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RADEC Learning Model in Elementary Science Education for Sustainable Learning

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Abstract
Science learning in elementary schools requires instructional models that promote active student engagement and meaningful conceptual understanding in line with the demands of sustainable education. This study aims to systematically review the implementation of the RADEC learning model in elementary science education. The method employed is a systematic literature review of reputable journal articles published between 2020 and 2024, indexed in SINTA levels 1–3 and accessed through Google Scholar. The review process includes identification, selection, and analysis to examine research trends, instructional characteristics, and learning outcomes. The findings indicate that the RADEC model consistently facilitates active learning through the stages of reading, answering, discussing, explaining, and creating, thereby supporting deeper conceptual understanding. Its implementation also enhances student engagement, critical thinking skills, and contextual learning experiences. The RADEC model is considered an effective and innovative approach to improving the quality of elementary science learning and supporting sustainable education goals.
Keywords: *RADEC learning model, elementary science education, sustainable education.*

Abstract
Pembelajaran IPA di sekolah dasar memerlukan model yang mendorong keterlibatan aktif siswa serta pemahaman konseptual yang bermakna sesuai tuntutan pendidikan berkelanjutan. Penelitian ini bertujuan meninjau secara sistematis implementasi model pembelajaran RADEC dalam pembelajaran IPA SD. Metode yang digunakan adalah systematic literature review terhadap artikel jurnal bereputasi periode 2020–2024 yang terindeks SINTA 1–3 melalui Google Scholar. Proses kajian meliputi identifikasi, seleksi, dan analisis untuk mengkaji tren penelitian, karakteristik pembelajaran, dan hasil belajar. Hasil menunjukkan bahwa model RADEC secara konsisten memfasilitasi pembelajaran aktif melalui tahapan membaca, menjawab, berdiskusi, menjelaskan, dan mencipta, sehingga mendukung pemahaman konsep yang lebih mendalam. Implementasinya juga meningkatkan keterlibatan siswa, kemampuan berpikir kritis, serta pengalaman belajar kontekstual. Model RADEC dinilai efektif dan inovatif dalam meningkatkan kualitas pembelajaran IPA SD serta mendukung tujuan pendidikan berkelanjutan.
Kata kunci: *Model pembelajaran RADEC, pendidikan IPA sekolah dasar, pendidikan berkelanjutan.*

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INTRODUCTION

Twenty first century education requires learning processes that are not only oriented toward knowledge acquisition but also toward the development of higher-order thinking skills, literacy, character, and sustainability awareness (UNESCO, 2017). In addition, student-centered and active learning approaches have been widely recognized as effective strategies to improve conceptual understanding and critical thinking skills (Michael Prince, 2004). At the elementary school level, science education plays a strategic role in fostering students' foundational scientific literacy and shaping their scientific ways of thinking from an early age. However, numerous studies indicate that elementary science learning still faces significant challenges, particularly in developing higher-order thinking skills (HOTS), student engagement, and meaningful conceptual understanding (Santiani et al., 2024; Astuti, 2025).

Teacher-centered instructional practices remain prevalent in elementary science classrooms. Learning activities tend to focus on content delivery and rote memorization, resulting in limited student involvement in critical reading, discussion, explanation of ideas, and the application of science concepts to real-life contexts. This condition has been reported to negatively affect students' critical thinking abilities and scientific literacy (Suryana et al., 2021). Ideally, science learning should actively engage students in constructing knowledge through reading, reasoning, discussion, and creative activities.

In response to these challenges, various innovative learning models have been developed to enhance the quality of elementary science education. Recent literature suggests that student-centered learning models emphasizing active engagement contribute significantly to improving both learning processes and outcomes in science education (Rahmadina et al., 2024). One instructional model that has gained increasing attention in recent years is the RADEC learning model (Read, Answer, Discuss, Explain, and Create). RADEC is designed to promote student-centered learning through structured stages, including reading as a foundation for understanding, answering guiding questions, collaborative discussion, explanation of ideas, and the creation of products or solutions as a form of knowledge construction. This model is considered relevant for fostering higher-order thinking skills, literacy, and meaningful learning oriented toward sustainability (Suryanti et al., 2024).

Empirical studies have consistently reported positive effects of the RADEC learning model on elementary science learning. Nadia et al. (2023) found that RADEC enhances students' learning engagement and higher-order thinking skills by providing opportunities for independent reading, discussion, and expression of ideas. Similarly, Samsudin and Firdaus (2022) reported that RADEC effectively improves elementary students' understanding of science concepts.

Beyond cognitive outcomes, RADEC has also been shown to contribute to the development of students' literacy and character. Suryana et al. (2025) demonstrated that RADEC implementation promotes positive character transformation, including responsibility, collaboration, and learner autonomy. Furthermore, several studies have integrated RADEC with the Education for Sustainable Development (ESD) approach and reported improvements in students' sustainability awareness and environmental literacy (Lestari et al., 2021; Lestari et al., 2022; Lestari et al., 2023). These findings indicate that RADEC not only enhances academic achievement but also supports science learning oriented toward sustainable learning goals.

Despite the growing body of research on RADEC, existing studies remain fragmented across different journals with diverse focuses, methods, and findings. Variations in research contexts, participants, and indicators have resulted in the absence of a comprehensive synthesis regarding the implementation characteristics and overall contributions of the RADEC learning model in elementary science education. Therefore, a systematic and structured review is required to integrate and evaluate the existing evidence.

Previous studies on the implementation of the RADEC learning model in science education have generally been conducted in isolated contexts, focusing on specific variables such as learning outcomes, higher-order thinking skills, student engagement, or literacy. These studies are often limited to particular topics, grade levels, or research designs, resulting in findings that are partial and not yet integrated into a comprehensive understanding. In addition, variations in research objectives, methodologies, and measured indicators have led to inconsistencies in reporting the overall effectiveness and characteristics of RADEC implementation in elementary science learning. Consequently, there is a need for a systematic synthesis of existing studies to provide a more holistic and coherent understanding of how the RADEC learning model contributes to science learning in elementary schools.

This study adopts a Systematic Literature Review (SLR) approach to provide a comprehensive, objective, and transparent synthesis of previous research findings. The review is conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure the traceability and validity of the literature selection process (Page et al., 2021). Through a PRISMA-based SLR, this study aims to identify research trends, implementation characteristics, and the impacts of the RADEC learning model in elementary science education.

Although previous literature reviews have examined the RADEC learning model (e.g., Andriyani et al., 2024; Burhandin et al., 2024), these reviews have limitations in terms of contextual scope and specific focus on elementary science learning. Therefore, the present study concentrates on recent empirical studies addressing the implementation of RADEC in elementary science education, with the intention of complementing and enriching existing literature.

Based on the above considerations, this study seeks to systematically examine how the RADEC learning model is implemented in elementary science classrooms and to synthesize its contributions to learning processes, learning outcomes, and the development of students' thinking skills and literacy. Accordingly, this review aims to address the following research questions: (1) What are the characteristics of RADEC implementation in elementary science learning? (2) How does the RADEC learning model influence science learning processes in elementary schools? and (3) What contributions does RADEC provide to elementary students' science learning outcomes, particularly in terms of thinking skills and literacy?

METHODS

This study employed a Systematic Literature Review (SLR) approach guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. A systematic literature review is a structured method used to identify, evaluate, and synthesize relevant research evidence in a transparent and replicable

manner (Page et al., 2021). This approach was selected because it enables a comprehensive, systematic, and transparent synthesis of previous research findings related to the implementation of the RADEC learning model in elementary science education. The SLR method allows researchers to identify, evaluate, and synthesize research evidence objectively based on predefined inclusion criteria.

The research design adopted in this study was a systematic literature review. The review focused on empirical research articles and relevant systematic reviews that examined the application of the RADEC learning model in elementary school science learning. The review process followed the PRISMA stages, including literature identification, screening, eligibility assessment, and the final inclusion of articles for analysis. Adhering to the PRISMA guidelines ensured that each stage of the review process was conducted in a structured and well-documented manner, thereby enhancing the traceability and validity of the review process (Page et al., 2021).

The data sources for this study consisted of scientific articles published in reputable national and international journals. National journal articles were selected from journals indexed in SINTA with a minimum ranking of Level 3, while international articles were obtained from reputable peer-reviewed journals. The reviewed articles were published between 2020 and 2025 to represent recent research developments and to ensure the relevance of the findings to contemporary elementary science learning contexts.

Data collection was conducted through a systematic search of scientific articles using relevant keywords, including RADEC learning model, science learning, elementary school, and elementary science education. The search was performed across selected academic journal databases. All identified articles were subsequently screened based on predefined inclusion and exclusion criteria.

The inclusion criteria for this review were as follows: (1) the article reported empirical research or a systematic review; (2) the study explicitly examined the implementation of the RADEC learning model; (3) the research context involved elementary school science learning; (4) the article was published in a reputable national or international journal; and (5) the full text of the article was accessible. The exclusion criteria included: (1) conceptual or opinion based articles; (2) studies that did not explicitly address the RADEC learning model; and (3) articles that were not relevant to elementary school science learning.

The article selection process was conducted in stages following the PRISMA flow. During the identification stage, all articles retrieved from the database searches were collected. This was followed by a screening stage in which titles and abstracts were reviewed to determine their relevance to the focus of the study. Articles that passed the screening stage were then assessed for eligibility through full text review. Articles that met all inclusion criteria were ultimately included in the final analysis.

The processes of identification, screening, eligibility assessment, and inclusion of articles are visually presented through the PRISMA flow diagram in Figure 1.

Figure 1. PRISMA Flow Diagram of the Article Selection Process

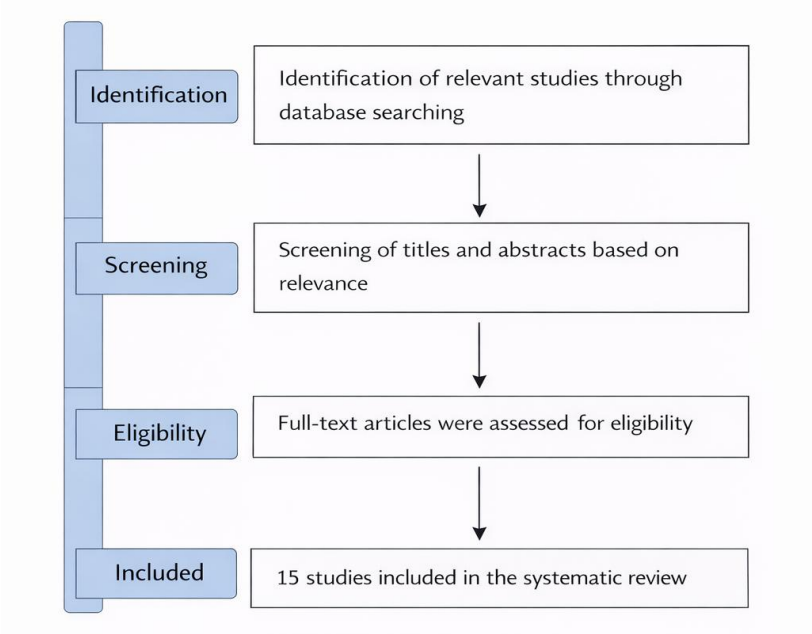
Data analysis was conducted using a qualitative descriptive analysis technique. Each selected article was analyzed to identify key research characteristics, including publication year, research objectives, research design, research participants, and primary research focus. Subsequently, the findings were synthesized to identify patterns, similarities, and differences across studies related to the implementation of the RADEC learning model.

The results of the analysis were organized into major thematic categories based on the focus of the reviewed articles. These themes included: (1) the implementation of the RADEC learning model in elementary science education; (2) the impact of RADEC on higher-order thinking skills, critical thinking, and creative thinking; (3) the contribution of RADEC to scientific literacy, environmental literacy, and Education for Sustainable Development (ESD); (4) the influence of RADEC on student learning activities, collaboration, and character development; and (5) the impact of RADEC on learning outcomes and students' conceptual understanding of science. The synthesis was conducted narratively to provide a comprehensive overview of the contributions of the RADEC learning model to elementary science education.

RESULTS AND DISCUSSION

A. Results

Based on the literature selection process using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach, a total of 15 articles met the inclusion criteria and were analyzed further. These articles were published between 2020 and 2025 and originated from nationally accredited journals indexed by SINTA as well as reputable international journals. All selected studies specifically examined the implementation of the RADEC (Read, Answer, Discuss, Explain, and Create) learning model at the elementary school level, particularly in the context of science (IPA) and IPAS learning.



The results of the selection indicate that research on the RADEC learning model has shown an increasing trend in recent years, particularly studies focusing on the development of 21st-century skills, scientific literacy, and sustainable education. The selected articles were subsequently analyzed to identify research focuses and key findings relevant to the objectives of this study.

Based on the analysis of the selected articles, an overview of research focuses and key findings related to the implementation of the RADEC learning model in elementary science education was obtained. A summary of the main characteristics and findings of the reviewed studies is presented in **Table 1**.

Table 1. Summary of Key Findings on the Implementation of the RADEC Learning Model in Elementary Schools

No	Author (Year)	Research Focus	Main Findings
1	Suryanti et al. (2024)	RADEC and HOTS	RADEC effectively improves students' higher-order thinking skills
2	Lestari et al. (2021)	RADEC based on ESD	RADEC integrates ESD dimensions into science learning
3	Nadia et al. (2023)	Learning activities and HOTS	Students' learning activities and HOTS increased
4	Herawati (2024)	Scientific literacy and environmental awareness	RADEC improves scientific literacy and environmental care
5	Lestari (2023)	Environmental literacy	RADEC contributes to strengthening environmental literacy
6	As'ary et al. (2024)	Collaboration	RADEC enhances students' collaboration skills
7	Samsudin & Firdaus (2022)	Science concept understanding	RADEC improves students' understanding of science concepts
8	Suryana et al. (2025)	Character development	RADEC supports positive character transformation
9	Lestari et al. (2022)	Sustainability awareness	RADEC increases students' sustainability awareness
10	Andriyani et al. (2024)	SLR on RADEC and critical thinking	RADEC positively affects critical thinking skills
11	Suryana et al. (2021)	Creative thinking	RADEC enhances students' creative thinking
12	Fiteriani et al. (2025)	Critical thinking in IPAS	RADEC effectively improves critical thinking skills
13	Kamal et al. (2023)	Literacy	RADEC supports literacy development
14	Sukmawati et al. (2020)	Science learning outcomes	RADEC improves science learning outcomes
15	Burhandin et al. (2024)	SLR on RADEC implementation	RADEC consistently shows positive impacts

These results indicate that most of the reviewed studies reported positive effects of the RADEC learning model on both the learning process and learning outcomes in elementary science education. Overall, the findings suggest that the consistent implementation of the RADEC stages is a key factor in fostering active and meaningful science learning in elementary schools.

B. Discussion

1. Characteristics of RADEC Implementation in Elementary Science Learning

This study aimed to examine the characteristics of RADEC implementation in elementary science education. The findings indicate that the RADEC learning model is consistently implemented through five structured stages: *read, answer, discuss, explain, and create*. These stages reflect a systematic instructional sequence that promotes active student engagement from the beginning of the learning process.

The *read* stage serves as a foundation for initial concept acquisition, enabling students to build prior knowledge before classroom interaction (Samsudin & Firdaus, 2022; Sukmawati et al., 2020). This is followed by the *answer* stage, where students respond to guiding questions that stimulate early cognitive processing.

Furthermore, the *discuss* and *explain* stages emphasize collaborative learning and knowledge articulation. Students actively exchange ideas, clarify misconceptions, and construct shared understanding through social interaction (Nadia et al., 2023; As'ary et al., 2024). The final stage, *create*, encourages students to apply their understanding by producing outputs such as solutions, projects, or contextual responses (Herawati, 2024; Lestari, 2023).

These characteristics demonstrate that RADEC aligns with constructivist learning theory, where students actively construct knowledge through experience and interaction (Burhandin et al., 2024). Thus, RADEC can be characterized as a structured, student-centered learning model that integrates literacy, collaboration, and creativity within science learning.

2. Influence of the RADEC Model on Science Learning Processes

The second objective of this study was to analyze how the RADEC learning model influences science learning processes in elementary schools. The findings reveal that RADEC significantly transforms the learning process from teacher-centered to student-centered learning.

Students become more actively involved in various learning activities, including reading, responding to questions, engaging in discussions, and presenting their ideas. This active participation enhances classroom interaction and promotes meaningful learning experiences (Nadia et al., 2023). In particular, the discussion stage fosters collaboration skills, as students work together to solve problems and share perspectives (As'ary et al., 2024).

In addition, the structured stages of RADEC support a more organized and interactive learning process. Students are not passive recipients of information but are actively engaged in constructing knowledge through guided activities. The integration of reading and discussion also strengthens students' engagement and learning motivation.

Moreover, several studies indicate that RADEC contributes to the development of positive student behaviors and character, such as responsibility, cooperation, and active participation (Suryana et al., 2025; Herawati, 2024). Therefore, RADEC not only improves the procedural aspects

of learning but also enhances the overall quality of the learning process in elementary science classrooms.

3. Contributions of RADEC to Learning Outcomes, Thinking Skills, and Literacy

The third objective of this study was to examine the contributions of the RADEC learning model to students' learning outcomes, particularly in terms of thinking skills and literacy. The findings consistently show that RADEC has a positive impact on multiple dimensions of learning outcomes.

First, RADEC significantly improves higher-order thinking skills (HOTS), including critical and creative thinking. The stages of *discuss*, *explain*, and *create* require students to analyze information, evaluate ideas, and generate new solutions, thereby fostering deeper cognitive engagement (Suryanti et al., 2024; Fiteriani et al., 2025; Andriyani et al., 2024).

Second, RADEC contributes to the development of scientific literacy and environmental literacy. The integration of real-life contexts and sustainability issues within the learning process enables students to understand scientific concepts while developing awareness of environmental problems (Herawati, 2024; Lestari et al., 2021; Lestari et al., 2022).

Third, RADEC positively affects students' conceptual understanding and overall learning outcomes. Students taught using RADEC demonstrate better comprehension of science concepts compared to those experiencing conventional instruction (Samsudin & Firdaus, 2022; Sukmawati et al., 2020). This is because RADEC emphasizes meaningful learning rather than rote memorization.

In addition, the model supports the development of 21st-century competencies, including critical thinking, creativity, collaboration, and communication. These competencies are essential for achieving sustainable education goals, particularly in fostering lifelong learning and responsible citizenship.

Overall, the findings confirm that RADEC is an effective instructional model that enhances cognitive, affective, and skill-based learning outcomes in elementary science education..

Overall, the synthesis of findings indicates that the RADEC learning model consistently provides positive contributions to elementary science education. These contributions include improvements in higher-order thinking skills, scientific and environmental literacy, learning activities and collaboration, character development, and student learning outcomes. The findings support previous studies asserting that RADEC is an innovative learning model aligned with the demands of 21st-century education and sustainable education (Andriyani et al., 2024; Burhandin et al., 2024).

CONCLUSION

This study aimed to systematically examine the implementation and contributions of the RADEC learning model in elementary science education based on three research questions.

First, regarding the characteristics of RADEC implementation, the findings show that the model is consistently applied through five structured stages: read, answer, discuss, explain, and create. These stages reflect a student-centered learning approach that facilitates active engagement, collaborative interaction, and meaningful knowledge construction in science learning.

Second, in terms of its influence on the science learning process, the RADEC learning model transforms classroom practices into more interactive and participatory learning environments. Students are actively involved in reading, discussing, explaining, and creating, which enhances engagement, collaboration, and the overall quality of the learning process.

Third, concerning its contributions to learning outcomes, the RADEC model demonstrates a positive impact on students' higher-order thinking skills, including critical and creative thinking, as well as on scientific and environmental literacy. In addition, the model improves students' conceptual understanding and supports the development of 21st-century competencies and sustainability awareness.

In conclusion, the RADEC learning model can be considered an effective and innovative instructional approach that not only improves learning processes but also enhances learning outcomes in elementary science education. Therefore, RADEC has strong potential to support the implementation of sustainable and meaningful learning at the elementary school level.

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REFERENCES

Andriyani, F., & Ekawati, R. (2024). Systematic Literature Review: Model Pembelajaran RADEC terhadap Keterampilan Berpikir Siswa: Systematic Literature Review. ELSE (Elementary School Education Journal): Jurnal Pendidikan dan Pembelajaran Sekolah Dasar, 8(3). http://dx.doi.org/10.30651/else.v8i3.24425

As' ary, M. Y., Sujana, A., & Sopandi, W. (2024). Analysis of Collaboration Ability in the RADEC Learning Model for Elementary School Students. Mimbar Sekolah Dasar, 11(4), 851-863.. https://doi.org/10.53400/mimbar-sd.v11i4.88317

Astuti, Y. P. (2025). Science Learning in Primary Schools: A Comprehensive Analysis of Curriculum Merdeka Implementation. Journal of Education Research and Evaluation, 9(2), 269-281. https://doi.org/10.23887/jere.v9i2.91470

Burhanudin, B., Maftuh, B., Sujana, A., Sopandi, W., Sapriya, S., & Nanola, N. (2024). The RADEC Learning Model in Primary Schools: A Systematic Literature Review. Mimbar Sekolah Dasar, 11(2), 487-511. https://doi.org/10.53400/mimbar-sd.v11i2.65596

Fiteriani, I., Sopandi, W., & Hernawan, A. H. (2025). Efektivitas Model Pembelajaran RADEC (Read, Answer, Discuss, Explain, Create) Terhadap Keterampilan Berpikir Kritis Siswa Pada Mata Pelajaran IPAS. Jurnal Penelitian Pendidikan IPA, 11(10), 305-311. https://doi.org/10.29303/jppipa.v11i10.12763

Herawati, N., Novita, L., & Jaenudin, D. (2024). Radec Model: Improving Elementary Students' Environmental Care And Science Literacy Through Energy Source Materials. Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar (JPPGuseda), 7(3), 130-139. https://doi.org/10.55215/jppguseda.v7i3.10127

Astuti, Y. P. (2025). Science Learning in Primary Schools: A Comprehensive Analysis of Curriculum Merdeka Implementation. Journal of Education Research and Evaluation, 9(2), 269-281. https://doi.org/10.23887/jere.v9i2.91470

Kamal, M., Sulonglfiani, A., & Melani, M. (2023). Radec Learning and Literacy: Enhancing Students' Literacy through the Development of Radec Learning Model

at Madrasah. Jurnal Iqra': Kajian Ilmu Pendidikan, 8(2), 465-480. https://doi.org/10.25217/ji.v8i2.2938

Lestari, H., Rahmawati, I., Ali, M., Sopandi, W., & Wulan, A. R. (2023). An Innovative Approach to Environmental Literacy: The Sustainable RADEC Learning Model for Elementary Schools. Al Ibtida: Jurnal Pendidikan Guru MI, 10(2), 189-210. http://dx.doi.org/10.24235/al.ibtida.snj.v10i2.13123

Lestari, H., Ali, M., Sopandi, W., & Wulan, A. R. (2021). Infusion of environment dimension of ESD into science learning through the RADEC learning model in Elementary Schools. Jurnal Penelitian Pendidikan IPA, 7(SpecialIssue). https://doi.org/10.29303/jppipa.v7iSpecialIssue.817

Lestari, H., Ali, M., Sopandi, W., Wulan, A. R., & Rahmawati, I. (2022). The Impact of the RADEC Learning Model Oriented ESD on Students' Sustainability Consciousness in Elementary School. Pegem Journal of Education and Instruction, 12(2), 113-122. https://doi.org/10.47750/pegegog.12.02.11.

Nadia, D. O. ., Solfema, S., Miaz, Y. ., & Ardipal, A. (2023). The Effect of RADEC Learning Model on Student Learning Activities and HOTS on Science Learning in Elementary Schools. Jurnal Penelitian Pendidikan IPA, 9(SpecialIssue), 364–371. https://doi.org/10.29303/jppipa.v9iSpecialIssue.6702

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. bmj, 372. https://doi.org/10.1136/bmj.n71

Prince, M. (2004). Does active learning work? Journal of Engineering Education, 93(3), 223–231.

Rahmadina, A., Rohmani, R., & Haryadi, R. N. (2024). Introducing learning models focusing on elementary school science activity in terms of a systemic literature review. Journal of Science and Education (JSE), 4(2), 109-124. https://doi.org/10.56003/jse.v4i2.318

Samsudin, A., & Firdaus, A. R. (2022). THE EFFECTIVENESS OF THE READ, ANSWER, DISCUSS, EXPLAIN, AND CREATE (RADEC) LEARNING MODEL ASSISTED BY FLASHCARD MEDIA IN IMPROVING STUDENTS'UNDERSTANDING OF SCIENCE CONCEPTS IN ELEMENTARY SCHOOL. Edukasi Islami: Jurnal Pendidikan Islam, 11(001), 367-374.. https://doi.org/10.30868/ei.v11i4.3633

Santiani, N. P. E., Parmiti, D. P., & Werang, B. R. (2024). 21st Century Skills Oriented Science Learning Worksheets for Elementary Schools. International Journal of Elementary Education, 8(1), 101-111. https://doi.org/10.23887/ijee.v8i1.62868

Sukmawati, D., Sopandi, W., & Sujana, A. (2020, March). The application of read-answer-discuss-explain-and create (radec) models to improve student learning outcomes in class v elementary school on human respiratory system. In International Conference on Elementary Education (Vol. 2, No. 1, pp. 1734-1742).

Suryana, S. I., Sopandi, W., Sujana, A., & Pramswari, L. P. (2021). Creative thinking ability of elementary school students in science learning using the RADEC learning model. Jurnal Penelitian Pendidikan IPA, 7, 225-232. https://doi.org/10.29303/jppipa.v7iSpecialIssue.1066

Suryana, N., Sopandi, W., Budimansyah, D., & Ruyadi, Y. (2025). Character Transformation Through the Implementation of the Radec Learning Model at the Elementary School Level. Scaffolding: Jurnal Pendidikan Islam dan Multikulturalisme, 7(1), 875-888. https://doi.org/10.37680/scaffolding.v7i1.7268

Suryanti, E., Ihsan, M., Nulloh, A. R., Sulaeman, A. Y., Syafei, I., & Suparman, U. (2024). The Effectiveness of RADEC Learning Model to Improve HOTS (Higher Order Thinking Skill) in Insya'Learning: Efektivitas Model Pembelajaran RADEC untuk Meningkatkan HOTS (Higher Order Thinking Skill) pada Pembelajaran Insya'. al Mahāra: Jurnal Pendidikan Bahasa Arab, 10(1), 1-15. https://doi.org/10.14421/almahara.2024.0101-01

UNESCO. (2017). Education for sustainable development goals: Learning objectives. UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000247444