EDUCARE Journal of Primary Education
ISSN 2716-1021 (p) 2716-1013 (e)
OPEN ACCESS
https://educare.uinkhas.ac.id/index.php/jie
DOI: 10.35719/educare.v6i1.313
Vol 6, No 1, June 2025, pp. 31-48

The Effectiveness of the RADEC Learning Model in Improving Student Learning Achievement

Achmad Miftachul Ulum[1], Moch. Farich Alfani[2]*, Abd Razak Zakaria[3]
[1]Universitas Islam Negeri Maulana Malik Ibrahim Malang, East Java, Indonesia
[2]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Special Region of Yogyakarta, Indonesia
[3]Faculty of Education, University of Malaya, Malaysia

Article Information:
Received 2024-11-09
Revised 2025-04-30
Published 2025-05-31

Keywords: Learning Model, RADEC, Learning Achievement

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.

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

To cite this article (APA Style):
Ulum, A. M., Alfani, M. F., & Zakaria, A. R. (2025). The Effectiveness of the RADEC Learning Model in Improving Student Learning Achievement. *EDUCARE: Journal of Primary Education, 6(1)*, 31–48. https://doi.org/10.35719/educare.v6i1.313

***Corresponding Author**: Moch. Farich Alfani, Elementary Madrasah Teacher Education Study Program, Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Special Region of Yogyakarta, Indonesia, email: arichalfani25@gmail.com

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 these findings, this study focuses on improving overall learning achievement, covering cognitive, affective, and psychomotor aspects, with a comprehensive evaluation of the effectiveness of the RADEC model in various learning contexts.

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 objectives and benefits of the study outlined above, this research hypothesizes that the implementation of the RADEC (Read, Answer, Discuss, Explain, Create) learning model can significantly improve students' academic achievement in elementary schools compared to traditional learning models. The RADEC learning model, which applies a student-centered learning (SCL) approach, is expected to enhance student outcomes across the three main educational domains: cognitive, affective, and psychomotor. Students engaged in a more active and comprehensive learning process involving reading, answering, discussing, explaining, and creating activities are better able to understand the material, apply it in relevant contexts, and analyze it critically. Therefore, students' academic achievement in understanding the material and practical skills is expected to increase significantly after using the RADEC model. Based on this, the study hypothesizes that the RADEC model is more effective in improving student academic achievement compared to traditional learning models that involve less active student participation.

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. According to Huyler & McGill (2019) a quantitative approach allows researchers to measure variables objectively and analyze the relationship between variables through statistical procedures. The primary purpose of the experimental method is to test the cause-and-effect relationship by giving specific treatments to subjects; as explained by Hariton and Locascio (2018), experiments allow researchers to control variables and observe the effects of the treatment. This is

reinforced by the opinion of Dash and Paul (2021), who emphasized that experiments provide a strong foundation for testing the effectiveness of an intervention.

The research design used in this study was an actual experiment with a pretest-posttest control group design model. Liu and Li (2023) stated that this design provides high internal validity because of the random grouping of subjects and the comparison between the experimental and control groups before and after treatment. The study was conducted at the elementary school level, with a population that included all students. The sampling technique used random sampling, which is a method that provides an equal opportunity for each member of the population to be selected as a sample. According to Ahmed (2024), random sampling is an ideal technique to reduce bias in sample selection. Maqbool et al. (2024) also emphasized that this method increases the representativeness of the sample to the population.

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 student 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 treatment. According to Pluye et al., (2009), using pretests and posttests effectively detects changes due to intervention. Observations complement cognitive data with information about student engagement in learning (Yang et al., 2019; Fischer & Kleen, 2021). Data analysis was carried out descriptively to describe student achievement and inferentially evaluate the RADEC model's effectiveness. Before the inferential analysis, normality and homogeneity tests were conducted to ensure that statistical assumptions were met (Li et al., 2020; Saleh et al., 2022). The results of this analysis are 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 statistical test 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, so using the paired t-test was considered 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 in the same group, namely the pretest and posttest scores. Yu et al. (2022) emphasized that using small samples or ordinal data, the Wilcoxon test effectively detects significant changes in repeated experimental designs.

In this analysis, the null hypothesis (H_0) states that the RADEC learning model does not significantly improve student learning outcomes. Conversely, the alternative hypothesis (H_1) states that the RADEC model effectively enhances student learning outcomes. Decision-makingThe Wilcoxon test's decision-making is based on the significance value (Asymp. Sig). If the Asymp. If the sig value obtained is less than 0.05 (Asymp. Sig < 0.05), then the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This means a significant difference exists between the pretest and posttest scores, so applying the RADEC model is declared effective. However, if the Asymp. If the sig value is greater than 0.05 (Asymp. Sig > 0.05), the null hypothesis is accepted, and the RADEC model is considered not to improve student learning outcomes significantly. This test is essential to ensure the effectiveness of the learning model objectively and measurably.

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.

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. The details of these stages are presented in Table 1 below.

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.

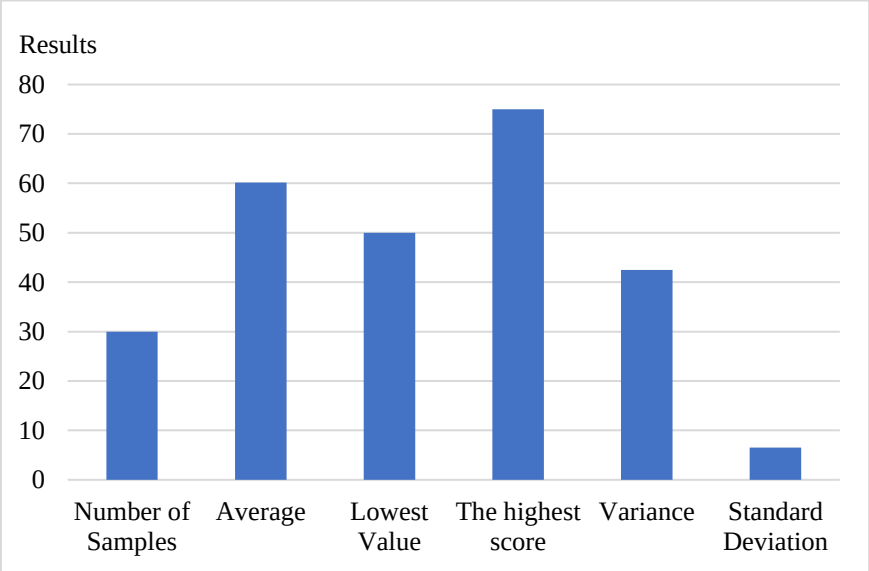
Based on the description of the RADEC stages, this model emphasizes the active and student-centered learning process. Each stage has a specific interrelated function to create a meaningful learning experience. With students gradually involved from reading to creating, the RADEC model

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 MI/SD

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.

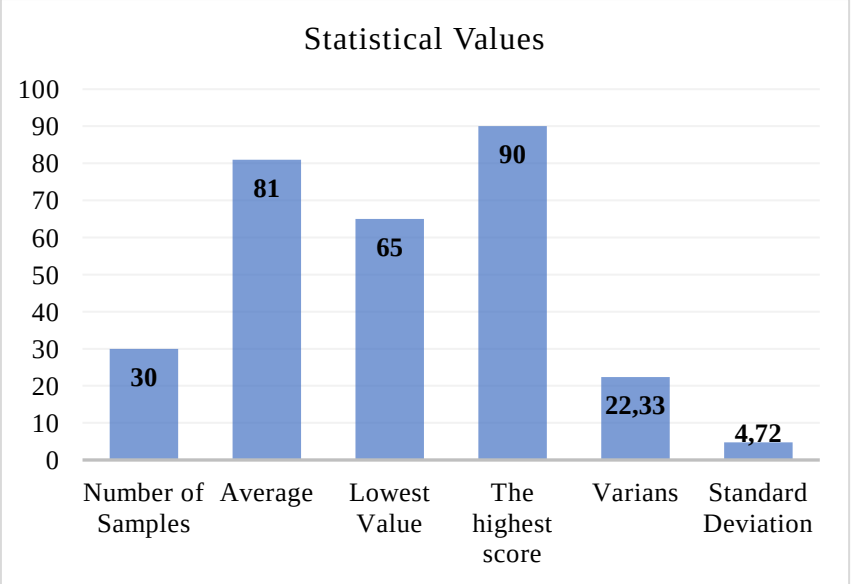
Graph 1. Results of Descriptive Analysis



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 carried out a descriptive analysis on the post-test data collected from the control class to gain a clearer understanding of the students' learning outcomes. This analysis was intended to examine the value trends, data distribution, and overall achievement levels of students following instruction using conventional teaching methods. The findings from this descriptive study are presented through tables and detailed narrative explanations, aiming to offer comprehensive and organized insights into the academic performance of the control group. These results will serve as a benchmark for comparison with the experimental class, helping to evaluate the effectiveness of the learning approaches. By systematically detailing the control class outcomes, the study provides a solid foundation for analyzing differences in student achievement between the traditional learning method and the RADEC learning model applied in the experimental group.

Graph 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 6, 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 7 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 has a significant positive impact on improving student learning outcomes. The average posttest score in the experimental class reached 83.06, higher than the control class, which had an average of 81, with a difference of 2.06 points. Most students in the experimental class were in the "Good" and "Very Good" categories, unlike the pretest results, where most were in the low category. This shows that significant development has occurred since applying the RADEC model. On the other hand, the posttest results of the control class, with an average of 81, the highest score of 90, and the lowest score of 65, as well as a variance of 22.33 and a standard deviation of 4.72, illustrate a relatively even distribution of scores. As many as 80% of students in the control class were in the "Good" category, while the rest were spread across the "Fair," "Very Good," and "Poor" categories. These results show an increase, although not as strong as in the experimental class. The pretest data of the experimental class shows that with an average of 61.77, most students are still included in the "Less" and "Very Less" categories. This indicates that students' initial abilities are low, so significant improvements in the posttest can be directly linked to the effectiveness of the RADEC learning model application.

Discussion

Learning Innovation through the Development of the RADEC Model in Elementary Schools

The RADEC learning model is an innovation that integrates five active stages, namely Read, Ask, Discuss, Explain, and Create, which aims to improve the quality of student involvement in the learning process (Lestari et al., 2022). According to Le et al. (2017), this approach effectively strengthens conceptual understanding while developing critical thinking skills. De Klerk et al. (2024) emphasized that active student participation contributes significantly to better learning outcomes. The main goal of RADEC is to create an interactive learning atmosphere and encourage students to become creative and communicative independent learners (Thornhill-Miller et al., 2023; Marini et al., 2025). In practice, this model emphasizes constructive and collaborative activities, where the role of the teacher shifts to a facilitator who actively guides the learning process, as Almulla (2023) suggested in the 21st-century learning approach.

In its implementation in the classroom, the RADEC learning model is applied sequentially, starting from the Read stage, where students read learning materials or resources independently or in groups. According to Yang (2023), independent reading activities help build initial understanding, while Lim (2024) emphasizes that collaborative reading can increase engagement and meaning in the text. The next stage is Ask, where students are invited to ask critical questions related to the content of the reading to explore more profound understanding. Afterward, students enter the Discuss stage, which is discussing in groups to answer questions and share views (Willemsen et al., 2019). At the Explain stage, students present the discussion results to the class to practice communication and argumentation skills (Gosen et al., 2024). Finally, at the Create stage, students are asked to produce creative products such as posters, mockups, or reports as a form of application of understanding (van Balen et al., 2022). Throughout this process, the teacher acts as a facilitator who provides direction mediates discussions, and prepares a variety of learning resources to support learning effectiveness (McCombs, 2015; Singh et al., 2021; Sato et al., 2024).

The results of the implementation of the RADEC learning model in various elementary schools showed a significant increase in students' academic achievement, especially in subjects that emphasize conceptual understanding (Dessie et al., 2023; Twahirwa & Ntivuguruzwa, 2024). Darling-Hammond et al. (2019) stated that active learning approaches such as RADEC encourage

cognitive achievement and improve students' questioning, discussion, communication, and creativity skills. This finding is supported by Le et al. (2017) and Mebert et al. (2020), who emphasized that active learning positively impacts students' affective and psychomotor aspects. However, implementing RADEC also faces challenges, including longer time allocations for discussions and product creation and teachers' difficulties managing more active classroom dynamics (Kamalov et al., 2023). Therefore, Giannakos et al. (2024) and Wang et al. (2024) emphasized the importance of ongoing professional training for teachers so that the implementation of RADEC can take place optimally and sustainably.

The RADEC learning model is considered a superior innovation because it aligns with 21st-century literacy and skills demands, especially in developing students' critical thinking, collaboration, and creativity skills (Darwin et al., 2023; Niño et al., 2024). According to Patel (2003), a systematic and gradual learning approach can create a more meaningful and holistic learning experience, a view also supported by Miseliunaite et al. (2022). However, the success of RADEC implementation depends on teacher competence in facilitating discussions and effectively managing students' creative activities (Ruaya et al., 2022; Hanaysha et al., 2023). The availability of relevant learning media is also a determining factor in supporting the sustainability of this model. Guo and Li (2024) and du Plooy et al. (2024) emphasize the importance of adapting RADEC based on student characteristics and school contexts so that its implementation is not lopsided. Overall, RADEC has excellent potential to improve the quality of basic education, but it requires strengthening teacher capacity and adequate learning resource support so that this model can be implemented sustainably and effectively (Kruk et al., 2018; Strielkowski et al., 2025).

Optimizing Student Learning Achievement through RADEC Learning Model Innovation

The RADEC (Read, Ask, Discuss, Explain, Create) learning model is an innovative approach that emphasizes the active involvement of students in the learning process (Baričević & Luić, 2023; Gan et al., 2024). Each stage in this model is systematically designed to develop higher-order thinking skills, improve literacy skills, and encourage student collaboration. Walters-Williams (2022) and Kim et al. (2022) emphasize that the Read stage helps students build conceptual understanding independently, while the Ask stage encourages them to hone their critical thinking skills by formulating in-depth questions. In the Discuss stage, students explore ideas through group discussions, as stated by Zion et al. (2015), who see discussion as an essential means of developing metacognition. The Explain stage strengthens students' understanding by communicating ideas, and Create allows them to express their knowledge through concrete and creative products (Scott-Barrett et al., 2023). According to Sukardi et al. (2022), active involvement built through the RADEC model can create meaningful learning experiences and significantly impact learning outcomes. This is in line with Vygotsky's view, which emphasizes that social interaction in collaborative activities plays a central role in students' cognitive development (Sarmiento-Campos et al., 2022; Rigopouli et al., 2025).

The success of the RADEC learning model in improving student learning achievement has been supported by various empirical findings that show its effectiveness at the elementary school level (Nurmalisa et al., 2023; Chen & Huang, 2024). According to Zawacki-Richter et al. (2019), learning models involving active participation, such as RADEC, can strengthen students' science process skills, such as asking questions, participating in discussions, and conveying ideas orally. Golden (2023) added that this process also encourages the development of scientific communication and collaboration in groups. In addition to cognitive aspects, Fischer et al. (2023) stated that students involved in the RADEC model showed improvements in terms of reflectivity, the ability to relate learning concepts to real-life contexts, and productivity in producing learning works such as reports, presentations, and other creative products. Ng et al. (2021) also emphasized that active involvement in learning encourages students' intrinsic motivation. Thus, various expert opinions and empirical evidence show that RADEC is a practical and holistic approach to optimizing learning achievement while developing students' 21st-century skills.

Furthermore, the results of quantitative data analysis confirm that implementing the RADEC learning model significantly improves student learning outcomes (El-Sabagh, 2021; Aminah & Dwi Setyowati, 2024). In this study, the average posttest score of students in the experimental class reached 83.06, much higher than the control class, which only achieved an average of 81. This increase shows a difference of 2.06 points, which statistically and pedagogically reflects the positive influence of the RADEC model intervention. Braun and Clarke (2006) stated that consistent changes in quantitative data reflect the effectiveness of the treatment in the context of educational experiments. The majority of students in the experimental class showed a significant increase from the "Poor" and "Very Poor" categories during the pretest (average 61.77) to "Good" and "Very Good" during the posttest. Meanwhile, in the control class, although there was an increase (mean posttest 81, highest score 90, lowest score 65, variance 22.33, SD 4.72), the distribution of scores still varied. Dinsmore and Fryer (2019) and Darling-Hammond et al. (2023) emphasized that cognitive and collaborative activity-based learning models such as RADEC can facilitate more optimal academic achievement and the development of high-level thinking skills.

Compared to traditional learning methods that tend to be one-way and teacher-centered, the RADEC model offers several advantages recognized by various education experts (Andersen & Rustad, 2022; Candraswari & Suniasih, 2024). According to Masek et al. (2021), this model can foster active student participation, making them learn subjects directly involved in the knowledge construction process. Marougkas et al. (2023) added that this active involvement is significant for building sustainable learning motivation. In addition, Tang et al. (2020) stated that RADEC systematically encourages the development of critical and creative thinking skills because each stage—from reading to creating—is designed to stimulate the exploration of ideas and solutions. According to Kiviranta et al. (2023), learning through RADEC is holistic because it targets cognitive aspects and strengthens students' social, communication, and responsibility skills. As Jackson et al. (2019) explained, the Create stage transfers learning to real contexts, contributing to deeper and more lasting understanding. Altinyelken and Hoeksma (2021) emphasized that active learning, such as RADEC, has improved the quality of learning outcomes because it directly engages students in meaningful learning experiences.

However, implementing the RADEC learning model has several challenges that must be considered. One of the main obstacles is the readiness of teachers who are not yet accustomed to active, collaborative, and student-centered learning approaches (Ventista & Brown, 2023). To overcome this, intensive training and mentoring in designing and implementing RADEC-based teaching tools are essential. In addition, Liu and Lu (2024) emphasized that time management in the RADEC learning process requires flexible and adaptive planning so all stages can run optimally. The limitations of learning media are also a significant obstacle, but can be overcome by utilizing digital technology and open learning resources (Hennessy et al., 2022). Another challenge arises in the context of large classes, where strategies such as effective student grouping and the involvement of peer tutors can be efficient solutions (Martin-Alguacil et al., 2024). In this regard, emphasized that the success of implementing innovative models such as RADEC is greatly influenced by the pedagogical readiness of teachers and systemic support from the school. Therefore, strengthening teacher professional competence and institutional policies that encourage learning innovation are essential prerequisites for the sustainability and effectiveness of RADEC implementation in improving the quality of education.

CONCLUSION

The RADEC (Read, Ask, Discuss, Explain, Create) learning model is an innovation that encourages active student involvement through systematic stages that build 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 the challenges of time and classroom management, ongoing training for teachers is essential to ensure the success and sustainability of the implementation of this model. The RADEC learning

model improves student achievement through five active stages that encourage critical thinking, collaboration, and creativity. Empirical support shows a significant increase in learning outcomes, especially in the experimental class, with an average posttest of 83.06. RADEC impacts cognitive aspects and facilitates intrinsic motivation, reflectivity, and 21st-century skills. Its success confirms the effectiveness of this model in creating a holistic and meaningful learning experience.

The conclusion of this study provides two critical implications: theoretical and practical. Theoretically, the RADEC model strengthens the constructivist foundation in learning, where students actively construct knowledge through social interaction and meaningful learning experiences. The success of RADEC in improving learning outcomes and developing critical thinking skills, collaboration, and creativity confirms the importance of an activity-based learning approach and active participation. These findings also support Vygotsky's theory on the importance of social interaction in cognitive development and the theory of active learning that emphasizes the role of students as subjects in the learning process. Applying the RADEC model in elementary schools provides strategic direction for teachers and educational policymakers in designing more interactive and student-centered learning. Teachers need to receive ongoing professional training to manage the RADEC stages effectively. In addition, schools need to provide varied and supportive learning resources and flexible time allocation to allow for creative exploration and in-depth discussion. The RADEC model has proven to be an innovative solution to improve the quality of education and prepare students to face the challenges of the 21st century.

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.

ACKNOWLEDGEMENT

We want to express our sincere gratitude to the principal, teachers, students, and the Faculty of Tarbiyah and Teacher Training of UIN Maulana Malik Ibrahim Malang for their support and cooperation in this research. The meaningful contributions and guidance allowed us to learn, observe, and develop our academic potential. This experience has become a valuable part of our educational journey.

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