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Implementation of Problem-Solving Oriented RADEC Learning Model in Colloidal Material for the Emergence of Creative Thinking Skills of High School Students

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A B S T R A C T

Creative thinking skills are part of Higher Order Thinking Skills (HOTS) that aid students in problem-solving. Teachers have a responsibility to cultivate these skills by employing suitable learning models. The RADEC (Read-Answer-Discuss-Explain-Create) learning model offers an alternative approach for teachers to enhance student competencies. This study aimed to investigate the impact of a problem-solving-oriented RADEC approach through the colloidal topic on students' creative thinking skills. The research was conducted at a private high school in Cianjur Regency and involved 28 students from class XI. The pre-experimental method employed a one-group pre-test and post-test design. The findings revealed that this learning model effectively nurtured students' creative thinking skills. Students demonstrated significant improvements in various aspects of creative thinking, with percentages as follows: fluency (78.88%), flexibility (71.62%), elaboration (68.33%), originality (70.83%), and metaphorical thinking (61.11%). The pre-test and post-test scores indicated an increase in students' creative thinking skills, with an n-gain value of 0.5936, categorized as moderate. In summary, the problem-solving-oriented RADEC learning model proved effective in enhancing students' creative thinking skills in the context of colloidal material. This research has implications for teachers, urging them to consider implementing the RADEC model to foster the development of student's creative thinking abilities.

1. Introduction

Implementing creative thinking in learning is crucial as it is one of the essential 21st-century skills that holds great significance for students and the education system. Creative thinking is a habit of the mind that is trained by paying attention

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to intuition, activating imagination, and expressing new possibilities (Johnson, 2010).

Ongoing research focuses on students' creativity and creative thinking. Findings from the Global Creativity Index (GCI) in 2015 revealed that Indonesia ranked 115th out of 139 countries, indicating a significantly low creativity index of 0.202 (Florida et al., 2015). Another study compared the creative thinking abilities of high and low-achieving students, the results showed that there was no difference in creative thinking abilities between high and low-achieving students (Anwar et al., 2012). In addition, the chemical test used for the assessment process is less innovative, so it cannot measure students' creative thinking skills and problem-solving, whereas the test used by the teacher only measures memorization and understanding of concepts (Hidayat et al., 2018). The results of the study showed that the average score of students' creative thinking skills was in the low category with a percentage gain of 39.76% and 46.88% (Tawil & Haris, 2016). The observations indicate challenges in learning concerning students' creative thinking abilities. These challenges include students requiring substantial time to respond to teacher questions, a lack of idea development, and a tendency to provide answers solely based on the knowledge and explanations provided by the teacher (Utami et al., 2018).

Creating suitable conditions for developing creative thinking skills through problem-solving activities using learning models is crucial. However, the study findings reveal that teachers face limitations and have not been able to implement thematic learning models based on the 2013 curriculum due to various reasons (the syntax of the learning model is hard to memorize, lack of understanding of the learning steps according to the syntax in the learning model, complex teaching preparation, does not support students in facing various exams, requires a longer time allocation so that they are less able to deal with the time available) (Sopandi, 2019; Mislinawati & Nurmasyitah, 2018).

Consequently, researchers have taken an interest in implementing an alternative and innovative learning model, namely the RADEC model, to address these challenges. The RADEC model, introduced by Sopandi in 2017, is based on Lev Vygotsky's theory of the Zone of Proximal Development (ZPD). Where students have actual abilities, namely the ability to complete tasks without the help of others and the potential ability to complete tasks with the help of others (teachers or peers) (Murphy et al., 2015; Van Uum et al., 2017).

The RADEC model consists of five learning stages that contribute to the development of student's creative thinking skills. The first stage, Read (R), is carried out before learning activities that involve students reading information from various sources to acquire prior knowledge and enhance their reading comprehension skills. This stage contributes to the mastery of concepts and learning outcomes. The second stage, Answer (A), focuses on pre-learning questions that prompt students to engage with the subject matter. The third stage, Discuss (D), involves group discussions where students exchange ideas and deepen their understanding by sharing their answers from the previous stage. In the fourth stage, Explain (E), teachers present the teaching materials that encompass the cognitive aspects formulated in the lesson plans. These stages emphasize the mastery of concepts, enabling students to utilize their knowledge to foster creative thinking. Finally, the fifth stage, Create (C), emphasizes problem-solving and creative thinking skills. Students engage in productive questioning and generate creative ideas. Teachers can provide research examples as inspiration, encouraging students to explore innovative solutions to problems. By incorporating these five stages, the RADEC model promotes concept mastery and encourages the development of student's creative thinking skills, enabling them to think critically and generate unique solutions. According to the researcher, this model is also in line with the mandate of the minister of education and culture in his speech on teacher's day 2019 that classroom activities always make changes by inviting students to discuss, not just listen, giving students opportunities to teach in class, inviting students to learn from the world around them, spark activities that involve the whole class, and the ability to collaborate.

The chosen topic for this study is colloids, which is recognized as a challenging topic due to its abstract nature, microscopic concepts, and the presence of terms that are often difficult to comprehend. This is what causes students to have difficulties, so they have to memorize to understand colloidal topics (Rakhmadani et al., 2013), students also assume they can just memorize this material when they are going to face exams. As a result, student learning activities become passive (Hayati et al., 2014). In addition, the results of interviews with teachers showed that there were still students who had not completed learning colloidal material, with a complete learning achievement percentage of 41.17% and 65.71% from two different classes (Novilia et al., 2016). Although the presentation of colloid material is carried out only with the experimental method, not all material about colloids can be covered in the practicum due to time constraints. To address this issue, students are encouraged to write down all material about colloids in notes. However, this approach may lead to students only understanding what is done in the practicum while reading the notes may make students feel bored and their motivation to understand colloidal material may drop. This causes students to find it difficult to remember and master concepts (Sulfia & Habibati, 2017).

There are many applications of colloidal topics used in everyday life that are important to understand, such as the water purification process, the formation of deltas at river mouths, and the problem of surrounding waste that can be used as colloid products. Through problems that are recognized and close to everyday life, students are expected to be able to find out how the causes of these problems and provide alternative solutions to problems, especially in colloidal material. Thus, students are indirectly trained and accustomed so that it influences their creative thinking skills, which are important in the 21st century. Therefore, this study aims to determine the emergence of students' creative thinking through the implementation of the problem-solving-oriented RADEC model in online colloidal topics.

2. Methodology

This study used a pre-experimental method with a one-group pre-test post-test design. There are three stages in this study shown in Figure 1, namely:

O_1------------------	X------------------	O_2
Pre-test	Treatment	Post-test

Figure 1. Design One Group Pre-test Post-test

(Fraenkel et al., 2012)

Figure 1 Description:

1. Participants work on pre-test questions to find out the initial conditions before being given treatment (O_1).
2. Participants receive treatment, namely colloid learning using the RADEC learning model oriented to problem-solving.
3. Participants work on post-test questions to find out their condition after being given treatment (O_2)

The test items (pre-test and post-test) and LKPD instruments made by the researchers referred to indicators of creative thinking skills based on the scoring rubric in Table 1.

Table 1. *Keterampilan Berpikir Kreatif* (KBKr) Indicators

KBKr Indicator	KBKr Sub Indicator	Scoring Rubric	Score
Fluency	Generates a large number of options/ideas in response to questions	Mention/write three or more ideas, suggestions, or different alternative answers	4
		Mention/write two different ideas, suggestions, or alternative answers	3
		Mention/write two different alternative ideas, suggestions, or answers	2
		Mention/write one idea, suggestion, or alternative answer	1
		Did not answer or gave the wrong answer	0
Flexibility	Provide an interpretation of the problem from a different point of view	Write three or more alternative answers that are very logical and relevant to the problem given from different points of view	4
		Write three or more alternative answers that are quite logical and relevant to the problem given from different points of view	3
		Write three or more alternative answers that are quite logical but less relevant to the problem given from different points of view	2

KBKr Indicator	KBKr Sub Indicator	Scoring Rubric	Score
		Write an alternative answer that is quite logical and relevant to the problem given with only one point of view	1
		Did not answer or gave the wrong answer	0
Elaboration	a) Add details and expand ideas b) Make ideas richer, more interesting, or more complete	Explain three or more logical details of the existing idea, so that the formulation of the idea becomes clearer and can be implemented more easily	4
		Explain one logical detail of an existing idea, so that the formulation of the idea becomes clearer and can be implemented more easily	3
		Provides two logical details of the existing idea, but is not relevant enough to the main idea concept, so it does not make the idea clearer.	2
		Does not add details to existing ideas, so the formulation of ideas cannot be implemented properly	1
		Did not answer or gave the wrong answer	0
Originality	Generate new options/ideas that are statically uncommon or infrequent	Mention/write three or more interesting unique ideas, which are logical, relatively new, and relevant to the given problem	4
		Mention/write three or more interesting unique ideas, which are logical, relatively new, but not sufficiently relevant to the given problem	3
		Mention/write unique ideas which are quite interesting, which are quite logical, relatively new, and quite relevant to the given problem	2
		State / write three common ideas that are logical and relevant to the given problem	1
		Did not answer or gave the wrong answer	0
Metaphorical thinking	Use comparisons or analogies to create new series	Combining three or more ideas, modifying, and explaining the formulation of ideas using logical and coherent analogies	4
		Combining three or more ideas, modifying, but unable to explain the formulation of ideas using analogies logically and coherently	3
		Combining three or more ideas that are relevant but do not explain the formulation of ideas using analogies logically	2
		Lack of ability to combine relevant	1

KBKr Indicator	KBKr Sub Indicator	Scoring Rubric	Score
		ideas so that they become a coherent whole	
		Did not answer or gave the wrong answer	0

Source: Indicators of creative thinking Treffinger, et al (2002) in (Zubaidah et al., 2017)

The disparity in the post-test scores compared to the pre-test scores can be attributed to the treatment administered. Table 2. shows the results of the pre-test and post-test of 28 students of class XI.

Table 2. Pre-test and Post-test Scores of Students

Participant	Pre-test Score	Post-test Score
1	30	90
2	55	95
3	25	60
4	20	65
5	25	50
6	45	75
7	35	75
8	20	65
9	40	90
10	25	65
11	65	85
12	20	80
13	55	85
14	45	80
15	30	80
16	45	70
17	35	65
18	5	65
19	20	75
20	25	60
21	45	75
22	30	65
23	15	55
24	30	65
25	45	85
26	20	55
27	10	70
28	25	65
Average Score	31,6071	71,7857
Standard Deviation	14,341	11,644

Based on the information in Table 2, the data were statistically analyzed using SPSS 24 for Windows through a normality test using Shapiro Wilks. The decision-making for the normality test is as follows:

H_0: score data (pre-test or post-test) normally distributed.
H_1: score data (pre-test or post-test) are not normally distributed.

With the following decision-making criteria:
a) If the significance value > 0,05, so H_0 accepted
b) If the significance value ≤ 0,05, so H_0 rejected

(Susetyo, 2014)

Table 3. Normality Test Results from Pre-test and Post-Test Data of Students' Creative Thinking Skills

Tests of Normality			
Creative Thinking Skills	**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**
Pre-Test	.960	28	.354
Post-Test	.961	28	.365

Based on the output of the Normality Test above using Shapiro Wilk with 28 participants in this study (df <50), it is known that the Sig. (2-tailed) for all pre-test and post-test scores of student's creative thinking skills is > 0.05, so then H0 is accepted. Also, it can be said that the score data is normally distributed.

The data, which has been declared normally distributed, can use parametric analysis, namely the t-test and the N-Gain test. The t-test is used to compare the differences between two variables, whether the two variables are the same or different, namely testing generalization ability (the significance of the research results in the form of a comparison of two sample averages) (Riduwan, 2017). The N-Gain test is used to find out how to improve creative thinking skills after learning is done because the t-test only sees differences and has not seen whether the differences have been effective or still lacking (Herlanti, 2014).

The hypothesis for the t-test is:
H_0: No significant difference between the pre-test and post-test scores of student's creative thinking skills
H_1: There is a significant difference between the pre-test and post-test scores of student's creative thinking skills

With the following decision-making criteria:
1. If the value of t count > t table, so H_0 rejected and H_1 accepted
2. If the value of t count < t table, so H_0 accepted and H_1 rejected

Based on the t table value, which is 2.051831. Therefore t count 18.743 > t table 2.051831 so that Ho is rejected and Ha is accepted. This means that there is a significant difference between the average pretest scores (before RADEC learning is carried out) and post-test scores (after RADEC learning is carried out). The N-Gain value is 0.5936, which is moderate (Wahab et al., 2021). The results obtained indicate that the implementation of RADEC learning effectively enhances student skills.

3. Results and Discussion

1) Activities Before the First Meeting

Prior to conducting the research, students are instructed to download the Google Classroom and Google Meet applications. Then, the teacher provides guidance on how to utilize it. Students are also informed that the learning activities will be conducted in groups. Consequently, the teacher divides the class into five groups, assigning a leader to each group. These leaders hold the responsibility of ensuring attendance and, in collaboration with the teacher, overseeing the learning process for their respective group members. The students engage in pre-test questions via Google Classroom, followed by literacy activities centered around reading (Reading Stage). The teacher supplies reading materials in the form of electronic books, learning videos, and PowerPoint presentations, all tailored to the appropriate topics on Coloid. These resources are accessible to students through their Google Classroom accounts.

The reading activity holds significance as it fosters knowledge growth and serves as a foundation for enhancing students' conceptual mastery (Küçükoğlu, 2013). Additionally, it helps develop other skills related to extracting meaning from text, as students are not merely passive recipients of information but actively construct meaning from what they read (Pourhosein Gilakjani & Sabouri, 2016), as well as being able to minimize the duration of time during virtual face-to-face activities (Siregar, 2019) because they have studied the colloid material and can make a choice of which information to read first. Following the reading activity, students individually respond to the initial pre-learning questions (Answer Stage) about the concept of colloids, aligning with the learning indicators. The students then upload their answer results to the Google Classroom platform before the first meeting takes place.

2) Learning at the First Meeting

During the first meeting, the students engage in a group discussion process (Discuss Stage) via Google Classroom to collectively refine and reformulate the most suitable answers to the pre-learning questions. The discussion stage fosters an active and collaborative learning environment, encouraging students to engage with one another, provide motivation, and collectively enhance their understanding and mastery of the subject matter (Sopandi, 2017). Group discussion activities provide an opportunity for students to exchange ideas and perspectives regarding assignments assigned by the teacher. Within this space, students with lower skills can engage in practice and learning by benefiting from the insights and expertise of their peers who possess better skills (Canelas et al., 2017). Once the discussion process concludes, each group takes turns presenting their findings and insights (Explain Stage).

During this stage, every group is granted the opportunity to pose questions, offer responses, and provide additional information to further refine their answers. The teacher facilitates the session, ensuring that all students within the group actively participate in the presentation and discussion. Based on the level of participation, the groups were ranked in the following sequence: Group 4 demonstrated the highest level of activity, followed by groups 3, 5, 1, and 2. Groups 4, 3, and 5 exhibited a high degree of engagement during the discussion process, while Group 1 displayed a moderate level of involvement. Group 2, on the other hand, demonstrated less activity during the discussion activities. Throughout the discuss and explain stages, it was evident that creative thinking abilities, including fluency, flexibility, and elaboration, were prominently displayed by the students.

During the fluency stage, students exhibited the ability to generate numerous suitable answers within a constrained duration. In terms of flexibility, students showcased their capacity to provide interpretations and illustrations that were unique to their perspectives. They also supplemented their answers by incorporating insights from their group members and other groups, thereby enhancing the completeness of their responses. Upon the completion of the first meeting, the teacher assigned a reading task (Read), followed by the second pre-learning question (Answer), which focused on problem-solving activities related to colloidal topics. Subsequently, students uploaded their answers to the Google Classroom platform prior to the commencement of the second meeting.

3) Learning at the Second Meeting

In the second meeting, the Create stage takes place, during which students engage in problem-solving activities within their respective groups on the Google Classroom platform. The process involves the following steps: a) Formulating problem questions, b) Identifying the factors contributing to the problem, c) Developing actions or designing experiments as potential solutions to address the problem, d) Reporting the action plan, and e) Implementing the action plan to resolve the problem. During this meeting, the teacher guides each group to tackle distinct problems using their own innovative ideas. Figure 2 illustrates the process of group problem-solving activities conducted through the discussion feature on Google Classroom.

Figure 2 showcases the group discussion process conducted by Group 3. The process begins with the identification of significant problems that require resolution. This activity serves as an assessment of the flexibility indicator of creative thinking. If students are unable to generate creative ideas, they have the option to choose from the creative ideas proposed by the teacher. The figure illustrates the active involvement of certain group members in guiding the selection of questions to be addressed collectively. Other members contribute suggestions for choosing the problems to be solved, and with the approval of all group members, a consensus is reached regarding the problem at hand, specifically related to the issue of contaminated water.

Figure 2. Problem-Solving Activities in the Create Stage at the Second Meeting Through Google Classroom

During the group discussion process in the learning environment, certain groups propose unique and diverse solutions, while others adhere closely to the ideas initially presented by the teacher. This discourse offers fresh inspiration and thoughtful considerations in selecting creative ideas to tackle the given problem. The discussion process undoubtedly contributes to the generation of innovative approaches to problem-solving.

Referring to Figure 2, the group has reached a consensus on the problem theme to be addressed. Subsequently, each member collaborates by dividing the responsibilities for answering subsequent questions on LKPD (student worksheet). They then reconvene in the forum to discuss and verify the accuracy of their answers. This stage involves seeking responses and determining whether any additional information or insights are required. Following the conclusion of the second meeting, each group proceeded to prepare a comprehensive and detailed problem-solving report, which would be presented during the third meeting.

4) Third Meeting Learning

The third meeting focuses on the Create stage, during which students present their problem-solving reports through Google Meet in a rotating fashion, where each group is represented by 1-3 students. The presenting group shares their problem-solving activities, while other groups have the opportunity to ask questions, provide feedback, and contribute to the overall presentation process. The teacher guides the presentations, ensuring an engaging and active atmosphere. Additionally, the teacher offers input and poses questions related to the topics presented. Figure 3 illustrates the problem-solving activities conducted during the third meeting via Google Meet.

Despite the online learning environment, students demonstrate their ability to fulfill the LKPD assignment. These assignments require them to generate creative ideas, explore diverse sources to gather accurate information and organize their findings into well-structured papers and PowerPoint presentations. Furthermore, students report on their problem-solving activities.

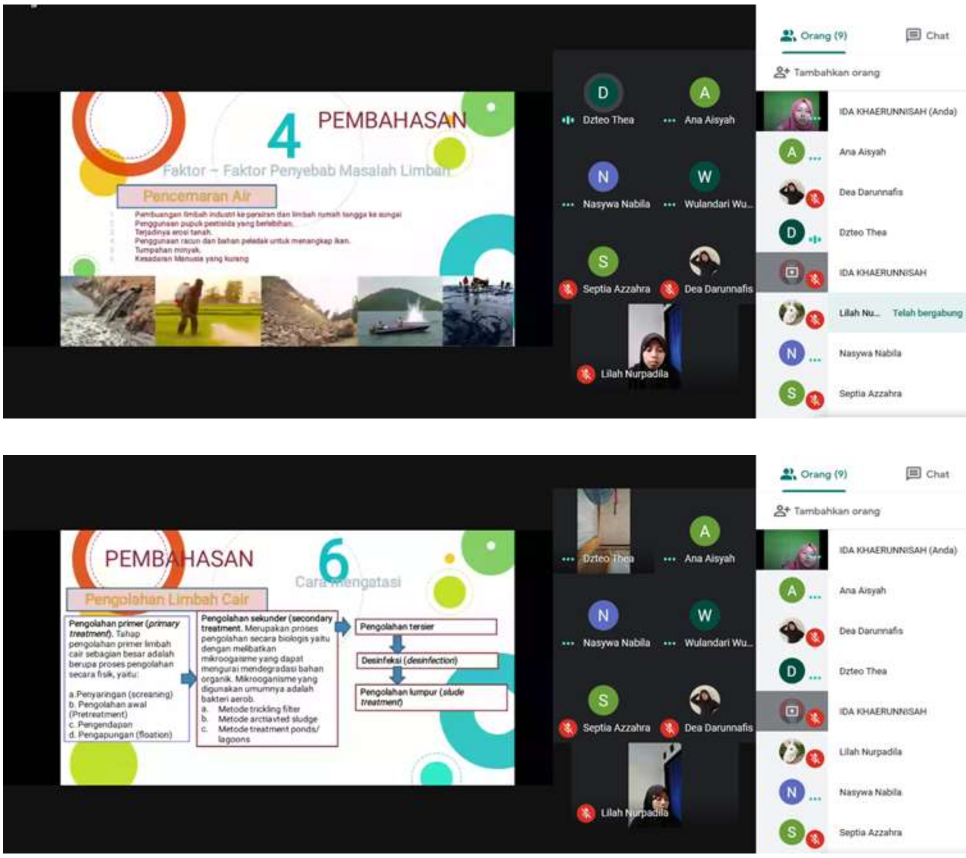

Figure 3. Problem-Solving Activities in the Create Stage at the Third Meeting Through Google Classroom

In Figure 3, Group 2 is observed presenting the outcomes of their problem-solving activities, focusing on the factors contributing to the problem. This exemplifies elaborative thinking, an indicator of creative thinking. The chosen problem revolves around the treatment of solid, liquid, and gas waste derived from industrial products or human activities in their daily lives, utilizing colloids. During the presentation, the students highlighted six key points, including the disposal of industrial waste into water sources, household waste into rivers, excessive pesticide usage, soil erosion, the use of toxins and explosives for fishing, and oil spills. They also emphasized the lack of awareness among humans. To support their points, students supplemented their presentations with relevant visuals and imagery.

Furthermore, the information presented is directly connected to the formulation of actions or the design of experiments as potential solutions to address the identified problems. This aspect signifies the indicator of creative thinking, specifically original thinking. Students shared valuable insights on the treatment of liquid waste, discussing diverse methods that are currently being developed on a significant industrial scale. The methods they convey are a) Primary treatment, this stage is in the form of physical processing of existing liquid waste, b) Secondary treatment, namely biological treatment involving microorganisms which are generally aerobic bacteria, c) Tertiary treatment, special processing because it adjusts the remaining content in wastewater, d) Disinfection, which aims to kill or reduce pathogenic microorganisms in waste. These processing methods can be implemented individually or in combination, and they can also be adapted or modified according to specific needs. In addition to addressing liquid waste, the presentation also covered strategies for handling solid and gas waste. The students proposed solutions such as imposing fines on individuals who dispose of waste in water bodies and installing warning boards in various locations to discourage indiscriminate waste disposal.

The presenting group aimed to gather comprehensive and captivating information through this problem-solving activity, ensuring that other students could easily comprehend the conveyed message. They also expressed their opinion regarding the significance of waste management from an early age, emphasizing that taking proactive steps toward a healthier environment would benefit everyone. Conversely, they highlighted the negative consequences of environmental pollution and emphasized the collective responsibility of creating a clean and healthy environment. The other groups attentively listened as the presented information was new and previously unfamiliar to them. Each group representative took turns sharing their problem-solving outcomes using the PowerPoint presentations they had prepared.

Throughout each stage of the RADEC learning process, creative thinking skills are consistently nurtured. Figure 4 illustrates the attainment of creative thinking skill indicators during the Create stage, which specifically focuses on problem-solving.

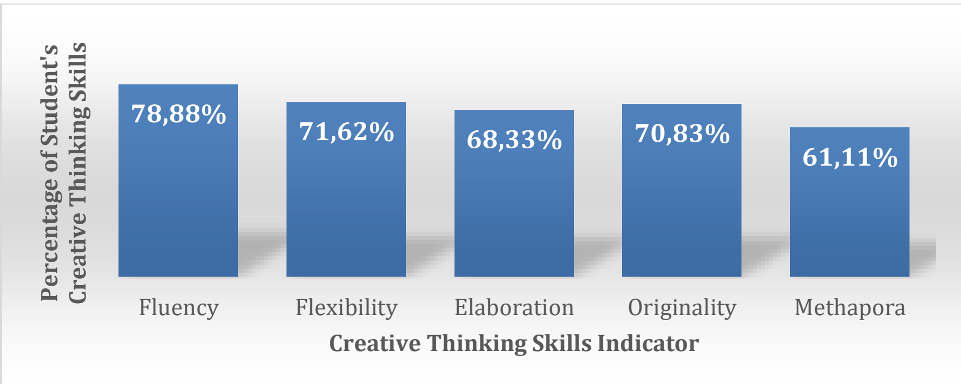

Figure 4. Percentage of Achievement indicator Creative thinking in Problem Solving-oriented RADEC Learning.

The fluency ability (fluent thinking) indicator exhibits the highest percentage compared to other creative thinking skill indicators. This is evident as students demonstrate their capacity for independent thinking by generating creative ideas when responding to pre-learning questions during the Answer stage and formulating problem questions in the Create stage within their groups. Each student contributes one to three distinct ideas as potential problem statements to be explored for solutions. The process begins with a student proposing a problem-solving idea, followed by another student presenting an additional idea. The students then seek confirmation from the teacher regarding the accuracy and suitability of their ideas.

The next indicator, flexible thinking, demonstrates a percentage of 71.62%. This is evident in the groups' collective agreement when selecting problem-solving questions and providing a rationale for the significance of those problems. Among the three groups, they confidently determined problem-solving questions through group consensus. However, the remaining two groups delegated the decision-making process to their group leaders or individuals perceived as more knowledgeable, who determined the problem-solving questions along with providing justifications for addressing the identified problems.

The subsequent creative thinking skill is reflected in the indicator of original thinking (originality) with a percentage of 70.83%. This indicator becomes apparent during the Create stage of learning, where students propose alternative solution ideas beyond those provided by the teacher. They also formulate action plans to address the identified problems, seeking consultation with the teacher when necessary. Based on the discussions held by the five groups, all groups were able to generate problem-solving questions. Among them, three groups—Groups 1, 3, and 5—introduced fresh problem-solving ideas. Group 1 explored the issue of water pollution with the problem formulation of "How can we eliminate water pollution in the future?" Group 3 focused on purifying contaminated water for daily usage, formulating the problem as "How can we treat dirty water to make it suitable for daily needs?" Group 5 delved into the impact of food containing additives, preservatives, and sweeteners devoid of nutrition, formulating the problem as "What would happen if food lacking nutritional value and containing additives, preservatives, and sweeteners continues to be consumed?". On the other hand, two groups—Groups 2 and 4—presented problem-solving ideas similar to the exemplified ones. Group 2 tackled the issue of cigarette smoke as a colloidal system, formulating the problem as "How can we eliminate careless smoking in public places?" Group 4 focused on waste treatment encompassing solid, liquid, and gas waste derived from industrial products and human activities that involve colloidal substances, formulating the problem as "How can we effectively treat solid, liquid, and gas waste containing colloids from industrial and daily activities?"

The ability to think elaboratively (elaboration) exhibits a percentage of 68.33%. This is observed through student activities such as making predictions regarding the potential consequences if a problem is left unresolved and identifying the factors contributing to the occurrence of problems. However, it is worth noting that students' prediction skills often lack detailed analysis. Their answers tend to provide a general outline, and there may be instances of repeated responses.

Figure 4 illustrates that the ability of metaphorical thinking has the lowest percentage. This can be attributed to students not being accustomed to exploring new concepts and making connections between unrelated elements that are interrelated, leading to effective problem-solving. Consequently, when evaluating the success of the formulated actions in solving problems, students struggle to provide explanations with logical and coherent analogies. Only two out of three groups have engaged in discussions concerning the relationship between the colloid concept and the problem at hand. This lack of metaphorical thinking may stem from various factors. It could be due to incomplete reading of the information sources, the abundance of reading materials, or simply a failure to finish reading all the necessary materials. As a result, students may struggle to link one solution to another or consider alternative perspectives in problem-solving. Additionally, based on observations, it was noticed that two out of five groups relied on the decision-making authority of their group leader or the most academically adept student. Consequently, these students faced challenges in directing the subsequent discussion process. However, if students encounter such difficulties within their groups and are unable to resolve them collectively, they are encouraged to report the issues to the teacher. The teacher can then provide further guidance and clarification to ensure the continuity of the problem-solving process.

4. Conclusion

The implementation of the solution-oriented RADEC model in the colloidal learning process effectively cultivates students' creative thinking skills. This is substantiated by the improvement in learning outcomes as demonstrated by the pre-test and post-test scores. Furthermore, the active engagement of students in the problem-solving process during the Create stage, as reflected in the successful utilization of LKPD (student worksheets), indicates positive results. Each stage of the RADEC model actively engages students in honing their thinking processes. As a result, they become adept at approaching problem-solving tasks that are relevant to their everyday lives. This acquired skill set is not only beneficial in the present but also equips students for future challenges, enabling them to navigate real-world situations effectively.

Based on the RADEC learning activities in class, students' creative thinking skills can be raised with the percentage of fluency (78.88%), flexibility (71.62%), originality (70.83%), elaboration (68.33%), and metaphorical thinking (61.11%). The findings demonstrate that all stages of the RADEC model effectively nurture students' creative thinking abilities. The model creates an inclusive learning environment that encourages students to generate and contribute their creative ideas. It provides ample opportunities for students to explore their imagination and engage in innovative thinking throughout the learning process.

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