JoSLEPI 3 (3) (2025)
Journal of Science Learning Process and Instructional Research
https://journal.riau-edutech.com/index.php/selektapkm
Publisher :
Andester Riau Edutech
Pusat Inovasi Pendidikan dan Teknologi
ISSN 3031-3252

THE EFFECT OF THE REACT LEARNING MODEL USING SCRATCH MEDIA ON COGNITIVE LEARNING OUTCOMES ON THE SOLAR SYSTEM MATERIAL AT SMPN 5 PEKANBARU

Winda Pratiwi[1*], Nur Islami[1], Muhammad Nor[1]

[1] *Physics Education, Faculty of Teacher Training and Education, Riau University, Indonesia*

Corresponding author's email: winda.pratiwi3287@student.unri.ac.id
Submiited: 16/06/2025
Accepted: 21/08/2025
Published: 29/12/2025
Vol. 3
No. 3

Abstract- This study aims to investigate the effect of implementing the REACT learning model using scratch media on cognitive learning outcomes in the solar system material of class VII students of SMPN 5 Pekanbaru and to determine the significant differences between the cognitive learning outcomes of students in classes that implement the REACT learning model using scratch media and students who implement conventional learning at SMPN 5 Pekanbaru. The population of this study was 257 class VIII students. The sample determination used a simple random sampling technique with a sample size of 64 people. The research method used was an experimental method with a quasi-experimental type. This study used a posttest-only control group design. The results of the study found that the REACT learning model using scratch media applied to the experimental class was in the medium category with an average cognitive ability score of 61.13, while the control class that implemented conventional learning was in the low category with an average cognitive ability score of 41.36. Based on the results of the hypothesis test, there was a significant effect of implementing the REACT learning model using scratch media on student learning outcomes, where there was an increase in learning outcomes when using the REACT learning model using scratch media. Based on the research that has been conducted, the REACT learning model using scratch media has been proven to have an influence on students' cognitive learning outcomes on the solar system material.

Keywords: *Cognitive Learning Outcomes, REACT (Relating, Experiencing, Appliying, Cooperating, transferring) and Scratch*

1 Introduction

Education is a universal activity in human life because education is a resource and bridge for humans to be able to fulfill their potential through the learning process obtained. Education also includes all the knowledge gained throughout life, in every place and situation, which has a positive influence on the development of each individual (Wiguna, Welsiliana, et al., 2021: 3673). Education is an important goal for the progress of the nation, which is determined by the quality of human resources to ensure the sustainable development of the nation (Anggreni, 2020: 16). Education is currently in the industrial revolution 5.0 with the term society era. The era of society 5.0 is an era that complements the industrial paradigm 4.0 which is closely related to technology (Suherman, et al., 2023: 170). Since the development of science and technology in the world of education (IPTEK) the education process has become more advanced. With the existence of technology, many things have changed from the past to the present. This can be seen from the way teachers teach, the way students learn, and learning materials that are constantly being updated (Fitri Mulyani, 2021: 102). Therefore, in facing the era of society 5.0, the world of education plays an important role in improving the quality of human resources (HR) (Subandowo, 2022: 26).

How to Cite
Winda Pratiwi, et al (2025) The Effect Of The React Learning Model Using Scratch Media On Cognitive Learning Outcomes On The Solar System Material At Smpn 5 Pekanbaru. Journal of Science, Learning Process and Instructional Research (JoSLEPI*)*. 3(3), 1-8

The 21st century is a century of development of science and technology known as the age of knowledge. The direction of 21st century education is very much in line with the goals of education in Indonesia (Sudarisman, 2015: 29). The 21st century learning system is a learning system where the curriculum that is developed requires schools to change their learning approach. Namely, what was originally centered on educators (teacher centered learning) has now changed to a learning approach that is centered on students (student centered learning) (Afni, Wahid, et al., 2021: 138).

However, the reality in schools shows that the learning process is still centered on teachers and does not require students to be more active. This is supported by the results of observations conducted in class VII of SMPN 5 Pekanbaru in the science learning process showing that the learning carried out by teachers still uses the lecture method. This learning seems monotonous and has not made students active, tends to be rigid, and less interesting. Students tend to be passive in receiving the transfer of knowledge, as a result, students who are less creative in learning and the information received cannot last long. In addition, complaints that are often faced by students in the science learning process are learning that is only based on textbooks and is not contextual (Nabilla, 2024: 148). Current technological developments have not been optimally utilized by educators in the learning process. This is due to the lack of understanding of teachers regarding the use of the latest technology, this is reinforced by the statement of one of the science teachers in class VII at SMPN 5 Pekanbaru who stated that there was a lack of understanding of the application of current learning media and asked more for help from junior teachers to help with technology and media. In the learning process, only old media such as blackboards, textbooks, and LKS are used without the use of the latest media at this time. This is in line with the results of research by Musyadad et al. (2019:12) who stated that not a few students have low learning outcomes, including in Natural Sciences (IPA) subjects.

One of the factors that can influence learning outcomes is internal factors and external factors, internal factors are factors that come from within students such as physiological conditions, intelligence, talent, interests, motivation and cognitive abilities. While external factors are factors that come from outside students such as environmental factors and instrumental factors (Fathiyah, 2022:3).

Based on non-contextual science learning, one alternative solution to overcome this problem is to create learning activities that emphasize conceptual and contextual understanding using the REACT learning model (Octavia, 2020: 15-16). CORD develops contextual learning to improve students' abilities and learning outcomes, therefore this learning model is a development of the curriculum and contextual-based learning. The REACT learning model is described by Crawford into five steps, namely: Relating, Experiencing, Applying, Cooperating, Transferring (Nurhasanah, 2021:74).

At the Relating stage, students learn existing knowledge material with the knowledge they have acquired so that they can focus on the problem. At the experiencing stage, student activities are more emphasized on exploration, discovery and creation of their own concepts by students. With the active activities of students and the willingness to think in understanding a problem, it will encourage students to learn independently so that the concept will be easy to understand. At the Applying stage, students are guided to be able to apply the concepts they have learned to existing problems. In practice, students apply concepts and information to existing exercises or questions. At the Cooperating stage, students are directed to be able to learn in groups to be able to share knowledge, in this case students are trained to be able to communicate well with others. At the Transferring stage, students are expected to be able to solve different problems but are still related to the material being discussed (Hakim, 2017:55) Relevant research using the REACT learning model by Fakhruriza and Kartika (2015:56) shows that the REACT learning model has proven to be effective in improving student learning outcomes. In addition, based on Hakim's research (2017:61) it shows the influence of the use of the REACT model contextual learning method on the learning outcomes of science subjects, there is a significant difference between the learning outcomes of the control class and the experimental class. Where the learning outcomes of the experimental class (class using the REACT learning model) are higher than the control class (class using the conventional learning model).

In today's technological era, the learning process can be assisted by various learning media. One of the media that can be used is Scratch media. With an easy-to-understand graphical interface, users can create various interactive projects such as animations, games, digital stories, and simple applications without requiring prior programming knowledge. (Nugroho, 2023:12). Scratch can be an alternative media that can improve student learning outcomes externally.

Based on this explanation, the author is interested in conducting research entitled "The Effect of the REACT Learning Model Using Scratch Media on Cognitive Learning Outcomes in Solar System Material at Junior High School"

2 Research Methodology

The research design used in this study is quantitative research using experimental research type. The type of research used is quasi-experimental with post-test only control group design as follows. The posttest-only control group design can be seen in table 1.

Tabel 1. posttest-only control group design

Group	Treatment	Post-test
Eksperiment	X	O_1
Control	-	O_2

(Sugiyono, 2021:132)

This study aims to determine the effect of the REACT learning model using scratch media on students' cognitive learning outcomes. This study was conducted at SMPN 5 Pekanbaru in class VII, even semester, 2024/2025 academic year. The research implementation time starts from March-June 2025. The population in this study were class VII students in even semester at SMPN 5 Pekanbaru consisting of 8 classes with a total of 257 students. From this population, 2 classes were selected as experimental classes and control classes. Class VII 6 was selected as the experimental class with 31 students, namely the class that received learning with the REACT learning model using scratch media and class VII 5 with 33 students was selected as the control class, namely the class that used the conventional learning model.

Instrument

The research instrument is a tool used to collect data in research that is processed and compiled systematically. The measuring instrument used in this study was a package in the form of posttest questions or student cognitive learning outcome tests. The test was made based on indicators in the solar system material. Data Collection

Data collection in this study was done by conducting a written test or post-test on student learning outcomes. The written test was conducted to determine the learning outcomes of students in the experimental class and the control class which would be used as analysis material later. The written test questions given to the experimental class and the control class were the same so that the differences in abilities between the two classes could be identified.

Data Analysis

In this study, the data analysis techniques used were descriptive analysis and inferential analysis. The descriptive analysis referred to in this study was to provide an overview of students' cognitive learning outcomes. Student test results were processed to obtain an average score.

Students' cognitive learning outcomes were analyzed by calculating the average percentage of the scores obtained by students. The scores obtained by students were calculated using the following formula:

The level of students' cognitive abilities is grouped into five criteria. The criteria for students' cognitive learning outcomes can be seen in Table 2.

Table 2 Classification of students' cognitive learning outcomes

Interval (%)	Category
$80 < x \leq 100$	Very high
$65 < x \leq 80$	High
$55 < x \leq 65$	Medium
$40 < x \leq 55$	Low
$0 < x \leq 40$	Very Low

(Arikunto, 2009)

This study also uses inferential analysis to determine the effect of the REACT learning model using Scratch media. The analysis of the application of learning testing on student learning outcomes uses the free sample t-test technique with the aim of testing the significance of the difference in the average score of student learning outcomes in the experimental class and the control class.

3 Results and Discussion

1. Descriptive Analysis Results

Interpretation of posttest results for students' cognitive learning outcomes about the solar system is shown in Table 3. There are two classes, an experimental class with 31 students and a control class with 33 students. Meanwhile, appendices 7 and 8 show the posttest results for students' cognitive learning outcomes.

Table 3. Interpretation of post-test scores for experimental and control classes.

Interval	Experimental class		control class		Category
	Percentage (%)	Total	Percentage (%)	Total	
$80 < x \leq 100$	6,45 %	2	3,03 %	1	Very High
$65 < x \leq 80$	35,48 %	11	3,03 %	1	High
$55 < x \leq 65$	16,12 %	5	6,06 %	2	Medium
$40 < x \leq 55$	32,25 %	10	39,4 %	13	Low
$0 < x \leq 40$	9,7 %	3	48,48%	16	Very Low
Average		61,13		41,36	
Category		Medium		Low	

Based on the results of statistical data processing, the average value of the experimental class was 61.13 with the " Medium " category, while in the control class the average value was 41.36 with the "low" category. This shows a difference in the category of achievement of students' cognitive learning outcomes between the two classes with a fairly significant difference in the average value of 19.77. A clearer picture of the achievement of each cognitive domain indicator can be seen in table 4

Comparison of the average pre-test scores for each aspect of the cognitive ability indicators of the experimental class and the control class can be seen in Figure 1

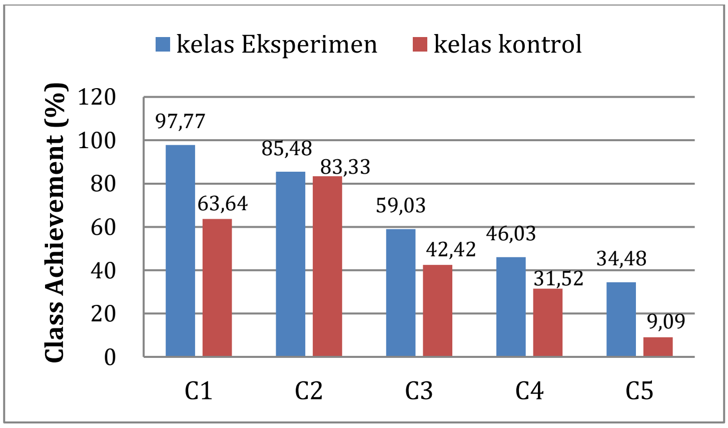

Figure 1 Achievement graph of control class and experimental class

Based on Figure 1, it can be seen that overall the average experimental class has a higher value than the control class. Further explanation of cognitive abilities, namely Remembering, Understanding, Applying, Analyzing and Evaluating as follows:

1) C1 (Remembering)

The remembering aspect (C1) is the student's ability to remember knowledge from a memory by taking definitions, facts or lists, or reciting previously learned knowledge (Listiani, 2022:399). The significant difference between the two classes of 34.13% indicates that the REACT learning model uses scratch media, especially in the first phase of Relating, namely linking knowledge, to support the cognitive aspect of remembering. In the Relating phase, students convey the knowledge they have and can relate it to the latest information received. Students who can convey knowledge related to the material will find it easier to remember the latest information obtained because it is still related to previous knowledge.

2) C2 (Understanding)

The understanding aspect (C2) is the student's ability to build meaning from various types of functions, both oral and written (Listiani, 2022:399). The very small difference of 2.15% indicates that the two learning models have almost the same effectiveness in understanding ability. However, the experimental class still has a higher average score. This is because there is a second phase, namely Experiencing, where students explore and discover with scratch media regarding new knowledge gained and knowledge they have. In this case, students learn to understand the right, important information and build knowledge independently to grow their ability to remember with long-term memory.

3) C3 (Applying)

The applying aspect (C3) is the student's ability to use procedures that refer to the material studied and used in products such as models, presentations, interviews, or simulations (Listiani, 2022:399). This significant difference of 16.61% is due to the third phase in the REACT learning model using scratch media, namely Applying. In the Applying phase, students apply the results of information from previous explorations and discoveries in the form of filling in LKPD data or other practice questions.

4) C4 (Analyzing)

The analyzing aspect (C4) is the student's ability to break down material or concepts into several parts by determining how the parts are interconnected or how the parts relate to the overall structure or purpose (Listiani, 2022:399). A significant difference of 14.93% is due to the fourth phase in the REACT learning model using scratch media, namely Cooperating. In this phase, students in groups analyze questions related to the data and information obtained by each student previously, which then combine everything to solve the questions that have been presented by working together and complementing each other. This can make students work faster in solving the problems presented.

5) C5 (evaluating)

The evaluating aspect (C5) is the student's ability to make judgments based on criteria and standards through checking and criticism (Listiani, 2022:399). A significant difference of 25.39% is due to the fifth phase of the REACT learning model using scratch media, namely Transfering. In this phase, students in groups transfer their knowledge by presenting the results of the discussion obtained and concluding it in front of the class, then other groups will respond and convey the latest information that was not conveyed by the presenter group. This supports students in evaluating the information they know and receive.

Based on this analysis, it can be concluded that the average value of students' cognitive abilities in the experimental class is higher than that of students in the control class, although there are several categories of small average values, but it does not rule out the fact that the experimental class is still higher than the control class.

2. Inferential Analysis

Inferential analysis was obtained with the help of IBM SPSS 22 to conduct normality tests, homogeneity tests, and hypothesis tests. Hypothesis testing requires prerequisite tests first, namely normality tests and homogeneity tests using pretest and posttest data on cognitive learning outcomes in both class groups. The normality test performed on this research data is the Kolmogorov-Smirnov test. The detailed results of the normality test can be seen in Table 5.

Table 5. The results of the post-test normality tests in the experimental and control classes

	Statistic	**df**	**Sig.**
Experimental classes	,135	31	,156
control classes	,146	33	,073

Based on Table 5, it shows that in the experimental class for post-test has a significance value of 0.156. In the control class, the results of the normality test for post-test have a significance value of 0.073. Based on these results, the pre-test and post-test data in the experimental class and the control class are normally distributed where the significance value (Sig.) > 0.05.

The next stage in inferential analysis is the homogeneity test. After the data is known to be normally distributed, the next step is to conduct a homogeneity test using the Levene Test. The results of the homogeneity test using the Levene Test are attached in Table 6.

Table 6. Results of Homogeneity Test of Experimental Class and Control Class

Levene Statistic	**df1**	**df2**	**Sig.**
,242	1	62	,625

After conducting prerequisite tests, namely normality tests and homogeneity tests, a hypothesis test was conducted to determine whether or not there was a significant difference between students in the experimental class and students in the control class who implemented conventional learning. The test used in this hypothesis test was the independent sample t-test which aims to determine the difference in students' cognitive learning outcomes between students in the experimental class and the control class on the solar system material.

The independent sample t-test was conducted to test both hypotheses with the help of IBM SPSS 22. The detailed results of the independent sample t-test can be seen in Table 7.

Table 7. Independent Sample T-test Results

		t-test for Equality of Means		
		t	**df**	**Sig.(2-tailed)**
Cognitive abilities	Equal variances assumed	4,974	62	,000
	Equal variances not assumed	4,981	61,974	,000

In Table 7, it can be seen that the significance value (Sig.2-tailed) < 0.05 for the post-test results of the experimental class and the control class. Thus, it can be concluded that there is a significant difference in the average cognitive learning outcomes of students between the experimental class that applies the REACT learning model using scratch media and the control class that applies the conventional learning model on the solar system material.

4 Conclusion

Based on the results of the research that has been conducted at SMPN 5 Pekanbaru by implementing the REACT learning model using scratch media on the solar system material, the following conclusions can be drawn:

1. That this learning model has a significant influence on students' cognitive learning outcomes. This is evident from the average value of the experimental class which is higher than the control class where the experimental class gets an average student score in the medium category while the average value of the control class is in the low category, so that the experimental class that applies the REACT learning model using scratch media gets a higher average score than the control class.
2. There is a significant difference in students' cognitive abilities between the experimental class that applies the REACT learning model using scratch media and the class that applies the conventional learning model on the solar system material.

Thus, the REACT learning model using scratch media is proven to have a significant influence in improving student learning outcomes on the solar system material at SMPN 5 Pekanbaru

Reference

Afni, N., Wahid, A., Hastati, S., Jumrah, A. M., & Mursidin, M. (2021). Development of 21st century learning models at SD Negeri 126 Borong, Herlang District, Bulukumba Regency. Madaniya, 2(2), 137-142.

Arikunto. (2009). Educational Psychology. Bandung: Pt. Remaja Rodaskarya

Anggreni, I. G. A. S., Wiarta, I. W., & Putra, D. K. N. S. (2020). The Effect of Learning Models (SAVI) Based on (ICT) on Mathematical Knowledge Competence. Journal of Pedagogy and Learning, 3(1), 15-24.

Anjeli, C., Azhar, & Irawan, D. (2024). Application of think pair share type cooperative learning model with use ICM (Index Card Match) strategy to improve the ability to understand the concepts of students in class X SMAN 2 Singingi. Journal of Science, Learning Process and Instructional Research, 2(1), 11–19.

cici elizabeth, Irawan, D., & Ernidawati. (2024). Implementation of the ECIRR learning model (Elicit, Confront, Identify, Resolve, Reinforce) in work and energy material for improving cognitive learning outcomes of class XI students SMAN 2 Tambang. Journal of Science, Learning Process and Instructional Research, 2(2), 1–8.

Fakhruriza, O., and I. Kartika. (2015). The Effectiveness of the Relating, Experiencing, Applying, Cooperating, Transferring (REACT) Learning Model to Improve Junior High School Students' Learning Outcomes on Heat Material. Journal of Physics Education Research and Study. 2(2): 54-57

Fathiyah, I. A. (2022). The influence of the REACT learning model on high-level thinking learning outcomes in the subject of fiqh MAN 2 Situbondo in the 2021/2022 academic year. Thesis, Islamic religious education study program, Kiai Haji Achmad Siddiq State University of Jember.

Fitri Mulyani, N. H. (2021). Analysis of the development of science and technology (IPTEK) in education. Journal of Education and Counseling. Journal of Education and Counseling (JPDK), 3(1), 101-109.

Hakim, M. L. (2017). The REACT learning model for science subjects. Edudeena: Journal of Islamic Religious Education, 1(1), 53-62.

Listiani, W. (2022). Bloom's Taxonomy Transformation in Evaluation. 2(03), 397–402.

Musyadad, V. F., Supriatna, A., & Parsa, S. M. (2019). Application of Problem Based Learning Model in Improving Student Learning Outcomes in Science Lessons on the Concept of Physical

Environmental Changes and Their Influence on Land. Tahsinia Journal, 1(1), 1-13.
Nabilla, M. S. A., Listiaji, P., & Dewi, N. R. (2024). Application of the react learning model in science learning: a systematic literature review of publications between 2014-2024. In proceeding of the national science seminar (pp. 147-153).
Nugroho, R. A. (2023). The Effect of Using Scratch Learning Media on Students' Critical Thinking Skills. Journal of Technology and Vocational Education, 21(2), 11-22.
Nurhasanah, D. S., & Luritawaty, I. P. (2021). REACT learning model for mathematical problem solving skills. Plusminus: Journal of Mathematics Education, 1(1), 71-82.
Octavia, Shilpy A. (2020). Learning Models. Yogyakarta: CV Budi Utama
Rosanti, N., & Irawan, D. (2024). The influence of motivation and leadership style on teacher performance through teacher job satisfaction at UPT SMP Negeri 1 Kampar Kiri Tengah. Journal of Science, Learning Process and Instructional Research, 2(3), 15–24.
Subandowo, M. (2022). Educational technology in the era of society 5.0. Sagacious Journal, 9(1), 24–35.
Sudarisman, S. (2015). Understanding the nature and characteristics of biology learning in an effort to answer the challenges of the 21st century and optimize the implementation of the 2013 curriculum. Florea: Journal of Biology and Learning, 2(1), 29–35.
Sugiyono. (2021). Educational Research Methods. Bandung: ALFABETA
Suherman, Y. R., Nugroho, T. A., Quraini, F. B., & Yasin, M. (2023). Analysis of the Development of Industrialization in the 5.0 Era on the Condition of Education in Menganti District, Gresik Regency, East Java. Journal of General Studies and Research, 1(3), 169-182
Wiguna, G. A., Welsiliana, W., Yostianti Tnunay, I. M., Pardosi, L., & Faesal, A. (2021). Conventional microscope optimization training for high school biology teachers. JMM (Journal of Independent Society), 5(6), 3673-3682