

STRENGTHENING THE RADEC MODEL IN SCIENCE LEARNING TO SUPPORT STUDENTS' HIGHER-ORDER THINKING SKILLS: SYSTEMATIC LITERATURE REVIEW

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Abstract

Science learning at the elementary school level requires a pedagogical approach that can encourage the development of higher-order thinking skills (HOTS) as part of improving the quality of the learning process. The RADEC (Read, Answer, Discuss, Explain, Create) model is considered relevant because it includes systematic, collaborative learning stages, and is oriented towards knowledge construction. Based on this need, this study aims to examine the forms of strengthening the RADEC model in science learning and its contribution to the development of students' HOTS. This study used the Systematic Literature Review (SLR) method by analyzing scientific articles that met the criteria for eligibility and relevance. The results of the review indicate that strengthening RADEC is carried out through the integration of contextual media, the development of HOTS-based teaching tools, the implementation of collaborative strategies, and the use of authentic assessments. These various forms of strengthening play a role in optimizing the RADEC stages, thereby supporting the improvement of analytical, evaluative, creative, scientific communication, and active participation skills of students. Overall, the SLR findings indicate that RADEC has substantive potential in strengthening the quality of science learning and supporting the achievement of higher-order thinking skills in elementary school students.

Keywords: Elementary School; RADEC; Science; HOTS

Abstrak

Pembelajaran IPAS pada jenjang sekolah dasar menuntut adanya pendekatan pedagogis yang mampu mendorong pengembangan kemampuan berpikir tingkat tinggi (HOTS) sebagai bagian dari peningkatan kualitas proses belajar. Model RADEC (Read, Answer, Discuss, Explain, Create) dipandang relevan karena memuat tahapan pembelajaran yang sistematis, kolaboratif, dan berorientasi pada konstruksi pengetahuan. Berdasarkan kebutuhan tersebut, penelitian ini bertujuan untuk mengkaji bentuk-bentuk penguatan model RADEC dalam pembelajaran IPAS serta kontribusinya terhadap pengembangan HOTS siswa. Penelitian ini menggunakan metode Systematic Literature Review (SLR) dengan menganalisis artikel ilmiah yang memenuhi kriteria kelayakan dan relevansi. Hasil telaah menunjukkan bahwa penguatan RADEC dilakukan melalui integrasi media kontekstual, pengembangan perangkat ajar berbasis HOTS, penerapan strategi kolaboratif, dan penggunaan asesmen autentik. Berbagai bentuk penguatan tersebut berperan dalam mengoptimalkan tahapan RADEC sehingga mendukung peningkatan kemampuan analitis, evaluatif, kreativitas, komunikasi ilmiah, dan partisipasi aktif siswa. Secara keseluruhan, temuan SLR mengindikasikan bahwa RADEC memiliki potensi substantif dalam memperkuat kualitas pembelajaran IPAS dan mendukung pencapaian kemampuan berpikir tingkat tinggi pada siswa sekolah dasar.

Kata Kunci: Sekolah dasar; RADEC; IPAS; HOTS

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Introduction

Education demands that students not only have cognitive mastery of knowledge in 21st Century but also be able to develop higher-order thinking skills (Winaryati, 2018). Higher Order Thinking Skills (HOTS) are the ability to think at a more complex cognitive level through

the application of problem-solving strategies, learning taxonomies such as Bloom's Taxonomy, teaching, and evaluation (Rahayuningsih and Jayanti, 2019). HOTS encompasses the ability to analyze, evaluate, and create, enabling students to face complex challenges and rapid change in the era of globalization (Ulu Kalin et al., 2024). However, in practice, the HOTS skills of elementary school students in Indonesia are still relatively low. Many students only focus on memorizing concepts and are unable to connect knowledge to real-world situations that require critical problem-solving (Mashlihah et al., 2025). This issue is increasingly apparent in science learning. Studies show that science learning in elementary schools is still dominated by lecture-based and teacher-centered methods, thus providing little space for students to engage in critical, creative, and scientific processes (Ariana, 2022). In fact, science is a subject with significant potential for developing higher-order thinking skills through inquiry and problem-solving activities based on real-world phenomena in the surrounding environment. One learning approach considered relevant for developing higher-order thinking skills (HOTS) is the RADEC (Read, Answer, Discuss, Explain, and Create) learning model. This model places students at the center of learning through systematic stages ranging from reading, answering, discussing, explaining, and creating, so that students are actively involved in the critical and creative thinking process. The RADEC approach provides opportunities for students to build a deep understanding of concepts and apply them in real-life learning contexts (Munjiah et al., 2024). The implementation of the RADEC model has been proven effective in improving elementary school students' higher-order thinking skills (HOTS) because it encourages them to analyze information, solve problems, and communicate ideas in a logical and meaningful manner (Maspiroh & Sartono, 2023). Other research also shows that the RADEC model can improve students' critical, creative, and collaborative thinking skills in science learning (Yulianti et al., 2024).

Several empirical studies confirm that RADEC learning has a significant impact on strengthening elementary school students' HOTS. This model is effective because it integrates literacy activities, conceptual understanding, collaborative discussions, and creative projects that challenge higher-order thinking skills (Rindiana et al., 2023). The success of the RADEC model implementation is also influenced by teacher readiness, the selection of appropriate materials, and the use of appropriate HOTS assessment instruments (Sofandi, 2019). However, research on strengthening RADEC in elementary schools has not been systematically mapped. There are variations in how this model is implemented, such as in the selection of science topics, duration of implementation, assessment strategies, and supporting and inhibiting factors that influence its success. Therefore, a systematic literature review is needed that can identify, analyze, summarize, and synthesize the results of previous research on strengthening the RADEC learning model to support elementary school students' higher-order thinking skills in science subjects.

This study is novel because it systematically analyzes and maps the strengthening of the RADEC learning model in science learning in elementary schools as an effort to support the improvement of students' Higher Order Thinking Skills (HOTS). Different from previous studies that tend to only describe some of the RADEC stages and examine learning outcomes without looking at the strengthening aspects of the model, this study comprehensively identifies the strengthened RADEC stages, the role of each stage in HOTS development, and the trends in research findings regarding the potential of RADEC for students' higher-order thinking skills. The Systematic Literature Review (SLR) approach used allows this study to present a broader and integrated review of various previous studies. This provides a new picture of the potential of RADEC as a model capable of stimulating critical, creative, analytical, and evaluative

thinking skills in science learning. Through this analysis, this study provides new contributions in the form of theoretical and practical recommendations on how RADEC can be strengthened and optimized to support the development of students' HOTS. Thus, this study can be an important reference for educators and researchers in designing science learning strategies that are more oriented towards the development of higher-order thinking skills in elementary schools.

Research Methods

This study used the Systematic Literature Review (SLR) method. The purpose of this study was to identify, evaluate, and analyze literature that discusses strengthening the Read, Answer, Discuss, Explain, and Create (RADEC) learning model in supporting Higher Order Thinking Skills (HOTS) for elementary school students, particularly in science subjects. The SLR approach was chosen because it can provide a comprehensive and structured understanding of the RADEC learning model in the context of elementary education. The research stages, by searching for articles spanning the 2021-2025 period through the Publish or Perish application in the Google Scholar database with the keywords "RADEC", "Higher Order Thinking Skills", "Elementary School" and "Natural Sciences". Next, the articles found will be selected through the title and abstract screening stage, then full article selection will be carried out to ensure suitability to the research topic. Articles that meet the criteria will be analyzed thematically to identify strengthening the RADEC learning model.

Next, the articles were analyzed based on the research questions. The research questions that served as the basis for the data analysis included:

1. What are the forms of strengthening the RADEC model in science learning to support students' high-level thinking skills (HOTS)?
2. Which aspects of the RADEC model are strengthened to support the improvement of students' higher-order thinking skills (HOTS) in science learning?
3. What is the potential of the RADEC model in strengthening students' HOTS abilities in science learning?

The data analysis technique in this study followed the PRISMA diagram guidelines to provide transparency in the literature selection process. In addition to the PRISMA-based selection process, this study also applied a quality appraisal stage to ensure that the articles analysed were of sufficient methodological quality. Quality assessment was carried out by examining several key aspects, including: clarity of research objectives, appropriateness of research design, clarity of RADEC model implementation procedures, validity of HOTS measurement instruments, and accuracy of data analysis techniques used. Each article was assessed descriptively based on these criteria to ensure the credibility and relevance of the research findings.

Articles that passed the eligibility stage were not given a quantitative weight in the form of a numerical score, but were considered qualitatively based on the strength of the evidence and their contribution to strengthening the HOTS-based RADEC model. Thus, all articles analysed met the minimum quality standards and had a relatively equal quality weight as a basis for data synthesis. The data analysis process in this study applied the PRISMA method.

1. Identification Stage

The article search was conducted using Publish or Perish software using the Google Scholar database. The keywords used were "RADEC," "Higher Order Thinking Skills," "science learning," "energy and its transformation," and "elementary school."

This resulted in 147 articles. Subsequent filtering was conducted based on the 2021–2025 period, resulting in 114 articles.

2. Screening Stage

Selection was conducted by reading the title and abstract of each article to ensure relevance to the research focus. At this stage, articles that showed a mismatch in focus, lacked a direct connection to the research variables, or were duplicates of other articles were eliminated. Based on this screening process, 79 articles were excluded, leaving 35 articles for the next eligibility assessment stage.

3. Eligibility Stage

At the eligibility stage, the articles to be used must meet predetermined criteria. These criteria aim to ensure that the articles meet the predetermined inclusion criteria. Research articles that meet the inclusion criteria will be used in the data analysis process, while articles that do not meet these criteria will be excluded from the data analysis according to the exclusion criteria. Details of the inclusion and exclusion criteria are presented in Table 1.

Table 1. Inclusion and Exclusion criteria

No.	Inclusion Criteria	Exclusion Criteria
1.	The article is the result of empirical research	Articles are only theoretical studies, reviews, or device development without classroom trials.
2.	Implementing the RADEC learning model	Not using the RADEC model or just mentioning it without implementation
3.	Measuring students' HOTS improvement	Does not measure HOTS or only addresses basic cognitive learning outcomes (LOTS)
4.	Focus on science learning in elementary school	Focus on subjects other than science/science
5.	The research subjects were elementary school students.	The research subjects were not elementary school students
6.	Articles are published in Indonesian or English	Articles published not in Indonesian/English
7.	Articles are available in full text and as journals.	The article is not in the form of a journal but proceedings, book repository and not a relevant platform.

Researchers analyzed the alignment of content with research objectives, as many as 28 articles were eliminated because they did not meet the inclusion criteria.

4. Included Stage

The final stage was the inclusion of articles eligible for analysis. Seven articles that met all inclusion criteria were then used as primary sources in the data synthesis process. These articles served as the basis for an analysis of the effectiveness of the HOTS-oriented Radec model implementation in improving fourth-grade students' higher-order thinking skills.

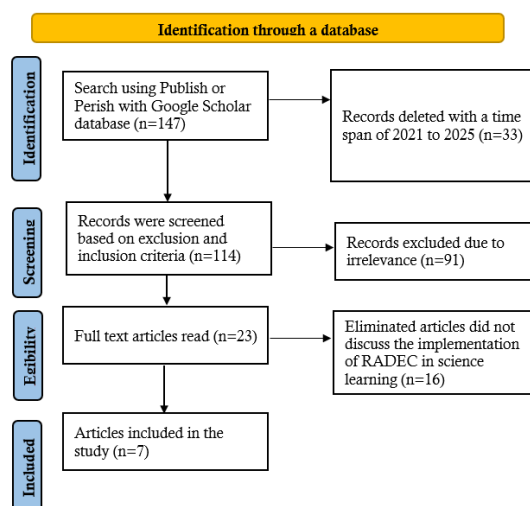


Figure 1. Prism Method

Result and Discussion

In order to analyze the strengthening of the RADEC (Read, Answer, Discuss, Explain, and Create) learning model in elementary school learning and answer the research questions, a selection of seven relevant scientific articles was conducted based on the publication year range of 2021 to 2025. An article search through Google Scholar found 147 articles with the keywords "RADEC learning model", "HOTS", "higher-order thinking", and "elementary school". Furthermore, the articles were filtered to only cover topics about the implementation of RADEC in science learning in elementary schools.

Table 2. Analysis of RADEC Strengthening Articles

Writer	Title	Research methods	Research result
Magfirah, Muh. Erwinto Imran, Amri Amal	The Influence of the RADEC Model (Read, Answer, Discussion, Explain and Create) on Higher Order Thinking Abilities	Quasi-experimental (Independent Sample t-Test)	The RADEC model was applied to the experimental class and compared with PBL. The sig value (2-tailed) = 0.035 < 0.05 indicates that RADEC is more effective in improving students' critical thinking skills and activeness.
Rifa Kurnia Agriyana	Higher Order Thinking Skills (HOTS) of Fifth Grade Elementary School Students Through the RADEC Learning Model on the Water Cycle Material	Quasi-experimental (experimental & control classes)	The RADEC model was applied to the experimental class with complete steps. The results showed a significant increase in HOTS skills in the experimental class compared to the control class.
Holifa Kurniayati, Framz Hardiansyah, Tri Sukitman	The Influence of the Radec Learning Model in Improving Students'	Qualitative approach with case study research type	RADEC was implemented to foster participation and collaboration through discussion activities

	Participation and Collaboration Skills in Elementary Schools		(Discuss) and collaborative product creation (Create). Results showed improvements in students' communication, cooperation, and participation skills, which support higher-order thinking skills.
Nida 'Ilmi Amalia, Khusna Widhyahrini, Oktio Frenki Biantoro	The Effectiveness of The RADEC Learning Model on High Order Thinking Skills (HOTS) in Science Learning	Quantitative (One Group Pretest-Posttest)	RADEC was fully implemented in the fourth grade material on changes in state of matter. Students read scientific texts, answered questions, discussed, explained results, and created simple products. HOTS scores increased from 43.03 to 79.24 with an N-Gain of 0.74 (high category).
Siti Rukhoyah Fitriyah, Ali Ismail, Isrok'atun	The Effect of the Video-Assisted Read, Answer, Discussion, Explain and Create (RADEC) Learning Model on Concept Mastery in the Material on Changes in the State of Objects	Quasi-experimental (Nonequivalent Control Group)	RADEC was conducted using learning videos used in the Read and Explain stages. The test results showed a significance level of $0.000 < 0.05$, indicating a significant increase in concept mastery and critical thinking skills.
Ariq Nabil Abdillah, Poppy Anggraeni, Ai Hayati Rahayu	The Effect of the Read, Answer, Discussion, Explain and Create (RADEC) Learning Model Assisted by Digital Comic Media on Higher-Order Thinking Skills	Pre-experimental (One Group Pretest-Posttest)	RADEC was implemented with the aid of digital comics to engage students in reading during the Read phase and support group discussions. Results showed an increase in the average score from 52.50 to 83.33, with an effect size of 2.45 (high category).
Anisa Fatmawati, Poppy Anggraeni, Nandang Kusnandar	Efforts to Improve Oral Activity and HOTS Science Skills for Single Substances and Mixed Substances Through the Read-Answer-Discussion-Explain and Create Model	Classroom Action Research	The RADEC model was implemented in five stages (Read, Answer, Discuss, Explain, and Create) on single substances and mixtures. The teacher acted as a facilitator at each stage. The implementation of RADEC increased students' oral activity from 69% to 87% and HOTS from 72% to 90%.

The analysis of seven articles shows that strengthening the RADEC model in science learning is generally carried out through the use of contextual learning media, the development of analytical-based worksheets (LKPD), collaborative strategies, and authentic assessments. Abdillah et al.'s (2025) study reinforced learning with digital comics that attract interest and help students' initial understanding, while Fitriyah et al.'s (2024) used videos of scientific phenomena to provide a concrete illustration of the material on changes in the state of matter. Reinforcement through HOTS-based LKPDs is seen in Fatmawati et al. (2025) study which includes images, graphs, and analytical questions, as well as in Nida 'Ilmi Amalia et al.'s (2024) and Amalia et al.'s (2024) studies which use open-ended questions and analysis of experimental results. In addition, collaborative strategies and authentic assessments also emerged as forms of reinforcement, such as group discussions in Kurniatati et al. (2025) study and the task of creating a miniature water cycle in Agriyana (2024) study.

The reinforcement conducted in these studies then focused on specific aspects of the RADEC model. The Reading aspect was reinforced through visual media that helped students gain a good initial understanding. The Answering aspect was reinforced primarily through analytical questions in the Student Worksheet (LKPD), as in the studies of Fatmawati et al. (2025) and Amalia et al. (2024). The Discussing aspect was the most reinforced aspect, as seen in the studies of Kurniatati et al. (2025) and Magfirah et al. (2024) who used group discussions to encourage students' evaluation and argumentation skills. The Explaining aspect was reinforced through presentations and written explanations that helped students communicate their thinking processes in a more structured manner, as shown in the studies of Nida 'Ilmi Amalia et al. (2024) and Amalia et al. (2024). In addition, the Create/Evaluating aspect was reinforced through project activities and the creation of science products, such as the miniature water cycle in the study of Agriyana (2024), which encouraged students' creativity and synthesis.

From the overall findings, the RADEC model has strong potential in improving elementary school students' higher-order thinking skills. Research by Fatmawati et al. (2025) and Amalia et al. (2024) shows the potential of RADEC in improving students' analytical skills through reading activities, answering questions, and analyzing experimental results. Students' evaluative abilities develop through activities of providing responses and assessing friends' arguments, as seen in the research of Magfirah et al. (2024). RADEC also has the potential to develop students' creativity through the creation of science products as shown by Agriyana (2024). In addition, RADEC strengthens students' participation, activeness, and scientific communication through group discussions and presentation activities, as reported by Kurniatati et al. (2025) and Nida 'Ilmi Amalia et al. (2024). Overall, these seven articles show that RADEC has consistent potential in supporting students' analytical, evaluation, creativity, and scientific communication skills in science learning.

The results of the study show that strengthening the RADEC learning model in science learning is able to support students' high-level thinking skills in elementary schools.

1. Strengthening the RADEC Model in Science Learning to Support Students' HOTS

Reinforcement of the RADEC model in science learning focuses more on providing supporting tools capable of stimulating higher-level cognitive activity. Reinforcement through contextual media, analytical worksheets (LKPD), collaborative strategies, and authentic assessments is a consistent pattern across all articles analyzed. This suggests that RADEC is not merely understood as a sequence of learning steps, but as a framework that can be optimized by providing a stimulus-rich learning environment. The use of visual media such as digital comics and scientific videos can strengthen students' initial understanding.

Digital comics enable students to build more concrete initial perceptions through visualization of stories (Abdillah et al., 2025), while videos of scientific phenomena help students make initial observations before entering more complex analytical activities (Fitriyah et al., 2024). These findings align with Pratiwi et al. (2018), who asserted that visual media increases attention and facilitates stronger mental representations, which then support higher-level thinking activities. Reinforcement through visual media is also evident in the study by Fitriyah et al. (2024), who used videos of scientific phenomena to clarify the concept of changes in the state of matter. The video presents real-life events relevant to everyday life, encouraging students to connect personal experiences with scientific explanations. This aligns with research by Supriatin et al. (2023), which shows that interactive videos can improve critical thinking skills by providing concrete stimuli in the surrounding environment.

In the study by Fatmawati et al. (2025), student worksheets (LKPD) were designed with images, graphs, and analytical questions, encouraging students to interpret data, connect information, and develop logical reasoning. These LKPDs function as instruments that guide students to think at a higher level than simply understanding basic concepts. These findings are supported by the findings of Wibowo et al. (2022), who stated that HOTS LKPDs play a crucial role in stimulating analytical skills because they require students to interpret independently. Reinforcement can also be achieved through collaborative strategies used to deepen discussions and exchange ideas. In the study by Kurniatati et al. (2025), students worked in small groups so they could compare ideas, provide feedback, and develop shared understanding. This type of interaction supports the development of evaluative skills because students are accustomed to assessing the accuracy of their peers' opinions. This aligns with the findings of Hoehn (2020), who explained that argumentative dialogue in small groups can improve argumentation and speaking skills in class.

In Agriyana's (2024) study, students created a miniature water cycle as a form of product assessment. This activity required creativity, conceptual understanding, and the ability to translate abstract ideas into tangible forms. Fatmawati et al.'s (2025) study demonstrated similar reinforcement through experimental report assignments that required students to systematically explain scientific work processes. This finding is consistent with Hasnunidah et al.'s (2024) study, which stated that project-based assessment can develop synthesis and creativity skills because students must design products that reflect the concepts learned. Overall, the various forms of reinforcement found in the seven studies indicate that RADEC has great potential to be developed through appropriately designed supporting tools. The use of visual media, analytical worksheets, collaborative discussions, and authentic assessments not only enrich the RADEC stages but also expand students' thinking space so that science learning can be more critical, contextual, and meaningful.

2. Aspects The RADEC Model in Science Learning to Support Students' HOTS

A review of seven articles shows that strengthening the RADEC model in science learning is not carried out uniformly across all stages of the model, but rather focuses on aspects that have the greatest contribution to the development of higher-order thinking skills (HOTS). Three main aspects that consistently receive attention are the initial understanding aspect (Reading), the dialogue and argumentation aspect (Discussing), and the creation and evaluation aspect (Create/Evaluate). The initial aspect of RADEC, when students read or obtain initial information, is reinforced with contextual media that supports conceptual understanding (Abdillah et al., 2025). This is supported by research showing that RADEC is significantly associated with increased reading comprehension skills, including in scientific literacy, compared to conventional methods (Rakhma et al., 2025). In addition to initial

understanding, the Answering aspect, which in practice is often manifested through worksheets (LKPD) containing analytical questions or graphical data (Fatmawati et al., 2025). In the case of studies using HOTS-based LKPD, students are required to interpret graphs, describe information, and formulate answers based on their critical understanding of the text or data. This is evident in research found in the RADEC literature, which emphasizes analytical activities (Fitria and Setiyawati, 2024). This aspect is strengthened because analytical thinking, interpreting data, explaining causal relationships, and drawing conclusions from findings, are all part of higher-order thinking skills. By providing analytical stimuli through student worksheets (LKPD), RADEC facilitates students' ability to not only receive information but also process and understand it in depth before moving on to discussion or creation.

A discussion emerged as the aspect most frequently reinforced. Many studies use group or pair discussions to enable students to exchange ideas, present arguments, and evaluate each other's opinions. This strategy helps students compare ideas, test logic, and build collective reasoning—activities synonymous with higher-order thinking indicators such as evaluative analysis and reflection (Salsabila et al., 2025). External literature also supports the argument that RADEC significantly improves critical thinking skills after students go through a process of discussion, analysis, and reflection together. This suggests that discussion is not merely a supplementary activity, but rather the cognitive core of RADEC, enabling students to think more broadly, consider multiple perspectives, and hone their evaluative and argumentative skills collectively (Rizal et al., 2024).

The final stage of RADEC, Create, has also received attention in many studies as a reinforced aspect. Some studies task students with creating tangible products (e.g., miniature water cycles) or writing experimental reports as a way to reflect on understanding and concretely test concepts (Agriyana, 2024). This form of reinforcement demonstrates that RADEC goes beyond understanding and discussion, but also provides space for students to translate knowledge into work, process information through reflection, and practice its application. These creative activities support higher-order thinking skills in the synthetic and evaluative categories and facilitate students' thinking as budding scientists, exploring, formulating hypotheses, and generating solutions or conceptual representations (Nurjannah et al., 2023).

3. The Potential of the RADEC Model in Science Learning to Support Students' HOTS

Analysis of various studies shows that the RADEC (Read, Answer, Discuss, Explain, Create) learning model has strong potential in supporting students' higher-order thinking skills (HOTS). This potential is consistent in several aspects, namely analytical, evaluative, creativity, active participation, and scientific communication skills, which are in accordance with the characteristics of 21st-century learning. Research by Fatmawati et al. (2025) and Amalia et al. (2024) shows the potential of RADEC in improving students' analytical skills through reading activities, answering questions, and analyzing experimental results. These activities provide space for students to develop analytical skills which are indicator C4 in Bloom's taxonomy, in line with the findings of Setyawan et al. (2023) who stated that analysis-based learning can improve students' analytical skills. Research by Fatmawati et al. (2025) and Amalia et al. (2024) shows the potential of RADEC in improving students' analytical skills through reading activities, answering questions, and analyzing experimental results. These activities provide space for students to develop analytical skills which are

indicator C4 in Bloom's taxonomy, in line with the findings of Setyawan et al (2023) which state that analysis-based learning can improve students' analytical abilities.

Another aspect that demonstrates RADEC's potential is its ability to develop students' creativity and creative abilities. Agriyana's (2024) research on creating a miniature water cycle project demonstrated that students were able to combine scientific concepts with visual creativity to produce products that reflected their in-depth understanding. This type of activity not only assessed the final result but also demonstrated students' divergent thinking skills in formulating ideas and expressing them physically. Meanwhile, Fatmawati et al. (2025) demonstrated that preparing experimental reports provided space for students to systematically organize scientific reasoning and convey their interpretations in written form. This report writing activity is related to creative abilities at the cognitive level, because students do not simply copy information but construct understanding based on their observations. This is in line with research by Yunasih et al. (2024) that in research on fifth-grade students, it showed that the Create stage in RADEC encouraged students to transform abstract concepts into tangible products, thereby strengthening students' creativity. This is in line with Guilford's creativity theory, which emphasizes that creative abilities are influenced by opportunities to develop ideas and produce new works.

RADEC increases student engagement in the learning process. Structured discussion and group work activities encourage students to be more confident in expressing their opinions and actively participate in learning (Fatikhin et al., 2024). Collaboration in RADEC through discussion, exchange of ideas, and clarification of opinions provides space for students to learn from different perspectives and strengthen social-cognitive skills, which are crucial in project-based or investigation-based science learning. Such potential is crucial for developing students who are not only competent individually but also able to collaborate, communicate, and solve problems collectively (Sofira et al., 2025). Students' ability to convey scientific reasoning coherently also improves through RADEC. Research shows that after participating in explain and discuss activities, students are able to convey their thoughts more logically and structured, which is one of the pillars of HOTS (Widodo et al., 2024). This aligns with Bandura's social learning theory, which states that social interaction and observation of peers' strategies can enhance learning.

Conclusion

The strengthening of the RADEC model in science learning consistently contributes significantly to the development of students' higher-order thinking skills, especially in the analytical, evaluative, creativity, scientific communication, and active participation aspects. Various strengthening strategies—from the use of contextual media, the preparation of HOTS-based student worksheets (LKPD), collaborative approaches, to authentic assessments—appear to be able to optimize each stage of RADEC (Read, Answer, Discuss, Explain, Create) in supporting a more meaningful learning process. Overall, these findings indicate that RADEC has strong potential in supporting the quality of science learning and meeting the needs of 21st-century competencies in elementary schools. Based on these research, further research is recommended to examine the effect size of the RADEC model on various HOTS indicators in a more quantitative and comparative manner. In addition, experimental research is needed to examine the integrated implementation of the RADEC model with the Merdeka Curriculum, particularly in the context of differentiated learning, projects to strengthen the Pancasila student profile (P5), and authentic assessment. Research can explore the effectiveness of RADEC at different grade levels, variations in science material, and combinations of RADEC with other

innovative learning models to expand the generalisation and strengthening of the HOTS-based RADEC model.

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