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Creative Thinking Ability of Elementary School Students in Science Learning Using the RADEC Learning Model

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Abstract: The purpose of this research is to know the creative thinking ability of elementary school students through the RADEC learning model. This research was conducted using a descriptive qualitative method involving 38 students in fifth grade in an elementary school in Sumedang Regency, West Java. This research was conducted in science learning at air topic. Data collection was carried out using instruments in the form of tests, questionnaires, and observation guidelines. The research data is processed by determining the percentage value of the student's answers then calculating the average value based on aspects of the creative thinking indicator. The results showed that the students' initial creative thinking ability was in the medium category. However, after the use of the RADEC learning model, students' creative thinking abilities increased and entered the high category with the difference in percentage values through questionnaires and tests accompanied by observations, respectively, of 25% & 16% for the fluency aspect, 12.50% & 18.80% for the flexibility aspect, 27.50% & 10.20% for the authenticity aspect, and 24.90% & 17.50% for the detail aspect. Based on the results of the questionnaire and observations, an increase in high thinking skills can occur because the phases in the RADEC learning model require students to be more active in expressing opinions, refuting, asking questions, finding solutions to a problem, and creating something new.

Keywords: RADEC; Creative Thinking Ability; Natural Science; Elementary School.

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Introduction

One important aspect of human life in this era of globalization is education. In the 21st century, education must be oriented to the competencies needed, one of which is the ability to think creatively. This is also supported by Trilling's opinion which states that the concept of skills that need to be developed in the 21st century is one of them, namely creative thinking (Sukmawati, et al., 2020). The ability to think creatively is very important in education because it has been proven to support student learning outcomes (Ramdani, et al., 2019).

Education itself is a foundation for developing human resources (Aribawati, et al., 2018). Education is the spearhead for the development of a nation's civilization that can grow human resources through the learning process (Muna, 2017). The education provided needs to be of high quality to support the creation of intelligent humans because education has an important role in shaping character, scientific and mental development. In addition, through education it is expected to increase knowledge so that the creation of intelligence in students (Pour, et al., 2018).

One way that can be done to develop students optimally is through science learning (Sari, et al., 2016). Natural Science is a learning process related to nature

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systematically, not only about mastering knowledge in the form of facts, concepts, and principles, but also about the process of an invention (Novitasari, 2017). The special characteristics possessed in science material, namely studying factual natural phenomena, both in the form of reality, and events, as well as cause and effect relationships. Science learning is not only theoretical but also associated with problems that occur in real life (Pamungkas, et al, 2017). The science learning process in elementary schools places more emphasis on providing a hands-on experience so that students can develop competencies and can explore and understand the natural surroundings scientifically (Novitasari, 2017).

Science learning in elementary school is a place for students to learn about themselves, the environment, and the prospect of further development in applying the knowledge they already have in everyday life. Science learning in elementary school will run more effectively if learning can be adapted to the developmental stage of elementary school-aged children and presented in an attractive manner (Sari et al., 2016). So, science learning needs to be designed properly so that it can arouse students' curiosity, then it will proceed in solving a problem that arises using the right learning model so that it can produce a product that can be realized in everyday life (Putri, et al., 2021).

In fact, many learning activities carried out by teachers in Indonesia still use conventional learning methods, namely the lecture method where the learning process is more teacher-centered than student-centered. This lecture method causes low student activity in the classroom because communication only occurs in one direction where the teacher only explains the material, gives examples of questions, and provides practice questions, while students only listen and record what is conveyed by the teacher without playing an active role during the learning process implementation (Pour, et al., 2018). Meanwhile, active learning is one of the important factors to support student success in obtaining learning outcomes (Alamsyah, 2016). This can also affect students' low creativity because students only focus on the answers explained by the teacher or what is in the book without developing their own ideas or ideas that are more varied (Alamsyah, 2016).

Creativity itself is a mixture of innovation, sensitivity, and flexibility that can form a person to be able to think productively based on personal satisfaction and other satisfactions (Fakhriyani, 2016). Creativity is a person's ability to initiate and then find something new that has never existed before. Creativity is the ability to produce ideas, products, or problem solving that are different, unique, new, and on target that can only be produced by a handful of people (Aribawati, et al., 2018). So, it can be concluded that creativity is a person's ability to create something new, either in the form of a real work or an idea in the form of a new work or a combination of things that already exist where these things are relatively different from what already exists (Manobe & Wardani, 2018). Creativity has a relationship with creative thinking skills because creativity can be formed if the creative thinking process goes well (Meika & Sujana, 2017).

The ability to think creatively is a person's ability to analyze something based on existing data or information and get many conditions that allow responding to a problem by emphasizing the number, effectiveness, and diversity of responses (Dewi, et al., 2019). Creative thinking skills training is one way that can be done to confront a problem directly with students and the students are asked to solve the problems given in different ways (Sugiharto et al., 2021). In creative thinking, there is a combination of logical thinking and divergent thinking based on intuition, but still in a conscious state. In simple terms, creative thinking is an activity to grow new things that are in accordance with the objectives by building ideas, synthesizing these ideas, and applying them (Siswono, 2004). The following are indicators of creative thinking according to (Munandar, 1992), namely fluency, flexibility, originality, and elaboration (Suprapto, et al., 2018).

Based on the problems above, it is necessary to apply a learning model that can improve the creative thinking skills of elementary school students through science learning. The learning model that has been proven to increase students' creativity in science learning is the RADEC learning model. The RADEC learning model was introduced by Sopandi in 2017 at the International Conference in Kuala Lumpur, Malaysia. The RADEC learning model is an alternative learning model that has been adapted to the conditions of education in Indonesia. The syntax of the RADEC learning model consists of Read, Answer, Discussion, Explain, and Create (RADEC). Based on research conducted by (Sopandi, 2017) that the RADEC learning model has a syntax that is easy to remember and effective when applied in learning activities. The syntax in the RADEC learning model is also able to create a collaborative and investigative climate when the learning process is carried out. In addition, the RADEC learning model is also able to develop the skills needed in the 21st century (Sukmawati, et al., 2020).

The RADEC learning model is also one of the universal science learning strategies that can build mastery of concepts in students (Sukardi, et al., 2021). In the RADEC learning process, students are more required to be directly involved in the learning process (Wahyuni, et al., 2020). The principle of the RADEC

learning model is that all students already have the potential and capacity to learn independently and to study higher in order to master knowledge and skills. Several studies have proven that the RADEC learning model can improve students' creative thinking skills (Pratama, et al., 2019).

In this study, an analysis of the creative thinking ability of elementary school students will be carried out by applying the RADEC learning model to fifth-grade students in an elementary school in Sumedang Regency in the science subject on air. The purpose of this study was to see the improvement of students' creative thinking skills after the implementation of the RADEC learning model.

Method

The method used in this study is a qualitative descriptive method. Descriptive research is research that describes what a variable, symptom, or situation is (Faelasofi, 2017). According to (Sugiyono, 2010), descriptive research is research to determine the value of independent variables without making comparisons or connecting with other variables. Descriptive analysis in this study is in the form of percentage results from each aspect contained in the indicators of creative thinking ability. Meanwhile, the qualitative approach is research that includes reports, descriptions of words, or pictures (Rusmiatiwi, 2018).

This research was conducted in one of the elementary schools in Sumedang Regency, West Java with the research subjects being class V students, totaling 38 students. This research was conducted in June 2021. The object of this research is the improvement of students' creative thinking skills in science learning after the use of the RADEC learning model.

Data collection techniques from students' creative thinking skills were collected through questionnaires and tests accompanied by observations during the learning activities carried out. The indicators for assessing creative thinking skills are based on several indicators described in Table 1.

The questionnaire was given to examine students' creative thinking skills when the RADEC learning model was not used and students' creative thinking skills when the RADEC learning model was used. The questionnaire consists of 10 questions containing a description of a learning condition that has been classified based on the aspects of the creative thinking indicator. In the questionnaire, there are four alternative answers, namely Always, Often, Rarely, and Never. The assessment of the questionnaire used is based on a Likert scale, which is a score of 4 if you answer always, a score of 3 if you answer often, a score of 2 if you answer rarely, and a score of 1 if you answer never.

For tests and observations, conducted to see the effect of the RADEC learning model on increasing students' creative thinking skills by looking at how students answer questions, solve a problem, express opinions, ask questions, refute, give creative ideas, etc. Guidelines for assessing creative thinking skills through tests accompanied by observations can be seen in Table 2.

Table 1. Indicators of Creative Thinking Ability

Aspect	Description
Fluency	1. Generating many ideas, answers, problem solving, or questions
	2. Independent in learning
Flexibility	1. Able to provide answers, opinions, or varied questions
	2. Can see a problem from a different point of view
	3. Able to find alternatives or different directions in a problem
Originality	1. Can give birth to new and unique expressions
	2. Able to think of unconventional ways to express oneself
	3. Have a strong desire to solve problems
Elaboration	1. Respond to questions given enthusiastically, actively, and enthusiastically in completing tasks
	2. Have the courage to accept or carry out heavy tasks
	3. Happy to find new ways or methods that are more practical in learning
	4. Critical in checking the work
	5. Aggressive in asking

Table 2. Guidelines for Assessing Students' Creative Thinking Ability through Tests and Observations

Aspect	Score	Description
Fluency, Flexibility, Originality, Elaboration	0	No answer (wrong answer)
	1	Giving one unfinished answer
	2	Give one correct answer
	3	Give two answers with one correct answer
	4	Give two or more correct answers

The number of students who have reached a certain category can be expressed in percent using equation 1 of (Sudijono, et al., 2015).

$$P = \frac{f}{N} \times 100\% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Information:
P = Percentage Number
f = Frequency being searched the percentage
N = number of samples

The data analysis technique used is a descriptive statistical technique where creative thinking skills are analyzed by determining the percentage value of each student's answer which is then calculated on average based on aspects of the creative thinking indicator. Furthermore, the mean values are categorized as in Table 3.

Table 3. Categories of Students' Creative Thinking Ability

No	Value (%)	Category
1	≤ 40	Very low
2	41 – 57	low
3	58 – 75	medium
4	76 – 92	high
5	≥ 93	Very high

Result and Discussion

Based on the results of questionnaires and tests accompanied by observations, students' initial ability to think creatively before the implementation of the RADEC learning model in science learning is in the moderate category, as described in Table 4 and Table 5.

Table 4. Initial Condition of Students' Creative Thinking Ability through Questionnaire

No	Indicator	Value Average (%)	Category
1	Fluency	62.50	medium
2	Flexibility	75.00	medium
3	Originality	55.00	low
4	Elaboration	56.30	low

Tabel 1. Kondisi Awal Kemampuan Berpikir Kreatif Siswa Melalui Tes dan Observasi

No	Indicator	Value Average (%)	Category
1	Fluency	62.50	medium
2	Flexibility	59.39	medium
3	Originality	59.30	medium
4	Elaboration	62.50	medium

Based on the data in Table 4 and Table 5, the initial ability of students' creative thinking before the use of the RADEC learning model was in the medium category. This can happen because students tend to be passive during the learning process. Passive students can occur because there is no preparation of students to receive learning, such as not reading or digging up information beforehand about the material to be discussed when learning activities begin. Students' brains are not provoked in advance to accept learning and carry out discussions in class. Meanwhile, indicators of creative thinking skills require students to be active in learning activities, such as sparking many ideas or answers, sparking problem-solving, producing varied answers, being able to give birth to new and unique expressions, and being independent in learning (Fajriah & Asiskawati, 2015).

After using the RADEC learning model in learning activities, students become more active during learning activities, such as discussing, expressing opinions, conveying the solution to a problem, and providing varied answers. Based on the results of questionnaires and tests accompanied by observations in Table 6 and Table 7, it can be seen that the RADEC learning model can help elementary school students in improving creative thinking skills where students' creative thinking abilities fall into the high category.

Table 6. Results of students' creative thinking ability with RADEC learning model through questionnaire

No	Indicator	Value Average (%)	Category
1	Fluency	87.50	High
2	Flexibility	87.50	High
3	Originality	82.50	High
4	Elaboration	81.20	High

Table 7. Test results and observations of students' creative thinking skills using the RADEC learning model

No	Indicator	Value Average (%)	Category
1	Fluency	78.50	High
2	Flexibility	78.10	High
3	Originality	69.50	Medium
4	Elaboration	80.00	High

In the fluency aspect, there was an increase in creative thinking skills by 25% through questionnaires and 16% based on test results accompanied by observations when answering questions. After using the RADEC learning model, the fluency of students in generating ideas or answers and the fluency of students in solving a problem is more visible because pre-learning questions are given in which it provokes students to problem solve a problem. In addition, the use of the RADEC learning model also makes students more independent in learning because before learning activities, students are required to dig up information first and then discuss it with group friends.

The flexibility aspect increased by 12.50% through a questionnaire and 18.80% based on test results accompanied by observations when answering questions. This can happen because students can produce varied answers and students can also see a given problem from a different perspective.

For the aspect of authenticity, there was an increase of 27.50% through a questionnaire and 10.20% based on test results accompanied by observations when answering questions. This can happen because students seem to have a strong desire to solve pre-learning questions as evidenced by the absence of unanswered pre-learning questions.

Meanwhile, in the detail aspect, there was an increase of 24.90% through questionnaires and 17.50% based on test results accompanied by observations when answering questions. This can happen because students are more aggressive in asking and responding to questions given actively and enthusiastically. Improvements in every aspect of creative thinking indicators can be seen in Figure 1 and Figure 2.

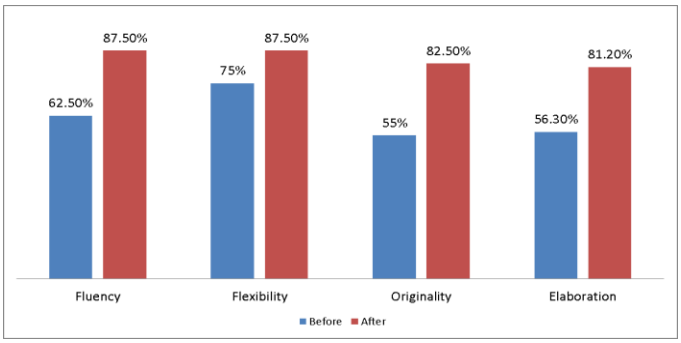

Figure 1. Comparison of questionnaire results from students' creative thinking ability before and after using RADEC

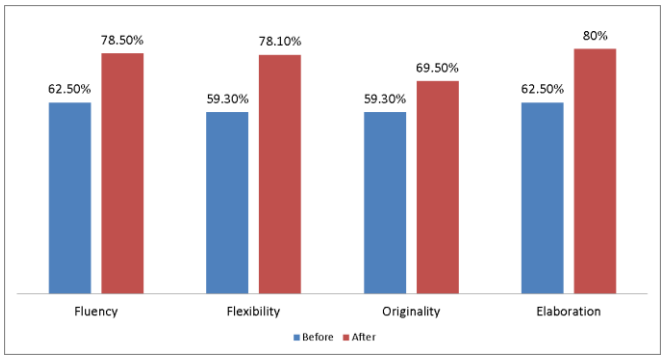

Figure 2. Comparison of test results and observations of students' creative thinking ability before and after using RADEC

Through the application of the RADEC learning model, students' creativity can be enhanced by creating research ideas, problem-solving, and other creative works (Lestari & Suhandi, 2020). This is in accordance with research (Wulandari, et al., 2020) which states that the RADEC learning model can improve students' creative thinking skills and is also evidenced by research (Ma'ruf, et al., 2020) which states that learning design using a model RADEC learning is feasible to be used to increase students' creativity. In addition, (Jumanto & Widodo, 2018) also prove that there is a significant difference in the results of students' creative thinking ability tests where students experience an increase in creative thinking skills after the implementation of the RADEC learning model in learning activities. The phases in the RADEC learning model have a major influence in improving students' creative thinking skills because these phases can train students to think, work together, and communicate in finding creative ideas and determining ideas to be realized, planned, implemented, reported. In addition, students can present these creative ideas in any form (Lestari & Suhandi, 2020).

The Read phase is carried out before the learning activities are carried out. In this phase, students are required to read the material from home before the learning activities begin. The reading material has been adjusted to the material that will be discussed in class. In this study, the material given is air. In this phase, students are provoked to prepare themselves to receive material and prepare information that will be discussed when the learning process is carried out. This phase can make students more ready to learn and accept learning. The Read phase can be measured because it is included in the indicators of creative thinking skills where students are required to study independently.

The Answer phase is also carried out before the learning activities are carried out. This phase is done by giving pre-learning questions related to the material to be studied and needs to be answered by students after the Read phase. In this study, the pre-learning questions given were in the form of a collection of HOTS questions related to air. The activities carried out in this phase are students are asked to answer pre-learning questions to be discussed with group friends when learning activities are carried out. In pre-learning questions, there are questions that require students to provide varied answers and solve a problem. The Answer phase can be measured because it is included in the indicators of students' creative thinking abilities.

The Discuss phase is carried out by students in the form of groups. The purpose of this phase is to provide opportunities for students to discuss and exchange opinions regarding the answers to pre-learning questions together with group members. The groups formed in this phase are in the form of small groups where the number of members is not too many so that the discussion process can run effectively. At this stage, the teacher needs to ensure that there is communication between students in each group to get the most appropriate answer. In addition, the teacher can also determine groups that have mastered and understood the material well and have creative ideas to apply the material being studied. In this phase, students are required to be more active in class by submitting the answers that have been prepared in the Answer phase. In this phase, students are also required

to have an opinion on what their friends have said. The Discuss phase can be measured because it is included in the indicators of students' creative thinking abilities.

The Explain phase directs students who are representatives of each group to make presentations on the material that has been discussed. Representatives of these students are students who have understood and mastered the material being studied well. In this phase, the teacher ensures that the material presented is scientifically correct and ensures that other students can understand the material presented by the student. In addition, the teacher also encourages other students to ask questions, refute, or add to what their friends have said. This phase also requires students to be more active because students are asked to refute, ask questions, or give different answers during the learning activities carried out. The Explain phase can be measured because it is included in the indicators of students' creative thinking abilities.

The Create phase begins by inspiring students to apply the knowledge they have learned together to produce creative ideas or thoughts in any form. In this study, students are required to apply the material they have learned in any form, such as songs, poetry, mind mapping, simple experiments, etc. In this phase, the teacher first gives examples to students, such as showing a learning video in which there are simple experiments that students can do about the material being studied or making a song whose lyrics are made of the material being studied. This is expected to inspire students and make it a reference and is expected to provoke students to think more creatively in applying the material they have learned.

In the five phases, it is evident that students are required to be more active during classroom learning, such as expressing opinions, giving different answers, asking questions, and finding ways to solve a problem that can improve students' creative thinking skills. Thus, it is proven that RADEC is effectively used in science learning for elementary school students to improve creative thinking skills. So, with an increase in students' creative thinking abilities, it is also expected to improve student learning outcomes because it has been widely proven that students' creative thinking abilities can affect student learning outcomes in science learning (Hagi, et al., 2021).

Students who have high creativity tend to be able to carry out every step of the creative thinking process well and can solve problems well. This can happen because students are able to imagine and express the ideas they have initiated and students can relate them to the material they have studied or their personal experiences. Meanwhile, students who have low creativity tend to experience obstacles in several steps of the creative thinking process and students are more difficult to overcome these problems (Siswono, 2004). If students have high creative thinking, students will get good learning outcomes because creative thinking is one aspect of higher order thinking skills (Lestari & Suhandi, 2020).

Conclusion

The RADEC learning model is a learning model that has been adapted to the conditions of education in Indonesia. It is proven that the RADEC learning model can improve students' creative thinking skills through the stages of reading, Answering, Discussing, Explaining, and Creating. The initial ability of students' creative thinking before the use of the RADEC learning model, based on the results of questionnaires and tests accompanied by observations, was in the moderate category with a percentage value of 62.50% & 62.50% in the fluency aspect, 75% & 59.30% in the flexibility aspect, 55% & 59.30% on the aspect of authenticity, and 56.30% & 62.50% on the aspect of detail. This can happen because, during the learning process, students tend to be passive. However, after using the RADEC learning model in learning activities, students became more active in the classroom and students' creative thinking abilities increased to enter the high category. Based on the results of questionnaires and tests accompanied by observations, students' creative thinking skills increased in percentage values, respectively, by 87.50% & 78.50% in the fluency aspect, 87.50% & 78.10% in the flexibility aspect, 82.50% & 69.50% in the authenticity aspect, and 81.20% & 80% on detail aspect.During the learning process, students discuss with groups to exchange opinions, provide objections, ask questions, and provide more varied answers. In addition, the RADEC learning model also requires students to produce something new which can develop and hone students' creativity. This proves that the RADEC learning model is effectively used to improve creative thinking skills through science learning in elementary school students.

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