

Implementation Of Radec Learning Model With Quizlet To Enhance Cognitive Learning Outcomes Of Students at SMP Negeri 4 Pekanbaru On Earth and Solar System Topics

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Abstract- This study aims to determine the effect of the RADEC (Read, Answer, Discuss, Explain, Create) learning model supported by Quizlet on students' cognitive learning outcomes in Earth and Solar System material. The RADEC model emphasizes a structured learning sequence that stimulates students to actively read, answer comprehension questions, engage in group discussions, explain concepts, and finally create new products or representations of their knowledge. The integration of Quizlet as a digital learning tool is expected to strengthen this process by providing interactive learning features such as flashcards, quizzes, and games that increase motivation and engagement. The research employs a quasi-experimental design with a non-equivalent post-test control group. The population of this study is seventh-grade students of SMP Negeri 4 Pekanbaru, with two classes selected as samples: one experimental class using the RADEC model with Quizlet and one control class using conventional learning. The instrument applied is a cognitive test developed based on Bloom's Taxonomy (C1–C6). Data were analyzed descriptively to compare mean scores and inferentially using an independent t-test to examine statistical significance. The findings show that the average score of the experimental class (82.13) is significantly higher than the control class (68.6), with a p-value of $0.000 < 0.05$. These results indicate that the RADEC model supported by Quizlet is effective in enhancing students' cognitive outcomes, particularly in higher-order thinking indicators such as analyzing and creating. The interactive nature of Quizlet not only reinforces students' comprehension but also fosters independent learning and collaboration. In conclusion, the combination of RADEC learning with Quizlet provides a promising alternative learning strategy in science education. This approach not only improves cognitive achievement but also cultivates active participation, digital literacy, and creativity among students. Therefore, this model is recommended for broader implementation to optimize learning outcomes in Earth and Solar System topics and potentially in other areas of science education.

Keywords: RADEC learning model, Quizlet, cognitive learning outcomes, earth and solar system, physics education

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1 Introduction

Educational innovation in Indonesia has entered a new era with the utilization of various technologies to improve the quality of education (Khairani et al., 2020: 158). In this context, teachers play a role as a key factor in creating a quality generation that is able to compete in the global era. The main challenge faced is how teachers can develop creativity and find learning alternatives that are in accordance with the independent curriculum being implemented (Murniah, 2024: 1586). The Merdeka Curriculum launched by the Ministry of Education, Culture, Research and Technology is a learning approach that gives students the freedom to learn in a fun atmosphere without pressure, so as to develop their natural talents (Rahayu

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et al., 2022: 210). This curriculum is in line with the vision of Indonesian education as outlined in the Pancasila Learner Profile, which includes six dimensions: faith and piety in God Almighty, global diversity, mutual cooperation, independence, critical reasoning, and creativity (Irawati et al., 2022: 20).

Learning Natural Sciences (IPA) in the Merdeka Curriculum has the aim of building basic science concepts that can be applied in everyday life (Sutarto et al., 2021: 2). However, science learning faces special challenges, especially in abstract material such as the Earth and the Solar System. This material is difficult for students to understand because it cannot be witnessed directly in everyday life (Maknun et al., 2025). Based on initial observations at SMP Negeri 4 Pekanbaru, it was found that seventh grade students had difficulty in understanding the Earth and Solar System material. This difficulty is caused by the theoretical nature of the material, the teacher-centered learning method, and the less systematic order of material delivery. This condition has an impact on the low cognitive learning outcomes of students on the material.

To overcome this problem, innovation is needed in learning models that can increase students' active involvement. The RADEC (Read, Answer, Discuss, Explain, Create) learning model is a student-centered approach that has proven effective in improving critical thinking skills and student learning outcomes (Ayu Lestari et al., 2022: 53). This model involves a series of activities that encourage students to be active in learning outcomes, collaborate, solve problems, and produce ideas or work. The implementation of the RADEC model can be optimized by the use of learning technology, one of which is the Quizlet application (Ikhsan, 2025). Quizlet is a digital platform that provides various interactive learning features such as flashcards, quizzes, and games that can support the learning stages in the RADEC model (Pradiani et al., 2024: 28). The combination of RADEC model and Quizlet application is expected to create more effective and fun learning.

This study aims to analyze the effect of applying the RADEC learning model assisted by Quizlet on students' cognitive learning outcomes on Earth and Solar System material. The results of this study are expected to contribute to the development of innovative science learning and in accordance with the demands of the Merdeka Curriculum.

2 Research Methodology

The research was conducted at SMP Negeri 4 Pekanbaru in the even semester of the 2025/2026 school year. The study population included all seventh grade students totaling 420 students from 10 classes. The sample was determined after normality and homogeneity tests were carried out on the test scores of the previous material.

This study used quasi-experimental method with *posttest only non-equivalent control group design*. There were two groups in this study: the experimental class that was treated with RADEC learning model assisted by *Quizlet*, and the control class that used conventional learning.

Description:

- X = Treatment with *Quizlet-assisted* RADEC learning
- O₁ = Experimental class posttest results
- O₂ = Control class posttest results

Data collection using (posttest) which is prepared based on indicators of Earth and Solar System material. Data analysis includes descriptive analysis to determine the level of student learning outcomes with the formula:

$$\text{Nilai Peserta Didik} = \frac{\text{Jumlah Skor yang diperoleh}}{\text{Jumlah Skor Maksimum}} \times 100$$

Table 1. The scores were categorized according to the following criteria:

Nilai	Klasifikasi
$80 \leq x \leq 100$	Sangat Baik
$60 \leq x \leq 79,99$	Baik
$40 \leq x \leq 59,99$	Cukup
$20 \leq x \leq 39,99$	Kurang
< 20	Sangat kurang

Inferential analysis uses an independent t-test to test the hypothesis, with the criteria H_0 is rejected if the significance value $\rho < 0.05$, which means there is a significant difference in student learning outcomes between the two classes.

3 Results and Discussion

The research entitled "Application of RADEC Learning Model (*read, answer, discuss, explain, create*) assisted by *Quizlet* to Improve Cognitive Learning Outcomes of State Junior High School Students 4 Pekanbaru Earth and Solar System Material" there are two variables, namely the independent variable and the dependent variable where the RADEC learning model assisted by *Quizlet* as the independent variable and cognitive learning outcomes as the dependent variable. This research was conducted by applying treatment to one experimental class using the RADEC cooperative learning model assisted by *Quizlet*.

This study used descriptive and inferential statistics. Grade 7.3 students at SMPN 4 Pekanbaru used RADEC (*read, answer, discuss, explain, create*) Learning Model assisted by *Quizlet* in science learning, while grade 7.1 students used conventional model. Cognitive learning outcomes of both groups were analyzed using descriptive analysis. Table 2 shows the data distribution of the acquisition of critical thinking skills test of class 7.3.

Table 2. Data Experiment class and Control class

Value	Classification	Experiment class		Control class	
		Number of Students	Percentage (%)	Number of Students	Percentage (%)
$80 \leq x \leq 100$	Very Good	22	51,16	8	19,05
$60 \leq x \leq 79,99$	Good	21	48,84	20	47,62
$40 \leq x \leq 59,99$	Fair	1	0	13	30,95
$20 \leq x \leq 39,99$	Poor	0	0	1	2,38
< 20	Very Poor	0	0	0	0
Number		43	100	42	100

(Source: Processed Data)

The results of the analysis showed a significant value with a significance value (p-value) of 0.000, a confidence level of 95%, and an average difference of 18.62. Hypothesis testing was conducted to compare the class group that used the RADEC Learning Model assisted by *Quizlet* with the group that did not use the model, to determine whether there was a significant difference between the two groups. The posttest results analyzed using the independent t-test showed a significance value of $p = 0.000$. Based on the decision-making criteria in hypothesis testing, if $p < 0.05$, then H_0 is rejected and H_1 is accepted. Thus,

based on these results, H_0 is rejected and H_1 is accepted, which means that there is a significant difference between the cognitive learning outcomes of students in the experimental and control classes after learning *Earth and Solar System* material using the RADEC learning model assisted by Quizlet.

Before using the Independent Sample T-Test test, it is necessary to ensure that the necessary statistical requirements have been met. Referring to the opinion of Sugiyono (2022: 77), H_0 is accepted if the significance value is ≥ 0.05 , and H_0 is rejected if the significance value is < 0.05 . Therefore, the decision-making criteria must be adjusted to these provisions. The results of the Independent Sample T-Test test are also reinforced by analysis using the SPSS version 20 program, which shows a significance value of $p = 0.000$, thus confirming that there is a significant difference in cognitive learning outcomes between students who use the assisted RADEC learning model and students who do not use it after studying *Earth and Solar System* material.

Based on the results of descriptive and inferential data analysis, it is found that the RADEC model is effective in improving students' concept understanding, especially on *Earth and Solar System* material. The RADEC (Read, Answer, Discuss, Explain, Create) learning model requires students to be active at every stage of learning through a systematic approach and based on digital technology. This model was developed to improve students' cognitive learning outcomes through five stages of structured learning, namely Read, Answer, Discuss, Explain, and Create (Kurnia et al., 2025: 1999). The Quizlet platform as digital media used in the RADEC model provides various features such as interactive *flashcards*, *educational games*, and *online tests*, which make the learning process more interesting and effective (Özdemir & Seçkin, 2024: 3). This stage also reflects the 21st century learning needs that focus on collaboration, creativity, communication and critical thinking.

According to Banafsa(2024), the use of Quizlet in RADEC learning makes learners more interested because of the variety of interactive activities. In the Read stage, learners read the material prepared by the teacher; in the Answer stage, they answer quizzes using *flashcards* on Quizlet (Tulljanah & Amini, 2021: 5515)The Discuss stage is carried out in groups to complete the LKPD with the help of Quizlet as a reference. At the Explain stage, students explain their understanding verbally to friends or in front of the class, so that their communication skills also develop. The last stage, Create, encourages students to create their own Quizlet sets according to the understanding they have gained. Features such as *Learn*, *Write*, *Spell*, and *Match* in Quizlet have proven effective in supporting improved learning outcomes (Nurmitasari et al., 2023: 707).

Conventional learning requires students to be more active in paying attention to the teacher when explaining and has limitations on learning media that only use textbooks. Conventional learning is considered boring so that it reduces students' interest in learning and also makes students learn less cooperatively. Conventional learning on certain materials such as the earth and solar system makes students can only see pictures in the package book without being able to see simulations or interesting visualizations, this causes students to only be able to imagine through their thoughts so that learning is less effective.

After the learning process takes place, students who become research subjects are given a posttest to measure the extent of understanding of the concepts that have been obtained. The results of the comparison of posttest data from the two treatment groups show that the achievement of students' cognitive learning outcomes is different in all indicators, as shown in Figure 1.

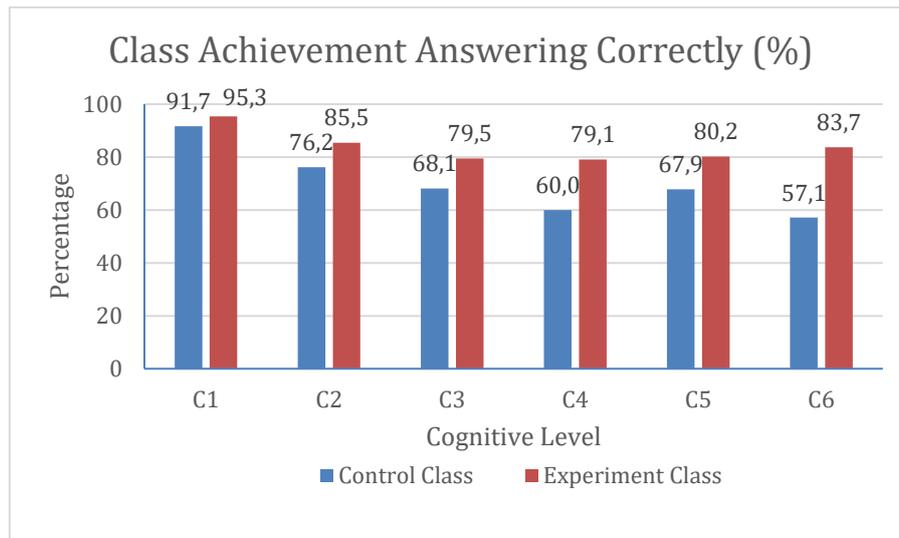


Figure. 1 Shows that the overall average score for the cognitive learning outcomes of experimental class students in all questions is higher than that of the control class, starting from C1 to C6.

a. Knowing (C1)

Knowing is the most basic cognitive level. At this level, students are expected to be able to remember and recognize basic information that has been learned. The results showed that the experimental class as a whole had mastered the material, indicated by the experimental class achievement percentage of 93.5%, while the control class only reached 91.7%. Although the difference is not too striking, it shows that the initial knowledge of students in both groups is relatively balanced. This finding is in line with the research of Dwikurnia et al (2023: 43) which states that students in the experimental class excel because the application of the Radek Learning Model Assisted by Quizlet consistently improves learning outcomes at each meeting.

b. Understanding (C2)

Understanding includes the ability of students to explain ideas or concepts that have been learned. In this indicator, the experimental class reached 85.5%, while the control class was only 76.2%. This achievement shows that students in the experimental class are not only able to remember, but also understand the content of the material more deeply. This was influenced by the Discuss and Explain stages in the RADEC model, where learners actively discussed and explained concepts to group mates. These results are consistent with the findings of Sofian et al (2022: 183) that digital-based active learning models can improve understanding of facts and concepts.

c. Applying (C3)

Applying is the ability of students to use information, rules, or procedures that have been learned into real situations. At the C3 level, the experimental class reached a percentage of 79.5%, much higher than the control class which was only 68.1%. This significant difference shows that students in the experimental class were able to apply the concepts learned directly through simulating the earth's rotation using a globe. This is reinforced by the research of Adyan et al. (2019: 153) which shows that the superiority of the experimental class is driven by higher learning motivation, because the use of direct learning media can increase the enthusiasm of students in the learning process.

d. Analyzing (C4)

Analysis involves the ability to break down a concept into parts and understand the relationship between these parts. The results on the C4 indicator showed that the experimental class obtained 79.1%, while the control class was only 60%. Although the difference is not as big as other indicators, this result still shows

the superiority of the experimental class. The discussion stage in RADEC provides space for students to compare, categorize, and find connections between concepts. This is very important to form the basis of logical and systematic thinking in understanding science.

e. Evaluating (C5)

Evaluation is the ability to make judgments based on certain criteria. In this indicator, the experimental class reached 80.2%, and the control class only 67.9%. These results show that students in the experimental class were better able to assess and provide arguments for the information provided. This process was supported by critical discussion activities and group evaluation in RADEC-based learning. The support of *test* and *quiz* features in Quizlet also allows students to evaluate their understanding independently.

f. Creating (C6)

Creating is the highest level in the cognitive domain, where learners are asked to combine their knowledge to create something new. The analysis showed that the experimental class achieved 83.7%, while the control class only obtained 57.1%. This large difference shows that the RADEC model assisted by Quizlet is very effective in developing learners' creative abilities. At the Create stage, students create new *flashcard* sets or *quizzes* on Quizlet according to their understanding. This not only hones creativity, but also strengthens concept mastery through the re-production of information in a meaningful way.

The explanation above shows that the experimental class analysis indicators have better average cognitive learning outcomes than the control class. This is due to the type of questions given which emphasizes the active participation of students in solving problems. Before answering, students must first analyze the information provided, so that they can provide the right answer (Irvanda et al., 2025: 44).

The RADEC model directs learners to be actively involved in each stage of learning. The Read stage emphasizes literacy and initial understanding of the material. The Answer stage provides independent practice through Quizlet's interactive features such as *flashcards* and *quizzes*. The Discuss stage allows students to work together in small groups to explore concepts, while the Explain stage trains scientific communication skills through the presentation of understanding. Finally, the Create stage challenges learners to create learning products (e.g. Quizlet sets) based on the understanding they have built independently. Research by Nurmitasari et al (2023). showed that the RADEC model is effective in improving learning outcomes because the process encourages student involvement in the five stages of active learning. E Silva et al (2023) also revealed that the use of Quizlet as an interactive digital media is able to increase student motivation and learning achievement, because it provides various features such as *games*, *flashcards*, and *quizzes* that can be accessed anytime and from anywhere.

Thus, the application of the Quizlet-assisted RADEC learning model not only has a positive impact on improving cognitive learning outcomes, but also supports the achievement of 21st century competencies through critical, collaborative and creative thinking skills. This is especially relevant in science learning such as Earth and Solar System material, which requires conceptual understanding and active involvement of students.

4 Conclusion

Based on the results of the research and discussion that has been carried out, it can be concluded that:

1. The application of the READEC learning model assisted by Quizlet is proven effective in improving students' cognitive learning outcomes of earth and solar system material. This is evidenced by the average value of the experimental class (82.13) which is higher than the control class (68.6).

2. There is a significant difference between the learning outcomes of students who use the RADEC learning model assisted by Quizlet and students who use conventional learning on earth and solar system material. This is indicated by the results of hypothesis testing with a significance value of $0.000 < 0.05$.
3. The CORE learning model assisted by Nearpod has a positive impact on all learning outcome indicators, with the most significant increase in the indicators of creating (26.6%) and analyzing (19.1%).
4. The stages of the RADEC (*Read, Answer, Discuss, Explain, Create*) learning model implemented with the help of Quizlet facilitate students to: read the material independently (*Read*), answer initial questions (*Answer*), *discuss* to deepen understanding (*Discuss*), explain concepts (*Explain*), and create learning products (*Create*), thus encouraging critical thinking and active involvement in learning.

Thus, the application of the RADEC learning model assisted by Quizlet can be an effective alternative learning strategy to improve students' cognitive learning outcomes on earth and solar system material at the junior high school level.

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