

## Article History

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## THE EFFECT OF THE READ, ANSWER, DISCUSS, EXPLAIN, AND CREATE (RADEC) LEARNING MODEL ON STUDENTS' CHEMICAL LITERACY SKILLS IN THE INDEPENDENT CURRICULUM

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## Abstract

This research aims to determine the influence of the Read, Answer, Discuss, Explain, and Create (RADEC) model on the chemical literacy abilities of class XI students at SMA Negeri 7 Lhokseumawe through aspects of chemical literacy, namely aspects of context, knowledge, and competence. This research is Pre-Experimental Design research, carried out in the odd semester of the 2023/2024 academic year at SMA Negeri 7 Lhokseumawe. The subjects in this study consisted of 2 classes that took cross-interest chemistry lessons, namely classes XI-1 and XI-2, with 55 students. Sampling was carried out by purposive sampling. The data collection techniques and instruments used in this research were essay questions in the form of stories or literacy, totaling nine questions about reaction rate. The research results show that the t-test data on students' chemical literacy test learning outcomes has a sig. value. (2-tailed)  $0.000 < 0.05$ , so  $H_0$  is rejected, and  $H_a$  is accepted. The conclusion is that the RADEC learning model influences the scientific literacy abilities of class XI students at SMAN 7 Lhokseumawe on the reaction rate material. The average value of the students' chemical literacy aspects is that the average value of the context aspect in the experimental class is 79.01, the knowledge aspect is 87.65, and the competency aspect is 60.49. The average value of the context aspect in the control class is 69.04, the knowledge aspect is 35.11, and the competency aspect is 45.83. The influence of chemical literacy abilities can be seen from the average value of students who use the RADEC learning model 76, with the good criterion being higher than students who use the conventional learning model, which is 50 with sufficient criteria.

**Keywords:** Chemical Literacy; RADEC; Contextual Knowledge; Competence

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## INTRODUCTION

Science literacy is a person's ability to apply scientific concepts in life; literacy is not only reading and writing but also includes thinking skills that make them empowered in learning [1]. Science literacy skills for students are needed because the literature in the field of science education also shows that science literacy is increasingly accepted and valued by educators as a student learning outcome [2].

The results of the Program for International Student Assessment (PISA) 2018 show that the science literacy of Indonesian students is still ranked 73 with a score of 371, and the average science literacy ability of OECD countries is 487 out of 78 countries that follow it. [3]. Based on the realization that the education system in Indonesia continues to be transformed to adapt to global developments, especially in chemistry learning (Sari et al., 2022). One of the problems faced by the world of education today is the weak learning process [5].

The learning process in class focuses on students' ability to remember information, but students' capacity is constantly used to remember and collect various information without having to relate it to everyday life [6]. The learning methods taught are less diverse and rely more on memorization.[5] so some students cannot

connect what they learn with how to apply that knowledge to solve problems in different situations and connect it to everyday life [6].

Likewise, with students' basic education, where teachers must teach this learning through creative and innovative learning models [8]. The learning model that teaches students to appear more active in learning is the Read, Answer, Discuss, Explain, and Create (RADEC) learning model. [9] *The RADEC learning model* is used by teachers whose syntax and context follow the current curriculum. [10]. This impacts students' lack of understanding of chemistry learning and lack of interest in the methods taught by the teacher. Some of them focus on their activities and talk with their peers.

Chemistry lessons are considered difficult to understand [11]; students think that learning chemistry only discusses formulas and calculations. However, in chemistry, many concepts are learned that are closely related to everyday life, so to learn chemistry, students need to learn optimally [12]. Based on the background of this problem, it is necessary to conduct further research on the effect of the Read, Answer, Discuss, Explain, and Create (RADEC) learning model on students' chemical literacy skills.

## METHOD

### Type of Research

This research type involves pre-experimental design, a research model that researchers use to control the cellular variables that affect the course of the experiment. (Sugiyono, 2013)[13]. In this design, there were two experimental groups: one group was applied as an experiment class using the RADEC learning model, and one group was applied as a control class using the conventional learning model.



**Figure 1.** Relationship between X and Y Variables

Where,

X = RADEC learning model

Y = Chemical literacy

**Table 1.** Intact-Group Comparison

| Group      | Treatment | Chemical Literacy Result / Post-test |
|------------|-----------|--------------------------------------|
| Experiment | X         | O <sub>1</sub>                       |
| Control    | -         | O <sub>2</sub>                       |

Where,

X = Learning using the RADEC model

O<sub>1</sub> = Post-test score of experimental class

O<sub>2</sub> = Post-test value of control class

This research was conducted in the odd semester of the 2023/2024 academic year on students of class XI who were cross-interested in Chemistry at SMAN 7 Lhokseumawe, Jl. Rancong Batuphat Timur, Kelc. Muara Satu, Lhokseumawe City Prov. Aceh.

### Research Subjects and Samples

The subjects to be studied in this research are 55 students of Class XI cross-interest SMAN 7 Lhokseumawe. The sample for this study was taken from two classes: XI-2 (27 people), an experimental class using the RADEC learning model, and XI-1 (28 people), a control class using the conventional learning model, which teachers always teach students. The sample selection was done by purposive sampling, which is the determination of samples based on certain considerations by looking at the average value of students.

### Data Collection Techniques and Instruments

Data collection techniques and instruments used in this study are essay questions in the form of stories or literacy, totaling nine questions about the reaction rate. This test serves to measure the chemical literacy skills possessed by students. The formula for calculating the percentage value is as follows:

$$\text{Student score} = \frac{\text{Score obtained}}{\text{Maximum Score}} \times 100\%$$

**Table 2.** Classification of Student Science Literacy Index

| Index range (%) | Description    |
|-----------------|----------------|
| 81-100          | Excellent      |
| 61-80           | Good           |
| 41-60           | Fairly good    |
| 21-40           | Poor           |
| 0-20            | Extremely Poor |

(Diniarti et al., 2015)

### Data Analysis Technique

Data analysis was carried out to test the research hypothesis. The first analysis was carried out on the question instrument. The question of chemical literacy before use was carried out with expert material validation by expert lecturers and continued with a validity, reliability, difficulty, and differentiation test.

After the instrument validity test, the question was carried out with a normality and homogeneity test using SPSS version 21. The final stage used hypothesis testing with an independent sample T-test. This test is used to determine the effect of the RADEC learning model on students' chemical literacy skills. The provisions of this test are if the value of Sig. (2-tailed) > 0.05, then H<sub>0</sub> is accepted, and H<sub>a</sub> is rejected (The RADEC learning model does not affect students' chemical literacy skills). If the value of Sig. (2-tailed) < 0.05, H<sub>0</sub> is rejected, and H<sub>a</sub> is accepted (RADEC learning model affects students' chemical literacy skills).

## RESULTS AND DISCUSSION

### Analysis Prerequisite Testing

Before conducting statistical analyses, it is crucial to evaluate the normality and homogeneity of the data as key prerequisites. Normality ensures that the data follows a Gaussian distribution, which is a fundamental assumption for parametric tests such as ANOVA or t-tests, enabling accurate and reliable inferences. Homogeneity, or the equality of variances across groups, is equally essential to ensure unbiased comparisons and valid test results. Tests like the Shapiro-Wilk test and visual tools such as histograms are commonly used to assess normality, while Levene's test is frequently applied to evaluate homogeneity. When these assumptions are violated, alternative approaches, such as data transformations or non-parametric tests, may be required to ensure the robustness and validity of the analysis.

### Normality Test

Data normality testing is used to determine whether the data is normally distributed or not, researchers use the Shapiro-Wilk test method. The data from the normality test can be seen in Table 3.

**Table 3.** Normality Test Results

| Class      | Shapiro-Wilk |    |       |
|------------|--------------|----|-------|
|            | Statistic    | Df | Sig.  |
| Experiment | 0.944        | 27 | 0.154 |
| Control    | 0.944        | 28 | 0.139 |

Based on the data results in table 3, the significance value of the experimental class is 0.154 and the control class is 0.139 so it can be concluded that the data is normally distributed.

### Homogeneity Test

The homogeneity test is carried out to determine whether the data has the same or homogeneous variance and is calculated using the Levene test. With the provisions, if the sig value  $> 0.05$ , then the data varies equally or homogeneously; if the sig value  $< 0.05$ , then the data does not vary equally or homogeneously. Data from the homogeneity test results can be seen in the following table:

**Table 4.** Homogeneity Test Results

| Homogeneity test |     |     |       |
|------------------|-----|-----|-------|
| Levene Statistic | df1 | df2 | Sig.  |
| 0.099            | 1   | 53  | 0.755 |

Based on the data in Table 4, which shows that the homogeneity test of the post-test scores of the experimental and control classes, with the value obtained of 0.755, can be concluded that the two classes have the same variant or homogeneity.

### Hypothesis Testing

The results of the hypothesis testing for the chemical literacy post-test were analyzed using an independent sample t-test, as detailed in Table 5.

**Table 5.** Independent sample t-test of student post-test score

|                                 | Sig. (2-tailed) | Mean Difference |
|---------------------------------|-----------------|-----------------|
| Student Chemical Literacy Score | 0.000           | 25.775          |

Based on the t-test results for students' chemical literacy skills, the significance (2-tailed) value is 0.000. Since this value is less than the threshold of 0.05 ( $0.000 < 0.05$ ), the null hypothesis ( $H_0$ ) is rejected, and the alternative hypothesis ( $H_a$ ) is accepted. This indicates that the RADEC learning model significantly influences the chemical literacy skills of Grade XI students at SMAN 7 Lhokseumawe, specifically regarding Reaction Rates.

### Student Chemical Literacy Test Results

The data analyzed in this study was derived from the post-test scores of students in both experimental and control classes. These scores were used to evaluate the effectiveness of the intervention in enhancing students' chemical literacy. The experimental class received the intervention, while the control class followed the standard instructional approach.

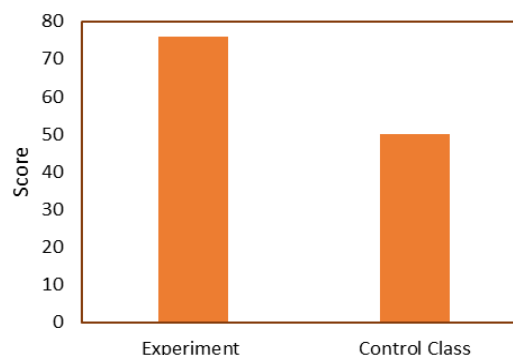
The test results provide insight into the student's understanding of key chemical concepts, ability to apply this knowledge to real-world scenarios, and critical thinking skills in chemistry. Comparing the post-

test scores allows assessing the impact of the teaching strategies implemented in the experimental class. Additionally, statistical analyses were performed to determine the significance of differences between the two groups, providing evidence of the intervention's effectiveness.

**Table 6.** Mean Value of Chemical Literacy Test

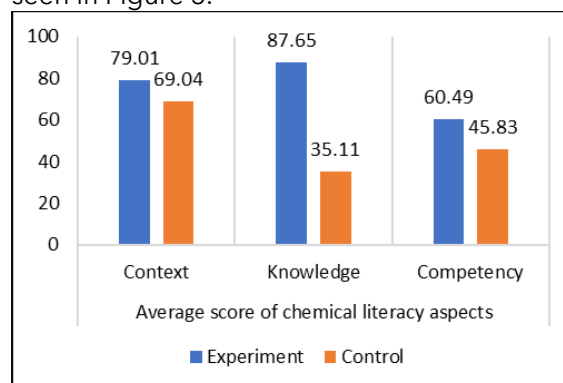
| Class      | Mean value | Description |
|------------|------------|-------------|
| Experiment | 76         | Good        |
| Control    | 50         | Fairly good |

Based on Table 6 above, it is obtained that the average value of the chemical literacy test of experimental class students is 76 with Good criteria using the RADEC learning model. The average value of the chemical literacy test of control class students is 50 with sufficient criteria using the Conventional learning model. The RADEC model positively impacts student learning related to literacy, where the first step in this model is reading. This can also be seen in the following diagram:



**Figure 2.** The score of Chemical Literacy achieved by both the control class and the experimental class

Based on the average score of students in the diagram above, there are 3 aspects of chemical literacy measured, namely aspects of context, knowledge and competence. 3 items are aspects of context and question numbers 1, 7, and 8. There are 3 items of knowledge aspects and question numbers 3, 5 and 6. There are 3 items of competency aspects and question numbers 2, 4 and 9. The percentage of the average value of chemical literacy aspects measured can be seen in Figure 3.



**Figure 3.** Average score of chemical literacy aspects

Based on Figure 3 above, the average value of students' chemical literacy aspects, the experimental class had an average value of context aspects of 79.01, knowledge aspects of 87.65, and competency aspects of 60.49. The average value of context aspects in the control class was 69.04, knowledge aspects 35.11, and competency aspects 45.83. It can be concluded that the average value of the chemical literacy aspects of experimental class students is higher than the average value of the chemical literacy aspects of control class students.

Based on the average value of the context aspect of the experimental class is higher than that of the control class, students in the experimental class have been able to apply their knowledge in reaction rate material related to daily life through reading activities before starting learning. Only some students in the control class can apply their knowledge. The role of the teacher himself is to connect the content learned with the real life of students, but the reality obtained by the teacher is that not all children will be able to connect what they get and understand. (Permatasari & Fitriza, 2019).

In terms of self-knowledge, the experimental class was higher than the control class. Based on existing data and classroom conditions, many students are less active when the teacher explains, busy talking to friends and thinking more about what they will do when they get home from school. This affects student learning outcomes, and students' ability to describe the investigation design is still low. Based on research conducted by (Zahara et al., 2022) The low ability of students is due to the fact that to compile scientific inculcation, it is suitable to use the practicum method or students have learned and done experiments before. The ability of students' chemical literacy in the aspect of competence itself is the lowest, where it includes the ability of students to recognize questions that allow for scientific investigation based on conditional situations, the ability to search for information and recognize scientific investigations [2]. This means that in this aspect itself, the ability of students obtained by the teacher is very low, so in the future, it can be improved again, as stated by (Permatasari & Fitriza, 2019).

There are five stages of learning in the RADEC Model that make students more active because students become the center of learning. In stage I (Read), students are encouraged to seek information from various sources, including textbooks, the Internet, etc. Students can stimulate their skills regarding new knowledge obtained through reading activities related to reaction rate material at this stage. Teachers play a role in learning students' reading literacy and succeed in increasing students' interest in reading by asking students to answer the teacher's questions before learning [15]. In stage II (Answer) students are trained to use their own reading comprehension skills to answer pre-learning questions based on the

information they have read previously. This stage increases students' independence in answering pre-learning questions. Therefore, each student makes his/her own effort in answering the questions posed before learning. In this way, the teacher plays an active role in determining students' understanding of the material discussed based on information obtained through reading activities (Pohan et al., 2020). Stage III (Discuss) discussion groups are formed according to the teacher's instructions and serve as a place for students to exchange information and discuss pre-learning questions and questions listed on student worksheets.

Teachers play a role in encouraging students to think critically and express opinions and instilling the mental courage to do so. (Sholihah & Amaliyah, 2022). So, collaboration between students who do not understand the material and training collaboration between students in their groups so that all group members can understand the questions given by the teacher. Stage IV (Explain), after group discussion, students present the results of their discussion to other groups. At this stage, students' oral communication skills increase, the teacher also plays an active role in helping students convey material and correcting if there is a wrong understanding of concepts in students. (Rambe et al., 2023) In Stage V (Create), students from other groups generate new ideas by asking questions about the discussion and then ask the group that presents the results questions. Students who present the material then answer questions to create good communication that will continue continuously. [19]. At this stage, students can conclude the material they have learned.

All students get an interesting learning experience. They can analyze a problem in everyday life based on the literacy questions that have been answered. This is evidenced by a narrative about cooking meat with papaya. This question allows students to analyze and understand the concept of reaction rate. Research conducted by (Putri & Zulfadewina, 2023) showed that students' science literacy skills improved by using the RADEC learning model. This RADEC learning model involves all students actively, not just one or two students who excel in the learning process (Nurpratiwi et al., 2023) Originally, students had the same opportunity as other students. Students also had the opportunity to try to provide answers given by the teacher and create simple practicums with materials from everyday life.

## CONCLUSION

Based on the results of the study, it can be concluded that the average value of chemical literacy aspects of students is an average value of context aspects in the experimental class 79.01, knowledge aspects 87.65, and competency aspects 60.49. The average value of context aspects in the control class was 69.04, knowledge aspects 35.11, and competency

aspects 45.83. Students' chemical literacy skills, with the average value of the experimental class, obtained 76 in the Good category, and the average value of the control class obtained 50 in the Fair category. The significance value of  $0.000 < 0.05$  supports this conclusion, meaning  $H_a$  is accepted, and  $H_0$  is rejected. Based on these findings, the RADEC learning model affects students' chemical literacy skills.

## REFERENCES

- [1] R. Thahir, N. Magfirah, and A. Anisa, "Hubungan Antara High Order Thinking Skills dan Kemampuan Literasi Sains Mahasiswa Pendidikan Biologi," *BIODIK*, vol. 7, no. 3, pp. 105-113, Sep. 2021, doi: 10.22437/bio.v7i3.14386.
- [2] S. Rita Zahara, S. Alvina, and I. Artikel Abstrak, "LITERASI SAINS DALAM PEMBELAJARAN SAINS SISWA SMP," *J. Pendidik. Berkarakter*, vol. 5, no. 2, pp. 119-124, 2022, doi: 10.31764.
- [3] OECD, "PISA Result in Focus," 2018.
- [4] N. Rohmah Hufnita Sari, J. Pendidikan Sejarah, and F. Ilmu Sosial dan Hukum, "PENGARUH SOAL HIGHER ORDER THINKING SKILLS TERHADAP KEMAMPUAN LITERASI SEJARAH SISWA KELAS XI IPS SMA NEGERI 1 KRIAN PADA MATA PELAJARAN SEJARAH Agus Suprijono," 2022.
- [5] F. Prayunisa and M. Rasyidi, "Perbandingan Model Pembelajaran Inkuiri Bebas Dan Inkuiri Bebas Termodifikasi Terhadap Hasil Belajar Kimia Siswa Ditinjau Dari Kemampuan Awal Siswa Kelas X SMAN 2 Selong Tahun Pelajaran 2019/2020," *J. Ilm. Wahana Pendidik.*, vol. 6, no. 4, pp. 595-601, 2020, doi: 10.5281/zenodo.4297695.
- [6] M. Mellyzar, S. Alvina, and S. R. Zahara, "Influence of POGIL and MFI Models on Science Literacy and Science Process Skills for Junior High School," *J. Penelit. Pendidik. IPA*, vol. 8, no. 4, pp. 2201-2209, 2022, doi: 10.29303/jppipa.v8i4.2121.
- [7] A. Mutia, T. Hadinugrahaningsih, and S. Budi, "Pengaruh Model Pembelajaran Inkuiri Terbimbing dengan Pendekatan Berbasis Kontekstual (CBA) terhadap Literasi Kimia Peserta Didik Kelas XI MIPA SMA Negeri Jakarta pada Materi Hidrolisis Garam," *JRPK J. Ris. Pendidik. Kim.*, vol. 10, no. 1, pp. 1-8, 2020, doi: 10.21009/jrpk.101.01.
- [8] H. Hasriadi, "Metode Pembelajaran Inovatif di Era Digitalisasi," *J. Sinestesia*, vol. 12, no. 1, pp. 136-151, 2022, [Online]. Available: <https://sinestesia.pustaka.my.id/journal/article/view/161>
- [9] I. Maspiroh, E. Kus, and E. Sartono, "Model Pembelajaran Radec (Read, Answer, Discuss, Explan, And Create) Untuk Meningkatkan Kemampuan Berikir Tingkat Tinggi (High Order Thingking Skill) Peserta Didik Pada Pembelajaran IPA di Sekolah Dasar," vol. 4, no. 2, 2022, doi: 10.57121/meta.v4i2.43.
- [10] Y. A. Pratama, W. Sopandi, Y. Hidayah, and M. Trihatusti, "Pengaruh model pembelajaran RADEC terhadap keterampilan berpikir tingkat tinggi siswa sekolah dasar," *JINoP (Jurnal Inov. Pembelajaran)*, vol. 6, no. 2, Nov. 2020, doi: 10.22219/jinop.v6i2.12653.
- [11] M. S. Watoni, "Analisis Faktor-faktor Penyebab Kesulitan Belajar pada Bidang Studi Akuntansi," *Manazhim*, vol. 1, no. 1, pp. 64-80, 2019, doi: 10.36088/manazhim.v1i1.138.
- [12] Z. Octarya, "Desain dan Uji Coba Media Pembelajaran E-learning Berbasis Blog Pada Materi Sistem Periodik Unsur," *Konfigurasi J. Pendidik. Kim. dan Terap.*, vol. 6, no. 1, p. 50, 2022, doi: 10.24014/konfigurasi.v6i1.14009.
- [13] D. Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan Tindakan*. 2013.
- [14] P. Permatasari and Z. Fitriza, "Analisis Literasi Sains Siswa Madrasah Aliyah pada Aspek Konten, Konteks, dan Kompetensi Materi Larutan Penyangga," *EduKimia*, vol. 1, no. 1, 2019, doi: 10.24036/ekj.v1i1.104087.
- [15] V. Safitri and F. Dafit, "Peran Guru Dalam Pembelajaran Membaca Dan Menulis Melalui Gerakan Literasi Di Sekolah Dasar," *J. Basicedu*, vol. 5, no. 3, pp. 1356-1364, 2021, [Online]. Available: <https://jbasic.org/index.php/basicedu/article/view/938>
- [16] A. A. Pohan, Y. Abidin, and A. Sastromiharjo, "Model Pembelajaran RADEC dalam Pembelajaran Membaca Pemahaman Siswa," *Semin. Int. Riksa Bhs. XIV*, vol. 496, pp. 250-258, 2020.
- [17] Marwah Sholihah and Nurrohmatul Amaliyah, "Peran Guru Dalam Menerapkan Metode Diskusi Kelompok Untuk Meningkatkan Keterampilan Berpikir Kritis Siswa Kelas V Sekolah Dasar," *J. Cakrawala Pendas*, vol. 8, no. 3, pp. 898-905, 2022, doi: 10.31949/jcp.v8i3.2826.
- [18] Riris Nurkholidah Rambe, Andini Syahfitri, Aini Humayroh, Nadila Alfina, Putri Azkia, and Tania Dwi Rianti, "Upaya Meningkatkan Keterampilan Berbicara Di Depan Umum," *J. Pendidik. dan Sastra Ingg.*, vol. 3, no. 2, pp. 11-24, 2023, doi: 10.55606/jupensi.v3i2.1966.
- [19] N. Sa'baniyah and B. A. Riyandari, "Pengaruh Kombinasi Metode Pembelajaran Think Pair Share Dan Take and Give Terhadap Kemampuan Berkomunikasi Dan Hasil Belajar Kimia Siswa Kelas X Sman 7 Mataram," *J. Kim. Pendidik. Kim.*, vol. 4, no. 2, pp. 175-184, 2022, doi: 10.20414/spin.v4i2.5177.
- [20] C. A. Putri and Z. Zulfadewina, "Pengaruh Model Pembelajaran RADEC berbasis STEAM

- terhadap Literasi Sains Siswa Kelas IV Sekolah Dasar," *J. Elem. Edukasia*, vol. 6, no. 3, pp. 1162-1170, 2023, doi: 10.31949/jee.v6i3.6280.
- [21] A. Nurpratiwi, G. Hamdu, and R. Sianturi, "Literasi Sains Siswa Sekolah Dasar melalui Model Pembelajaran Read-Answer-Discuss-Explain-And-Create (RADEC)," *JlIP - J. Ilm. Ilmu Pendidik.*, vol. 6, no. 8, pp. 5956-5962, 2023, doi: 10.54371/jiip.v6i8.2670.