penelitian ini terdiri dari 30 orang siswa kelas 7B di SMP Negeri 1 Jember, Jawa Timur, Indonesia. Desain penelitian yang digunakan adalah One Group with Pre-Test and Post-Test Research Design, dengan dua sesi uji coba pada materi Pencemaran Lingkungan dan Sistem Tata Surya. Kemudian data hasil literasi sains siswa dianalisis menggunakan formulasi Normalize Gain (N-Gain). Nilai rerata N-Gain pada uji coba kelompok kecil menunjukkan nilai sebesar 0,53 dan pada uji coba kelompok besar menunjukkan nilai sebesar 0.54. Kesimpulan hasil penelitian menunjukkan bahwa tingkat keefektifan penerapan model pembelajaran RC4 terhadap kemampuan literasi sains siswa termasuk dalam kategori keefektifan sedang.*

Keywords*: literasi sains, model pembelajaran, ipa, sekolah menengah pertama.*

INTRODUCTION

The tremendous advancement of science and technology today heralds the beginning og the twenty-first century. In education, practitioners and students currently face critical challenges. Education is expected to develop human resources with comprehensive capabilities for dealing with a variety of challenges (Yuliati, 2017). Students are required to be more sensitive in analyzing problems daily by having basic skills such as reading, writing, arithmetic, and scientific literacy (Imani et al., 2016). One of the crucial skills to be identified in a person is scientific literacy (Hasasiyah et al., 2020). The students need this skill to understand the environment, health, economy, and even problems in society due to the advancement of science and technology (Asyahari and Risa, 2015). It makes scientific literacy important for students in today's era.

Science is one of the subjects taught in schools, and it has a crucial role in improving students' scientific literacy skills. It is because science studies objects and natural phenomena that occur based on scientific investigation processes that produce facts, concepts, principles, and theories (Lukum, 2013). In the learning process, science does not only emphasize aspects of knowledge but it must provide direct experiences for students so that it can be applied in everyday life (Jufrida, et al., 2020). Hence, it is important to apply a more meaningful science learning process.

In Indonesia, practitioners also become aware of the importance of scientific literacy. Yet, they still find challenges in promoting scientific literacy among the students. One of the challenges comes from the students themselves. It is supported by previous studies which mentioned that students' scientific literacy skills are still low, with scores of each indicator below 50% in Indonesia (Hasasiyah et al., 2020; Jufrida et al., 2019; Adnan et al., 2021). Thus, a lot of effort is needed to enhance the students' scientific literacy skills.

Improving students' scientific literacy skills can be done through learning models. A learning model is a conceptual framework that describes systematic procedures used as guidelines for implementing learning activities in order to achieve certain learning goals (Tayeb, 2017). In other words, the learning model can improve scientific literacy skills if it contains learning steps based on aspects of achieving scientific literacy skills, namely explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and scientific evidence. In this case, the researchers have developed the RC4 learning model (Reading, Constructing, Collecting, Changing, Concluding) which is expected to be able to improve students' scientific literacy skills. In the reading step, students are asked to read short reading texts that the teacher has provided according to the material taught. According to Glyn and Muth (1994), one of the activities that can be done to make students scientifically literate is through reading. The students can evaluate information from printed media such as books or articles. In the constructing step, students are expected to be able to make temporary questions and answer the questions whose purpose is to help them construct their knowledge. When asking questions, the students have to think of something. If they find doubts or don't know the answer, they will try to find it through various means such as asking other people and reading books, so that they can gain new knowledge and understanding (Noviliya, 2018).

The next step is collecting. The students are asked to collect data through practical activities or literature study in groups. This activity is in line with Brunner's discovery learning theory and Ausubel's theory of meaningful learning. According to Brunner, good learning activities are characterized by students who can find their own knowledge. Meanwhile, according to Ausubel in Dahar (2011), learning will be meaningful if students can associate new information with relevant concepts in a person's cognitive structure. After the collecting step, the next step is changing step. The students are asked to change the data they got into data presentation forms such as tables, graphs, and so on. The learning theory related to this activity is the cognitive learning theory. Gagne (1985) mentioned that students must have cognitive strategies which are internal control processes in order to choose and change the way they pay attention, learn, remember, and think.

The last step is concluding. In the concluding step, the students need to able to analyze, interpret data, draw conclusions, and evaluate the results of their problem-solving discussions. The learning theory related to this activity is the theory of constructivism. According to Piaget (1964), knowledge is acquired based on a lifelong construction process through a process of

equilibration between knowledge schemes and new experiences. The skills to conclude is an important stage for students since it allows them to extract the essence of the learning process that they have completed (Yuni and Fisa, 2020; Yuni, 2015). These five steps are expected to be carried out sequentially and are called the syntactic learning model and at the same time used as the name for the learning model developed, namely the RC4 learning model (Reading, Constructing, Collecting, Changing, Concluding). Therefore, the aim of this research is to determine the level of effectiveness of the RC4 learning model to increase students' scientific literacy skills.

METHOD

Research Design

The research design used in the current research was One group with Pre-test and Post-test. This research was conducted in science course, precisely on environmental pollution and the solar system topics with two trial sessions. The pre-test was conducted to determine students' scientific literacy skills before applying the RC4 learning model, while the post-test was administered to determine students' scientific literacy skills after applying the RC4 learning model.

Participants

The participants involved in this research were 30 students from 7B grade in the even semester of the 2021-2022 academic year at SMP Negeri 1 Jember, East Java, Indonesia. They were divided into two trial sessions; 12 students for the small group trial and all students (30 students) for the large group trial. The class selection was carried out randomly through a homogeneity test (Levene test) based on the daily science test scores of all 7th grade students obtained in the previous materials.

Instrument

The instrument used in the present research was in the form of essay questions covering 3 questions arranged based on some aspects of achieving scientific literacy skills according to the OECD (2019). It consists of 3 scientific competencies, namely:

a. explaining phenomena scientifically
b. evaluating and designing scientific investigations
c. interpreting data and evidence scientifically

Data collection and data analysis

The result of students' scientific literacy skills was measured using a guide as shown in table 1.

Tabel 1. Classification of scores for each answer

Score	Description
4	Almost as expected, complete, and without any wrong statements
3	Contains correct things and there are also incomplete statements
2	Contain correct things, incomplete statements, and brief
1	The answers are not as expected and it contains wrong statements
0	The answers are not related to the questions asked or the students do not answer the questions at all

Quantitative data in the form of pretest and posttest of students' scientific literacy tests were analyzed using Normalized Gain ($\langle g \rangle$) formula as follows:

$$\text{Normalized Gain } (\langle g \rangle) = \frac{\text{PostTest Score} - \text{PreTest Score}}{\text{Maximum Score} - \text{PreTest Score}}$$

The next step was the data from the calculation of the gain index were converted using the score gain category in Table 2 as follows:

Tabel 2. Category of Gain Value

Value	Category
$\langle g \rangle > 0{,}7$	High
$0{,}3 \leq \langle g \rangle \leq 0{,}7$	Moderate
$\langle g \rangle < 0{,}3$	Low

(Hake, 1999).

RESULT AND DISCUSSION

Table 3. N-Gain result of the students' scientific literacy skills in small group trials.

U	n	Score		Difference	*N-Gain*	Category
		Pre	Post			
U1	12	6,50	9,25	2,75	0,50	Medium
U2	12	6,33	9,50	3,17	0,59	Medium
Average		**6,42**	**9,37**	**2,96**	**0,54**	**Medium**

Note:
U : Trial
n : Total of students

Table 3 shows that the N-Gain value of the first small group trial was 0.50, meaning that it was smaller than the second trial with an N-Gain value of 0.59. The average of the two trials shows a value of 0.54 which was in the moderate category.

Table 4. N-Gain result of the student's scientific literacy skills in large group trials

U	n	Score		Difference	*N-Gain*	Category
		Pre	Post			
U1	30	5,90	8,93	3,03	0,49	Medium
U2	30	6,60	9,57	2,97	0,56	Medium
Average		**6,25**	**9,25**	**3**	**0,53**	**Medium**

Note:
U : Trial
n : Total of students

Table 4 shows that the N-Gain value of the first large group trial was 0.49, smaller than the second trial with an N-Gain value of 0.56. The average of the two trials shows a value of 0.53 which was in the moderate category.

The syntax of the RC4 learning model (Reading, Constructing, Collecting, Changing, Concluding) used in this study was:

1. **Reading**: Students are asked to read and understand the phenomena presented in the form of short reading texts that can be accessed through barcode scanning activities.
2. **Constructing**: Students are free to make questions and predict temporary answers.
3. **Collecting**: Students collect data through practicum or study of literature.
4. **Changing**: Students change the data into data presentation forms such as graphs, tables, etc.
5. **Concluding**: Students analyze, interpret data, draw conclusions, and evaluate the results of the discussion.

The steps included in the syntax of the RC4 learning models (Reading, Constructing, Collecting, Changing, Concluding) were developed based on some aspects of achieving scientific literacy skills according to the OECD (2019). Thus, students' scientific literacy skills are expected to improve after applying the RC4 learning model in the class. This is in line with several studies that have been conducted. There are some attempts that can be done to increase the students' scientific literacy skills including; (1) teachers have to explain the concept of scientific literacy, (2) the teachers need to provide an understanding of scientific literacy and the application of scientific literacy in the learning process, for example by using various types of learning models which are student-centered and research activities, and (3) using evaluation tool based scientific literacy (Andriani et al, 2018; Sujudi et al, 2020; Haerani et al, 2020; Hasasiyah, et al, 2020).

The results showed that the level of effectiveness of the use of the RC4 learning model (Reading, Constructing, Collecting, Changing, Concluding) on the students' scientific literacy skills was in the moderate category in both small group trials and large group trials. Yet, the N-Gain value in small group trials tended to be greater than in large group trials. Although the RC4 learning model has been developed based on some aspects of achieving scientific literacy skills, it has not yet reached the high effectiveness category stage. This can be caused by several things that occur during the applying of the learning model such as the students focus during learning, the learning environment, and students' learning motivation.

According to the researchers' observations, there were differences in the conditions of students and student learning processes during small group trials and large group trials. The students who were in a class with a large number of students tended to be less focused compared to those in large group trials. In this trial, 30 students were divided into 6 groups. The large number of students and groups affected the students focus. The way that can be used to make a good group work is to minimize

group members, groups who have many members are usually less effective and efficient (Sriyono, 2000; Sudjana, 1995). Thus, the researcher who acts as a teacher is required to be able to manage the class and ensure that the discussion in each group goes well. Even so, the existence of barcode scanning activities in reading activities can help the students increase their interest in reading the provided texts so that the students in groups can focus on their own group rather than other groups. As a result, it makes the learning environment more conducive.

Beside the number of students in groups, students' learning motivation also affected the result of the applying of the RC4 learning model which was still in the moderate category. According to the observation result, students' learning motivation was still low. This is because students were in a transitional state from online to offline learning after the Covid-19 pandemic. They needed to build their learning motivation first since they were comfortable with the online learning. Even though their interest in reading increased as a result of scanning barcode activities in the reading step, the students were still lacking understanding the contents of the reading. It made the process of formulating questions and answers at the constructing stage tended to take longer. This is in line with several preceding studies which stated that the profile of students in learning after the pandemic tends to decrease. During the transition from online to offline learning, they still need to adapt, most of them are less enthusiastic about participating in face-to-face learning. They are also less focused and bored during learning. Their behaviors change and they feel lazy in learning, especially in reading. They tend not to be active in learning and it makes the learning outcomes decrease (Agustin et al., 2022; Aflaha, 2021; Handayani, 2020; Yetti, 2022). Thus, teachers have to ensure that the learning process goes well and the students are ready to receive the learning materials.

CONCLUSION

This study depicts that the level of effectiveness of implementation the RC4 learning model to enhance the students' scientific literacy skills was in the moderate category. It has not yet reached the high category stage since it was influenced by several factors, namely the students focus during the learning process, the learning environment, and students' learning motivation. Even though it has been developed based on some aspects of achieving scientific literacy, teachers need to ensure students' readiness first before implementing this learning model.

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