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The effectiveness of the RADEC learning model in improving student learning achievement

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ABSTRACT

Learning is closely related to student academic achievement as one of the indicators of success. In the era of Society 5.0, many learning models have not met effectiveness standards, thus requiring more relevant innovations. The RADEC (Read, Answer, Discuss, Explain, Create) model is an alternative that encourages active student involvement and enhances learning outcomes. This study aims to examine the effectiveness of the RADEC model in improving the academic achievement of elementary school students. The research employs a quantitative approach with a pretest-posttest control group experimental design involving two elementary school students. Data were collected through tests and observations and analyzed descriptively and inferentially using the Wilcoxon test to measure the effectiveness of the RADEC model in improving learning outcomes. The results indicate that the RADEC learning model effectively improves elementary students' academic achievement through five active stages that promote critical thinking, creativity, and collaboration. The average posttest score of the experimental group reached 83.06. This model also strengthens intrinsic motivation, reflectivity, and 21st-century skills. The role of the teacher as a facilitator and ongoing training are key to the successful and meaningful holistic implementation of the model. This study contributes to the development of innovative learning models relevant to the needs of 21st-century education. The RADEC model proves capable of enhancing student academic achievement, critical thinking skills, creativity, and collaboration. The findings serve as a reference for educators and policymakers in designing effective learning strategies and encourage continuous teacher training to improve the quality of education in elementary schools.

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INTRODUCTION

One of the main challenges in education is the low effectiveness of the learning models used, which is reflected in the unclear understanding of students' understanding of the subject matter. Several experts, such as Kim et al. (2019), Duong et al. (2022), and Martin Alguacil et al. (2024), emphasize that the effectiveness of learning is greatly influenced by students' ability to understand the material comprehensively and systematically. In subjects such as mathematics, for example, students often feel insecure in answering questions, which results in low learning motivation (Robas et al., 2020; Lahdenperä et al., 2022). According to Gamage et al. (2021) and Hinduja et al. (2024), obstacles to student learning stem from internal factors such as learning styles and emotional stability and external factors, such as interactions with teachers. Therefore, a fun and structured learning model is needed. Chin and Osborne (2008) and Nwoko et al. (2023) emphasize the importance of a model responsive to student needs. The RADEC model, which emphasizes reading, answering, discussing, explaining, and creating activities, is considered capable of increasing student engagement and encouraging improvements in overall learning achievement.

Based on studies from several related studies, such as those conducted by Sukmawati et al. (2024), the application of the RADEC model with the CRT approach has proven effective in improving students' 4C skills, with an increase in scores from 58.86 to 78.08. Local culture-based teaching materials, class agreements, and active student involvement influence this success. Research by Fitri & Caswita (2023) shows that the RADEC model can improve the collaborative abilities of low-ability students, which impacts improving mathematics and cognitive scores. Lestari et al. (2021) found that online assistance in implementing RADEC improves teachers' skills in training students' critical thinking skills. In addition, Sutantri et al. (2023) stated that the RADEC model can foster the Pancasila Student Profile with outstanding achievements. Research by Oktavia & Pamungkas (2023) also shows that RADEC is more effective in improving students' numeracy skills than problem-based models. Meanwhile, Anita et al. (2022) proved that RADEC effectively enhances students' reading skills.

Based on the preliminary review, previous studies have shown that the RADEC model is effective in improving various student skills, such as the 4C skills, collaborative abilities and cognitive scores, critical thinking, numeracy, and reading skills, as well as fostering the Pancasila Student Profile. However, most studies have been limited to applying RADEC to specific skills and have not discussed the comprehensive development of the model tailored to the elementary school context. In addition, the overall effectiveness of RADEC in simultaneously improving academic achievement, critical thinking, creativity, collaboration, and intrinsic motivation has rarely been studied. Therefore, research is needed that focuses on developing the RADEC model in elementary schools while testing its overall effectiveness in enhancing learning quality and student skills.

This study aims to examine the effectiveness of the RADEC (Read, Answer, Discuss, Explain, Create) learning model in improving students' academic achievement. Specifically, this research seeks to identify whether the RADEC model is superior to traditional learning models in enhancing students' cognitive, affective, and psychomotor outcomes. The benefit of this study is to provide an overview of how the RADEC learning model can enhance students’ understanding, application, and analysis of the material through a more active and engaged approach. The RADEC model is expected to address issues present in traditional learning processes, where students tend to be passive and less responsive. By using the RADEC model, students are anticipated to become more confident, active, and involved in each stage of learning, ultimately improving their academic performance. The findings of this research are expected to assist teachers in designing and implementing more effective learning models that support the achievement of educational goals.

Based on the research objectives, a preliminary conclusion is that the RADEC learning model has the potential to improve students’ academic achievement through a more active and participatory approach compared to traditional learning models. This model allows students to engage directly in each stage of learning reading, answering, discussing, explaining, and creating thereby supporting the simultaneous development of cognitive, affective, and psychomotor skills. Based on this, the research

questions are: Is the implementation of the RADEC learning model more effective than traditional learning models in improving students' academic achievement? How does the RADEC model affect the development of students' cognitive, affective, and psychomotor abilities comprehensively? And to what extent does active student involvement in each RADEC stage impact motivation, self-confidence, and learning outcomes?

RESEARCH METHOD

This study uses a quantitative approach with an experimental method because this approach is considered effective in presenting data in numerical form to obtain an objective picture of the phenomenon being studied, specifically regarding the development of the RADEC learning model in elementary schools and the effectiveness of its implementation. According to Huyler & McGill (2019), a quantitative approach allows researchers to measure variables objectively and analyze the relationships between variables through statistical procedures. The primary purpose of the experimental method is to test cause-and-effect relationships by providing specific treatments to subjects; as explained by Hariton and Locascio (2018), experiments allow researchers to control variables and observe the effects of the treatment, in this case, the implementation of the RADEC model. This is reinforced by Dash and Paul (2021), who emphasize that experiments provide a strong foundation for testing the effectiveness of an intervention, including in the context of improving students' academic achievement and skills through RADEC in elementary schools.

The research employed a true experimental design with a pretest-posttest control group model, focusing on the development of the RADEC learning model in elementary schools and evaluating its effectiveness. According to Liu and Li (2023), this design provides high internal validity through the random assignment of subjects and comparisons between experimental and control groups before and after the intervention, in this case, the implementation of RADEC. The study involved the entire student population at the elementary school level. Random sampling was applied to ensure that every student had an equal chance of being selected, minimizing selection bias (Ahmed, 2024). This technique also enhances the representativeness of the sample to the population, allowing the findings to more accurately reflect the effectiveness of the RADEC model (Maqbool et al., 2024). By combining controlled experimental procedures with representative sampling, the study aims to provide reliable evidence of RADEC's impact on student learning outcomes.

The sample in this study consisted of two groups: an experimental group that received treatment through the application of the RADEC model and a control group that followed conventional learning. Ding et al. (2023) stated that RADEC model-based learning effectively increases student participation and understanding through reading, asking, exploring, and communicating. In contrast, according to Kosteletos et al. (2023), conventional learning tends to involve students less actively in the learning process. The number of students in the experimental group was 13 people, while the control group consisted of 30 people.

Data collection in this study was carried out through tests and observations to obtain a comprehensive picture of students' learning outcomes and behavior. The test consisted of 20 multiple-choice questions used as a pretest and posttest to measure initial abilities and learning achievements after the treatment. According to Pluye et al. (2009), the use of pretests and posttests is effective for detecting changes resulting from interventions. Observations complemented cognitive data by providing information about student engagement in the learning process, as explained by Yang et al. (2019) and Fischer & Kleen (2021). Data analysis was conducted descriptively to describe student achievement and inferentially to evaluate the effectiveness of the RADEC model. Before inferential analysis, normality and homogeneity tests were conducted to ensure that statistical assumptions were met, as recommended by Li et al. (2020) and Saleh et al. (2022). The results of this analysis served as the basis for assessing the extent to which the RADEC model significantly improves student learning outcomes.

After going through the initial assumption testing stage, the researcher used the non-parametric Wilcoxon Signed-Rank Test to evaluate the effectiveness of the RADEC learning model in improving

student learning achievement. According to Kawar et al. (2024), the selection of statistical methods must be adjusted to the characteristics of the data obtained, including its distribution. The Wilcoxon test was chosen because the student learning outcome data did not meet the assumption of a normal distribution, making the use of a paired t-test inappropriate (King & Eckersley, 2019). Grzesiek et al. (2020) explained that the Wilcoxon test is a valid alternative for analyzing paired data that is not normally distributed. This test measures the difference between two conditions within the same group, namely the pretest and posttest scores. Yu et al. (2022) emphasized that for small samples or ordinal data, the Wilcoxon test effectively detects significant changes in repeated experimental designs.

RESULTS AND DISCUSSION

Results

Development of RADEC learning model in elementary schools

Based on the interviews with various informants, several significant findings related to the readiness and response to implementing the RADEC learning model in elementary schools. Informants consisted of class teachers, students, principals, and the results of researcher observations that supported field data. These findings provide a comprehensive picture of the potential and challenges in implementing the RADEC model as an innovative approach to the learning process.

Table 1
Findings from Interview Results with Informants

No	Informant	Meeting Points	Description
1	Class Teacher	Teacher Readiness	Teachers are not yet familiar with the RADEC model as a whole and need special training to be able to apply it appropriately and effectively.
2	Class Teacher	RADEC Training Needs	Teachers said that the implementation of RADEC requires systematic guidance and examples of lesson plans as a reference for implementing the RADEC stages.
3	Class Students	Positive Response to Discussion and Creation	Students showed high enthusiasm in the "Discussion" and "Creating" stages because they could share ideas and create their own work.
4	Researcher Observation	Participation Inequality	It was found that in the discussion stage, active students dominated, while passive students tended to be quiet and not actively involved.
5	Principal	Managerial Support	The principal provided support for the innovation of the learning model and was willing to facilitate RADEC training at the school level.

Note: Data was obtained from the results of interviews between researchers and class teachers

Overall, the interview results show that implementing the RADEC model in elementary schools has good prospects, especially in increasing student participation and creativity. However, support is still needed in the form of teacher training and the provision of appropriate learning tools. Student enthusiasm and the support of the principal are positive indicators that this model is worthy of further development. This finding emphasizes the importance of a structured implementation strategy so RADEC can be implemented optimally and sustainably. Furthermore, the RADEC learning model applied in elementary schools consists of five core stages designed to increase students' active involvement in learning. Each stage has a strategic role in building literacy skills, critical thinking, collaboration, and creativity. These stages include Reading, Answering, Discussing, Explaining, and Creating, which are implemented sequentially in one learning cycle.

Table 2
Stages of RADEC Learning in Elementary Schools

No.	RADEC Stage	Description	Learning Objectives
1	Reading	Students read the material or learning resources prepared by the teacher.	To improve literacy skills and initial understanding of the topics to be studied.
2	Answering	Students answer questions related to the reading independently.	To train critical thinking skills and individual understanding of reading content.

3	Discussing	Students discuss the answers or topics with group members.	To develop social, communication, and collaborative thinking skills.
4	Explaining	Group representatives or students present the results of the discussion in class.	To train the ability to argue and express opinions logically.
5	Creating	Students create products/works as a form of application of the material studied.	To encourage creativity and application of knowledge in real forms.

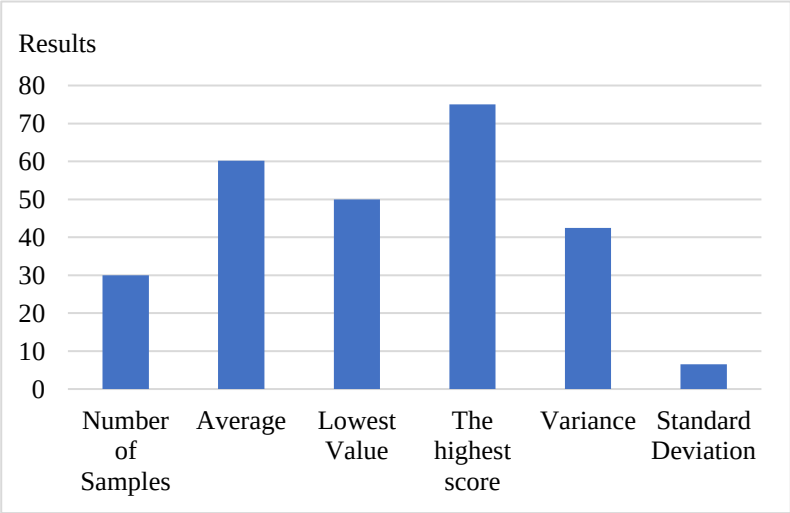
Note: Data was obtained from the results of interviews between researchers and class teachers

Based on the description of the RADEC stages, this model emphasizes the active and student-centered learning process. Each stage has a specific interrelated function to create a meaningful learning experience. With students gradually involved from reading to creating, the RADEC model provides space to develop high-level thinking skills while strengthening collaboration and creativity. This makes RADEC a relevant and potential model to be implemented at the elementary school level.

Effectiveness of RADEC learning model implemented in elementary school

During the pretest phase, students in both the experimental and control groups were given the same set of 20 multiple-choice questions. These identical questions were also administered as a posttest for the experimental group following the implementation of the RADEC learning model. To analyze the initial score distribution, the researcher performed a descriptive analysis on the pretest results of the control group. The findings of this analysis are illustrated in Graph 1, offering a clear summary of how student scores were distributed and their central tendency prior to any instructional intervention. This overview helps in understanding the baseline performance of students before the learning treatment was applied, providing essential context for evaluating the impact of the RADEC model in later stages of the study.

Figure 1
Results of Descriptive Analysis

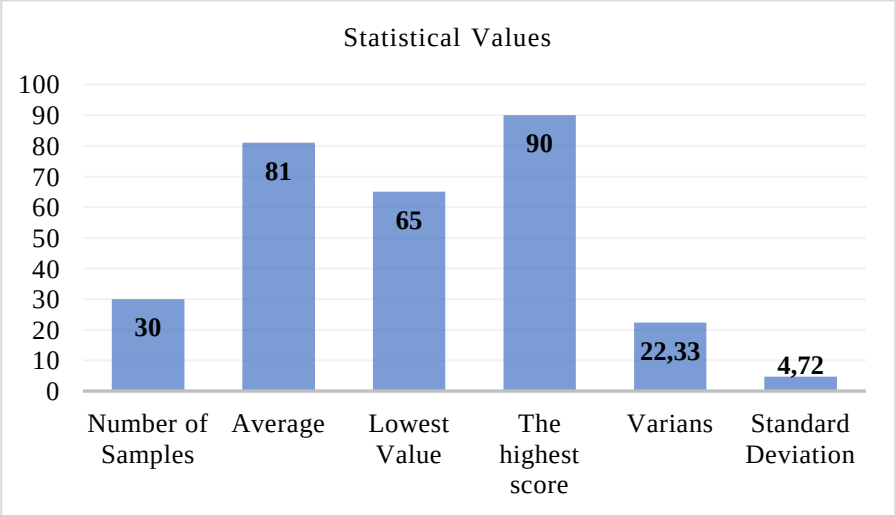


Based on the descriptive analysis presented in the graph, the average student score is 60.16, with scores ranging from a minimum of 50 to a maximum of 75. These results indicate that students' initial abilities are at a moderate level. The variance value of 42.47 and a standard deviation of 6.51 reveal that the scores are fairly consistent and show a relatively small spread around the mean. This implies that most students' performance is clustered close to the average score, reflecting a homogeneous group in terms of ability. Such homogeneity is important because it provides a solid foundation for comparing the effects of different learning interventions in subsequent stages. By having students with similar initial abilities, any changes in performance can be more confidently

attributed to the treatment applied, ensuring a fair and valid assessment of the learning model's effectiveness.

The researcher conducted a descriptive analysis of post-test data from the control class to examine student learning outcomes under conventional teaching methods. This analysis focused on value trends, data distribution, and overall achievement levels, presented through tables and detailed narratives. These findings serve as a benchmark for comparison with the experimental class, providing insights into differences in performance. By systematically detailing the control class results, the study establishes a foundation for evaluating the effectiveness of the RADEC learning model in enhancing student achievement.

Figure 2
Results of Posttest Data for Control Class



The RADEC learning model, when applied to experimental classes, produced more desirable results than conventional learning alone, as shown by the above data exposure. It was also revealed that, compared to the control class, students in the experimental class were more engaged in their education.

The researchers grouped the results of the control class posttest into five achievement categories to facilitate analysis. The categories will then be displayed in table form to clarify data interpretation.

Table 3
Grouping of Posttest Results for Control Class

Score	Category	Frequency	Percentage
0-59	Very Poor	0	0%
60-69	Poor	1	3,3%
70-79	Enough	4	13,4%
80-89	Good	24	80%
90-100	Very Good	1	3,3%
	Amount	30	100%

Based on the control class posttest grouping results, most students are in the "Good" category of 80%, which shows that conventional learning methods can bring most students a fairly adequate level of understanding. However, very few students reach the "Very Good" category (3.3%), and none are in the "Very Poor" category. This shows that conventional methods tend to be effective for average achievement but are less able to facilitate students to achieve maximum learning outcomes.

Next, the researcher conducted a descriptive analysis of the pretest results in the experimental class to obtain a general description and characteristics of the students' initial data before the application of the learning model. The pretest data will later be presented in tables and narrative descriptions to clarify the initial conditions of student learning achievement.

Table 4
Results of Experimental Class Pretest Data

Statistics	Statistical Values
Number of Samples	30
Average	61,77
Lowest Value	50
Highest Value	75
Variance	33,14
Standard Deviation	5,75

Based on the experimental class pretest results, the average student score was 61.77, with the lowest score of 50 and the highest score of 75. The variance of 33.14 and the standard deviation 5.75 indicate that the distribution of student scores is quite even without any extreme differences. This suggests that the initial abilities of students before the learning treatment are relatively homogeneous and sufficient. Hence, this condition allows for further evaluation of the effectiveness of the applied learning model.

The researchers grouped the results of the control class pretest into five categories to facilitate data analysis and understanding. This grouping will be presented in a table that describes the frequency distribution and percentage of students in each achievement category, thus facilitating the interpretation of initial learning outcomes.

Table 5
Grouping of Pretest Control Results

Score	Category	Frequency	Percentage
0-59	Very Poor	7	22,6%
60-69	Poor	20	64,5%
70-79	Enough	4	12,9%
80-89	Good	0	0%
90-100	Very Good	0	0%
Amount		31	100%

Based on Table 5, it can be seen that most of the control class students are in the “Poor” category of 64.5%, and another 22.6% are in the “Very Poor” category. Only 12.9% of students reached the “Enough” category, while none of the students reached the “Good” or “Very Good” category. This finding shows that the initial abilities of students in the control class are still relatively low, with the majority not reaching the minimum competency standards yet. This indicates that more effective learning interventions are needed to improve learning outcomes.

The researcher conducted a descriptive analysis to obtain a general description and characteristics of the post-test data from the experimental class. The analysis results will be presented systematically in Table 6 to facilitate interpretation and understanding of the data.

Table 6
Control Class Posttest Data

Statistics	Statistical Values
Number of Samples	13
Average	83,06
Lowest Value	75
Highest Value	95
Variance	17,22
Standard Deviation	4,14

The results of the control class posttest showed an average score of 83.06 with a relatively low spread of scores (standard deviation 4.14), indicating that most students obtained good and homogeneous results. However, this did not reflect a significant increase compared to the pretest.

The researcher divided the results of the experimental class posttest into five achievement categories, which will be displayed in Table 8 to facilitate data analysis.

Table 7
Grouping of Experimental Class Posttest Results

Score	Category	Frequency	Percentage
0-59	Very Poor	0	0%
60-69	Poor	0	0%
70-79	Enough	2	6,5%
80-89	Good	26	83,8%
90-100	Very Good	3	9,7%
Amount		31	100%

Based on Table 8, the results of the posttest of the experimental class show a very positive distribution of achievement. Most students, 83.8%, are in the “Good” category, while 9.7% of others reach the “Very Good” category. Only 6.5% of students are in the “Fair” category, and none of the students are in the “Poor” or “Very Poor” category. These findings indicate that the implementation of the RADEC learning model has a significant impact on improving student learning outcomes. The increase in the proportion of students in the high category reflects the effectiveness of the RADEC model in encouraging more optimal understanding and academic achievement.

Data analysis shows that the application of the RADEC learning model in the experimental class significantly improved student learning outcomes. The experimental class achieved an average posttest score of 83.06, higher than the control class’s 81, a difference of 2.06 points. Most students in the experimental class reached the "Good" and "Very Good" categories, compared to the pretest, where the majority were in the "Less" and "Very Less" categories (mean 61.77), indicating substantial improvement due to RADEC implementation. In the control class, posttest scores averaged 81, with a range of 65–90, variance of 22.33, and standard deviation of 4.72. About 80% were in the "Good" category. These results highlight RADEC’s effectiveness in fostering meaningful learning and enhancing academic performance through active, structured engagement.

Discussion

Learning innovation through the development of the radec model in elementary schools

The RADEC learning model, which integrates five active stages Read, Ask, Discuss, Explain, and Create has been positioned as an innovative approach to strengthen student engagement in the learning process (Lestari et al., 2022). Le et al. (2017) interpret this design as not only effective in reinforcing conceptual understanding but also in nurturing critical thinking, showing its dual impact on cognitive development. Similarly, De Klerk et al. (2024) highlight that active student participation, as promoted in RADEC, is a determining factor for improved learning outcomes, suggesting that engagement is as crucial as content mastery. Furthermore, Thornhill-Miller et al. (2023) and Marini et al. (2025) argue that the central aim of RADEC lies in fostering interactive learning environments where creativity and communicative independence are cultivated, positioning students as active knowledge constructors. In line with this, Almulla (2023) views the teacher’s role within the RADEC model as shifting toward facilitation, aligning with broader 21st-century learning paradigms that emphasize collaboration, autonomy, and guided exploration.

In classroom implementation, the RADEC learning model follows five sequential stages designed to foster active engagement. At the Read stage, Yang (2023) emphasizes that independent reading develops students’ initial comprehension, while Lim (2024) argues that collaborative reading enhances interaction and shared meaning, showing complementary strengths. The Ask stage invites students to pose critical questions, encouraging deeper inquiry and analytical thinking. In the Discuss

stage, Willemsen et al. (2019) highlight that group dialogue strengthens conceptual understanding while building peer-learning dynamics. Moving to the Explain stage, students present their ideas to the class, which Gosen et al. (2024) interpret as crucial for developing communication and argumentation skills. Finally, the Create stage requires students to design tangible products, such as posters or reports, that van Balen et al. (2022) view as authentic applications of knowledge. Throughout the process, the teacher's role shifts to that of a facilitator who guides inquiry, mediates discussions, and provides resources, a role McCombs (2015), Singh et al. (2021), and Sato et al. (2024) identify as essential in constructivist learning.

The implementation of the RADEC learning model in elementary schools has been shown to significantly enhance students' academic achievement, particularly in subjects requiring strong conceptual understanding. Dessie et al. (2023) and Twahirwa & Ntivuguruzwa (2024) argue that RADEC creates meaningful improvements in learning outcomes by emphasizing active engagement. Similarly, Darling-Hammond et al. (2019) interpret active learning models like RADEC as effective in promoting not only cognitive achievement but also students' questioning, discussion, communication, and creativity skills. This aligns with findings by Le et al. (2017) and Mebert et al. (2020), who highlight that active participation supports affective and psychomotor development, showing RADEC's multidimensional benefits. However, challenges remain. Kamalov et al. (2023) note that longer time demands for discussions and product creation, along with classroom management complexities, can hinder smooth implementation. To address this, Giannakos et al. (2024) and Wang et al. (2024) emphasize sustained professional training for teachers, ensuring RADEC is applied effectively and adapted to classroom realities.

The RADEC learning model is often regarded as a relevant innovation for 21st-century education because it supports the development of critical thinking, collaboration, and creativity skills identified as essential by Darwin et al. (2023) and Niño et al. (2024). Patel (2003) views systematic and gradual approaches, such as RADEC, as fostering deeper and more holistic learning experiences, an interpretation echoed by Miseliunaite et al. (2022), who stress its integrative benefits. Nevertheless, scholars highlight that successful implementation depends heavily on teacher competence. Ruaya et al. (2022) and Hanaysha et al. (2023) argue that facilitating meaningful discussions and managing dynamic creative activities requires advanced pedagogical skills. Beyond teacher capacity, the availability of appropriate learning media is another critical factor. Guo & Li (2024) and du Plooy et al. (2024) emphasize the importance of contextual adaptation so that RADEC addresses diverse student needs rather than applying a one-size-fits-all model. Ultimately, as Kruk et al. (2018) and Strielkowski et al. (2025) note, RADEC's sustainability depends on strengthening teacher preparation and ensuring resource support.

Optimizing student learning achievement through RADEC learning model innovation

The RADEC (Read, Ask, Discuss, Explain, Create) learning model is recognized as an innovative approach that actively engages students in the learning process (Baričević & Luić, 2023; Gan et al., 2024). Walters-Williams (2022) and Kim et al. (2022) interpret the Read stage as essential for building independent conceptual understanding, while the Ask stage is viewed as a means to enhance critical thinking through in-depth questioning. Zion et al. (2015) argue that the Discuss stage strengthens metacognitive skills and collaborative problem-solving. In the Explain stage, communicating ideas consolidates understanding, and the Create stage allows students to demonstrate knowledge through tangible, creative outputs (Scott-Barrett et al., 2023). Sukardi et al. (2022) further highlight that RADEC fosters meaningful learning experiences and positively impacts academic outcomes. These interpretations align with Vygotsky's perspective, which Rigopouli et al. (2025) and Sarmiento-Campos et al. (2022) emphasize, suggesting that social interaction and collaboration are central to cognitive development, reinforcing the model's effectiveness in cultivating higher-order thinking, literacy, and student engagement.

The effectiveness of the RADEC learning model in enhancing student achievement has been supported by empirical studies at the elementary school level (Nurmalisa et al., 2023; Chen & Huang,

2024). Zawacki Richter et al. (2019) argue that learning models promoting active participation, such as RADEC, strengthen science process skills, including questioning, group discussions, and oral communication. Golden (2023) interprets these interactions as fostering both scientific communication and collaborative abilities, indicating that RADEC supports social as well as cognitive development. Beyond cognitive gains, Fischer et al. (2023) highlight that students involved in RADEC demonstrate improved reflectivity, better connections between concepts and real-life contexts, and increased productivity in creating reports, presentations, and other creative outputs. Similarly, Ng et al. (2021) emphasize that active engagement nurtures intrinsic motivation, showing the affective benefits of this approach. Taken together, these analyses suggest that RADEC is not only effective in optimizing academic achievement but also serves as a holistic framework for cultivating 21st-century skills, integrating cognitive, social, and motivational dimensions in a single, coherent learning model.

Quantitative analysis indicates that the RADEC learning model significantly improves student learning outcomes (El Sabagh, 2021; Aminah & Dwi Setyowati, 2024). In this study, the experimental class achieved an average posttest score of 83.06, higher than the control class's 81, reflecting a 2.06-point difference that demonstrates the positive effect of RADEC interventions. Braun and Clarke (2006) interpret consistent quantitative changes as indicators of treatment effectiveness in educational experiments. Students in the experimental class improved from "Poor" and "Very Poor" categories during the pretest (mean 61.77) to "Good" and "Very Good" in the posttest, whereas the control group, despite increases (mean 81, highest 90, lowest 65, variance 22.33, SD 4.72), displayed more varied results. Dinsmore and Fryer (2019) and Darling-Hammond et al. (2023) further argue that collaborative, active learning models like RADEC not only enhance academic achievement but also develop higher-order thinking and teamwork skills, highlighting its dual role in cognitive and social learning development in elementary education.

Compared to traditional, teacher-centered methods, the RADEC model offers significant advantages in enhancing student learning (Andersen & Rustad, 2022; Candraswari & Suniasih, 2024). Masek et al. (2021) argue that RADEC promotes active participation, allowing students to engage directly in knowledge construction rather than passively receiving information. Marougkas et al. (2023) interpret this engagement as essential for sustaining motivation and encouraging continuous learning. Tang et al. (2020) further highlight that RADEC systematically develops critical and creative thinking by structuring stages from reading to creating that stimulate idea exploration and problem-solving. Kiviranta et al. (2023) emphasize its holistic nature, noting that the model enhances cognitive skills while fostering social interaction, communication, and responsibility. Jackson et al. (2019) argue that the Create stage bridges learning to real-world contexts, supporting deeper and longer-lasting understanding. Altinyelken and Hoeksma (2021) conclude that RADEC improves learning quality by immersing students in meaningful, active, and collaborative experiences, demonstrating its multidimensional benefits.

Implementing the RADEC learning model presents several challenges that must be addressed for optimal results. Ventista and Brown (2023) interpret teacher readiness as a major obstacle, noting that many educators are unaccustomed to active, collaborative, and student-centered approaches, which directly affects learning outcomes. Intensive training and mentoring in designing and implementing RADEC-based instructional tools are therefore essential. Liu and Lu (2024) emphasize that effective time management requires flexible and adaptive planning to ensure all stages from reading to creating run efficiently. Hennessy et al. (2022) argue that limited learning media can constrain implementation, but digital technologies and open educational resources offer practical solutions. In large classrooms, Martin-Alguacil et al. (2024) suggest structured student grouping and peer tutoring to enhance engagement. Taken together, these perspectives highlight that RADEC's success depends on both teacher competence and systemic school support, underscoring the need for professional development and institutional policies that promote innovative, sustainable learning practices.

CONCLUSION

Based on the discussion above, the RADEC learning model is an innovation that promotes active student engagement through systematic stages that develop understanding, critical thinking, and creativity. Its implementation in elementary schools has improved learning outcomes, communication skills, and collaboration. The role of teachers as facilitators is key to its effectiveness. Despite challenges related to time and classroom management, ongoing teacher training is essential to ensure the successful and sustainable implementation of this model. The RADEC learning model enhances student achievement through five active stages that encourage critical thinking, collaboration, and creativity. Empirical evidence shows a significant improvement in learning outcomes, particularly in the experimental class, with an average posttest score of 83.06. RADEC impacts cognitive aspects while also fostering intrinsic motivation, reflectivity, and 21st-century skills. Its success confirms the effectiveness of this model in creating a holistic and meaningful learning experience.

This study provides two key implications: theoretical and practical. Theoretically, the RADEC model reinforces the constructivist foundation in learning, allowing students to actively construct knowledge through social interaction and meaningful experiences. Its success in enhancing learning outcomes, critical thinking, collaboration, and creativity highlights the significance of activity-based learning and active student participation. These findings align with Vygotsky's theory on social interaction in cognitive development and active learning theory, which positions students as central agents in the learning process. Practically, implementing RADEC in elementary schools offers guidance for teachers and policymakers in designing interactive, student-centered learning. Teachers require ongoing professional development to effectively facilitate each RADEC stage. Additionally, schools must provide diverse learning resources and flexible time allocation to support creative exploration and in-depth discussion. Overall, RADEC demonstrates its potential as an innovative approach to improving educational quality and preparing students to meet 21st-century challenges.

Further research is recommended to explore the adaptation and implementation of the RADEC model across different socioeconomic school contexts and examine effective classroom management and time management strategies. Longitudinal studies are also essential to assess the long-term impact on students' academic achievement, social skills, and learning motivation. In addition, a focus on teacher professional development through ongoing training and technology utilization is needed to improve the effectiveness of RADEC implementation. Integration of digital technology into each stage of RADEC can increase student engagement. Finally, quantitative and qualitative measurements of non-cognitive aspects such as intrinsic motivation, creativity, and 21st-century skills will strengthen the evidence of the holistic benefits of this model.

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