Journal of Science and Social Research ISSN 2615 – 4307 (Print)
May 2025, VIII (2): 1590 – 1597 ISSN 2615 – 3262 (Online)
Available online at http://jurnal.goretanpena.com/index.php/JSSR

DEVELOPMENT OF INTERACTIVE E-LKPD BASED ON THE R2L METHOD TO IMPROVE STUDENTS' HOTS SCIENCE LITERACY

Silvia Gressiela Br Sembiring[1], Iis Siti Jahro[2]
Universitas Negeri Medan, Medan
e-mail: silviasembiring1309@gmail.com

Abstract: *This research aims to find out data and information about students' needs of Interactive e-LKPD based on the Reading to Learn (R2L) method to improve Students' HOTS Science Literacy on Reaction Rates; to find out data and information on the level of interactive feasibility of E-LKPD developed; to determine the influence of the interactive implementation of E-LKPD; to determine the level of effectiveness of interactive E-LKPD. This investigation employs a 4D model methodology. Based on questionnaire results 88.2% students' needs to E-LKPD based on R2L Method. Based on four material expert validators, it was determined that 4.32 of the material had a very valid or feasible, while 87.40% of student responses were rated as "very interesting." There is an influence in the use of E-LKPD with R2L method with a significance result of 0.000 <0.05. The level of effectiveness of E-LKPD is classified at the medium level with the N-Gain results obtained of 0.48. From these results it is concluded that the E-LKPD based on R2L Method can increase students' HOTS Science Literacy in the medium category.*

Keywords: *E-LKPD, HOTS, Reaction Rates. Reading to Learn, Science Literacy*

Abstrak: Penelitian ini bertujuan untuk mengetahui data dan informasi tentang kebutuhan siswa terhadap e-LKPD Interaktif berbasis metode Reading to Learn (R2L) untuk meningkatkan Literasi HOTS IPA Siswa pada materi Laju Reaksi; mengetahui data dan informasi tentang tingkat kelayakan interaktif E-LKPD yang dikembangkan; mengetahui pengaruh penerapan interaktif E-LKPD; mengetahui tingkat efektivitas E-LKPD interaktif. Penelitian ini menggunakan metodologi model 4D. Berdasarkan hasil angket, 88,2% kebutuhan siswa terhadap E-LKPD berbasis Metode R2L terpenuhi. Berdasarkan empat validator ahli materi, ditetapkan bahwa 4,32 materi memiliki nilai sangat valid atau layak, sedangkan 87,40% respon siswa dinilai "sangat menarik". Terdapat pengaruh dalam penggunaan E-LKPD dengan metode R2L dengan hasil signifikansi 0,000 < 0,05. Tingkat efektivitas E-LKPD tergolong sedang dengan hasil N-Gain yang diperoleh sebesar 0,48. Dari hasil tersebut dapat disimpulkan bahwa E-LKPD berbasis Metode R2L dapat meningkatkan Literasi IPA HOTS siswa pada kategori sedang.

Kata Kunci: E-LKPD, HOTS, Laju Reaksi, Membaca untuk Belajar, Literasi IPA

INTRODUCTION

The scientific literacy skills of students in Indonesia are still relatively low. The average PISA results in 2022 fell compared to 2018. The 2018 PISA scores in Indonesia for reading and science were 371 and 396 and decreased in 2022 with scores for reading and science of 359 and 383 (OECD, 2023). The elements of science literacy include fundamental literacies, knowledge of content, comprehension of scientific practices, the ability to recognize and evaluate relevant scientific expertise, epistemological knowledge, cultural awareness of science, as well as attitudes and thought patterns (Sharon & Tsabari, 2020). Students' low levels of scientific literacy can be attributed to several factors, such as the curriculum design, the learning methods employed, the learning

models implemented, the availability of learning facilities, and the teaching materials used. Additionally, the application of learning strategies that do not align well with the elements of scientific literacy competencies also contributes to this issue (Amini & Sinaga, 2021).

Low scientific literacy is also influenced by students' low interest in reading (Widyastuti, Awaliah, & Hardini, 2020). Students with low levels of scientific literacy will be less responsive to rapid developments in science and technology and lack the skills needed in the 21st century. As a result, students will not be able to compete globally in the future (Amini & Sinaga, 2021). The low interest in reading in Indonesia undoubtedly affects writing productivity. Writing activities among students are also still relatively low in line with the problem of writing difficulties (Widyastuti et al., 2020).

The importance of scientific literacy skills for Indonesian students to have from an early age, because the competition of technology and information in the 21st century requires individuals to compete and follow global trends (Yusmar & Fadilah, 2023). Scientific literacy is important for students to understand the environment, health, society, technology, and economy so that students have the competence and skills to apply to solve problems in real life (Safrizal, Zaroha, & Yulia, 2020) Safrizal et al., 2021). Good scientific literacy helps students make everyday decisions, both at the personal and social levels such as climate change, pollution, and energy resources (Safrizal et al., 2021; Sharon & Tsabari, 2020).

The ability to solve problems is influenced by a person's ability to think at a high level. Critical thinking skills (HOTS) are one of the goals of education in the 21st century. By having critical thinking skills, students can open up opportunities to have various life skills that are to the needs of the 21st century (Sarah, Aswita, Ainun, Maulidar, & Azzarkasyi, 2022). To develop high-level thinking skills (HOTS) students must actively participate in the learning process (Yusuf et al., 2020). An interactive, inspiring, fun, and challenging learning process motivates students to actively participate (Widiningsih & Abdi, 2021).
Literacy skills can be categorized into low, medium, and high. (Lestari & Effendi, 2022). Students who have high literacy skills tend to have high HOTS achievements as well (Alviah, Susilowati, & Masykuri, 2020). This aligns with the views of Kucirkova, Rowe, Oliver, and Piestrzynski, who emphasized that educating students in literacy skills should involve teaching and evaluating them with high-order thinking skills (HOTS). By incorporating HOTS into literacy instruction, students effectively learn to interpret various implicit perspectives within the text. The literacy assessments based on high-order thinking skills support implementing the Merdeka Belajar program. These assessments are intended to help teachers create exam questions and equip students to tackle complex challenges in their daily lives (Setyarini, Salim, & Harto, 2021). By employing high-order thinking skills, students are anticipated to analyze, reflect on, evaluate, and justify the texts they read in relation to the contexts they encounter (Pramartha et al., 2023; Setyarini et al., 2021).

Efforts made to improve the HOTS scientific literacy of students were carried out by Wulandari & Jahro (2023) who implemented learning with the Reading to Learn (R2L) method. The results of the study obtained there was an influence on students' HOTS scientific literacy abilities partially and simultaneously with the application of the R2L method which helped students read and understand the contents of the reading, and make summaries allow students to write down what they know about the material they receive through reading and writing. However, in a study conducted by Azwar & Jahro, 2023 to improve students' HOTS scientific literacy by applying the R2L

method, the results showed that there was no effect of the R2L method on students' HOTS scientific literacy abilities. This is because the R2L worksheets used are printed and less interactive, and the time for students to work on the R2L sheets is short so the results are less than optimal.

In today's era of globalization and digitalization, the ability to solve problems quickly and accurately is needed (Fitria et al., 2022). Training in learning activities can help students develop their HOTS. Students can be trained to use technology (Yusuf et al., 2020). Utilizing technology will offer attractive and creative student worksheets (Farzana, Miranti, Purwidiani, & Widagdo, 2024).

The learning process using E-LKPD will be more effective because its use can narrow space and time. The presentation of attractive E-LKPD will also make students more enthusiastic about learning (Suryaningsih & Nurlita, 2021). The implementation of E-LKPD in the teaching and learning process can transform student engagement from being monotonous to enjoyable and stimulating. This approach fosters a more interactive learning environment, encouraging students to feel more motivated and enthusiastic about their studies (Puspita & Dewi, 2021).

Most students still consider chemistry to be a difficult subject. This is because chemistry consists of abstract concepts and requires mastery of mathematical operations and strong memory. Students have difficulty with the material on reaction rates which are abstract chemical terms. Conceptual understanding is crucial to learning because students can develop their abilities in each subject matter. Students' conceptual understanding affects students' ability to solve problems (Amanda & Azra, 2023).

METHOD

The research was conducted at SMA Negeri 5 Medan located at Jalan Pelajar No. 17 Medan City, North Sumatra. This research adopts a Research and Development (R&D) approach using a 4D development model, which includes four key stages: defining, designing, developing, and disseminating.

The research subjects consist of two lecturers, two chemistry teachers from SMA Negeri 5, and 36 students from class XI-9 at SMA Negeri 5 Medan. The object of the study is an interactive E-LKPD grounded in the R2L method, centered on the topic of Reaction Rates for XI-grade students.

The research instruments comprise both test and non-test instruments. Non-test instruments include interview sheets, expert validation forms, and student feedback forms, while test instruments consist of pre-tests and post-tests.

The data analysis was split into two categories: qualitative and quantitative. Qualitative information was gathered from interviews, observations, and expert suggestions. The analysis technique for qualitative data is carried out with descriptive data analysis. Quantitative data is obtained from scores from validation sheets and response questionnaires that are distributed.

The analysis encompassed instrument testing, including validity, reliability, difficulty level, and differential power tests. For result evaluation, validity analysis, normality tests, homogeneity tests, N-gain assessments, and t-tests were performed. Qualitative data were analyzed using qualitative descriptive. Criticism and suggestions by the validator will be used as a material for improvement of the E-LKPD being developed.

RESULTS AND DISCUSSION

Define Stage

An analysis of student questionnaires distributed to 32 students in class XI MIPA 9 indicated that 88,2 %

of students stated that reaction rate was quite difficult to understand. As many as 71 % of students stated that teachers had not used LKPD based on Reading to Learn. As much as 88,4 % of students agree that E-LKPD based learning media needs to be developed. Consequently, it was determined that students in class XI MIPA 9 at SMA Negeri 5 Medan require an E-LKPD based on the Reading to Learn method, which should effectively engage them in their studies, making the reaction rate topic easier to understand and enhancing their HOTS Science Literacy. The curriculum used is Merdeka curriculum. The cognitive category of XI MIPA 9 are heterogeny.

Aspect	**Percentage (%)**
Interest in E-LKPD	89.46
Presentation	83.65
R2L Component	87.50
Language	90.40
Average Percentage	87. 40
Criteria for Interpreting Questionnaire Result	Very Interesting

Design Stage

The media platform used by researcher to develop E-LKPD is the Liveworksheets website. The researcher collected references for the question materials related to reaction rate topic to be studied in E-LKPD. The creation of the product begins with the design with the use of Canva application before being developed into Liveworksheets so that it can be opened and worked on by students through smartphones, laptops, or computers. The chosen format aims to determine the content that will be studied and loaded on the E-LKPD. Some of the content includes the component of R2L method.

Aspects	**Average score**	**Category**
Content	4.50	Very valid
Presentation	4.56	Very valid
Language	3.91	Valid
Feasibility Level	4.32	Very valid/ Feasible

Development Stage

Tabel 1. E-LKPD Validation Results

The validation results indicate an average score of 4.32, which categorizes the material in the E-LKPD as "very valid" based on the criteria provided by BSNP

Table 2 reflects positive responses from students, showing an average percentage of 87.4% with a "Very Interesting" attractiveness level.

Table 2. Results of Students' Response

Disseminate Stage

The dissemination was conducted with pretest activities at the first meeting, followed by the agenda of giving E-LKPD to students for three meetings. The researcher first gave directions for having internet and their handphones to open the website liveworksheets After the third meeting, researcher analyzed students' answers and conducted a post-test. Prior to deploying the test instrument, it underwent a preparation process and was then tested on students to assess the validity, reliability, difficulty level, and differentiation of the questions.

From 24 questions validated to students, The 10 questions that have met the criteria are then analyzed for the reliability of the questions. The reliability value of the 10 questions was 0.862 and included in the high reliability level category so that 10 questions that met the criteria could be used as a test instrument. After the 10 multiple choice questions were validated and met the criteria, a pretest was conducted for class XI-9. The number of students who took the pre-test was 30.

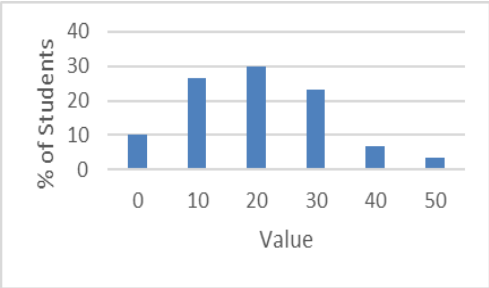

Figure 1 Pretest Results

It shows that the lowest pretest score was 0, obtained by 3 students, while the highest was 50, recorded by a single student. The average pretest score was 20.

E-LKPD work activities are carried out in the middle of learning. E-LKPD work activities with group discussions but individual collection results. This study focuses on students working on E-LKPD in three meetings. The results of the E-LKPD Assessment carried out by adjusting the main idea of the answer determined by the author in the E-LKPD assessment rubric with the main idea of the answer done by the student. The results of the E-LKPD assessment conducted for 3 (three) meetings are presented in table 3.

Table 3. Accumulation E-LKPD Results

	Meeting 1	**Meeting 2**	**Meeting 3**
Average	79	86	88

After 3 meetings of learning using E-LKPD, then students conducted a Post-Test test. There were 30 students who took the post-test.

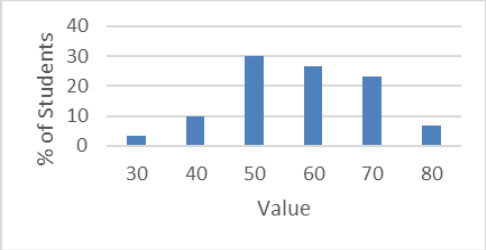

Figure 2. Post-Test Results

The lowest pretest score was 30, recorded by 3.33% or 1 student. There is the highest post-test score of 80 with 6.66% or 2 students. The average post-test score obtained is 57.67.

The significance level for the pretest is 0.063 and for the post-test is 0.087, both of which are higher than the significance level α (0.05), confirming that the data is normally distributed.

The value of Sig. pre-test and post-test is 0.736 which means it is greater when compared to the significance level α (0.05) so that the data is said to be homogeneous.

According to the first hypothesis test, the significance value is found to be less than α (0.05), leading to the acceptance of Ha and the rejection of H0. This aligns with the third research question regarding the influence of the R2L method-driven E-LKPD on students' abilities in HOTS Science Literacy, which shows a significance result of 0.000, still below α (0.05), thus confirming Ha and rejecting H0. This indicates a notable effect of the R2L method on students' ability in this domain, particularly regarding the reaction rate topic.

The N-Gain results compare pre-learning and post-learning outcomes, as shown in Table 4.7, where the average pretest score is 20 and the post-test score is 57.67, resulting in an N-Gain value of

The obstacles faced in implementing R2L-based E-LKPD are conditioning students who have low calculation skills and students who have kinaesthetic learning styles. Researchers make adjustments to the character of students by combining learning models. The learning model applied is not only PBL (Problem Based Learning) but combined with the Discovery Learning model on the reaction rate factor subtopic and making online simulations. PBL and Discovery learning methods have often been applied at the school. This type of E-LKPD has the potential to enhance students' literacy skills when integrated with an effective learning model like

Problem-Based Learning (PBL), as both approaches foster interaction between teachers and students (Tasman et al., 2022). This is in line with Rozali et al (2024) research which concluded that the science LKPD developed through Inquiry Training is an effective alternative learning resource for educators to improve science literacy which aims to improve students' HOTS science Literacy.

The effect of R2L-based E-LKPD on students' HOTS Literacy Science is also shown through the average value obtained during the 3 meetings compared to the achievement of the average value of HOTS Science Literacy ability through post-test. In the first meeting the average value of E-LKPD is 79, in the second meeting is 86 and the third meeting is 88. This is supported by a statement by Ani that the digital era requires adaptation in the learning process, one of which is the use of E-LKPD (Khoiri et al, 2023).

The E-LKPD that follows the R2L method for teaching reaction rates is considered to be quite effective, as indicated by an N-gain score of 0.48, which falls within the medium criteria range. This finding is consistent with the research conducted by Kiranadewi et al (2021), who use the problem-based learning model experienced a moderate increase with an N-Gain value of 0.48.

CONCLUSION

88.7% of students agreed to develop E-LKPD based on Reading to Learn method on reaction rates topic. The feasibility level of an average score of 4.32 and percentage of students' response 87.4% with very high criteria results and valid criteria for use in the learning process. There is a significant influence of learning using E-LKPD based on Reading to Learn method to Increase students' HOTS science literacy on the material of reaction rate and the effective criteria is medium. The research findings clearly indicate that the utilization of R2L-based E-LKPD significantly enhances students' HOTS literacy skills in science.

BIBLIOGRAPHY

Alviah, I., Susilowati, E., & Masykuri, M. (2020). Pengaruh Kemampuan Literasi Kimia Terhadap Capaian Higher Order Thinking Skills (Hots) Siswa Sma Negeri 1 Sukoharjo Pada Materi Larutan Penyangga Dengan Pemodelan Rasch. Jurnal Pendidikan Kimia, 9(2), 121–130.

Amanda, D. R., & Azra, F. (2023). The description of students learning difficulties in reaction rate materials. Jurnal Pijar Mipa, 18(5), 722–726.

Amini, S., & Sinaga, P. (2021). Inventory of scientific literacy ability of junior high school students based on the evaluation of PISA framework competency criteria Inventory of scientific literacy ability of junior high school students based on the evaluation of PISA framework compete. Journal of Physics: Conference Series, 1806(012017), 1–6.

Azwar, K., & Jahro, I. S. (2023). Pengaruh Metode Reading To Learn Dan Rangkuman Terhadap Hots-Literacy Sains Siswa Pada Materi Kesetimbangan Kimia. Pediaqu: Jurnal Pendidikan Sosial dan Humaniora, 2(1), 296–305.

Fitria, Y., Alfa, D. S., Irsyad, M., Anwar, M., & Fitri, Q. N. (2022). Student Literacy Competence in Science Learning in Junior High Schools with the Reading to Learn Model. Al-Ishlah: Jurnal Pendidikan, 14(2), 1607–1616.

Khoiri, N., Kurniawan, A. F., & Ismawati, E. Y. (2023). Analisis Validasi e-LKPD berbasis PBL pada Topik Pengukuran Besaran Fisis Kelas X SLTA. Jurnal Penelitian Pembelajaran Fisika, 14(2), 251-255.

Kiranadewi, D. F., & Hardini, A. T. A. (2021). Perbandingan Efektivitas Model Pembelajaran Problem Based

Learning Dengan Model Problem Solving Terhadap Kemampuan Berpikir Kritis Pada Pembelajaran PPKn. Journal for Lesson and Learning Studies, 4(1), 1–7. https://doi.org/10.23887/jlls.v4i1.33860

Lestari, R. D., & Effendi, K. N. S. (2022). Analisis Kemampuan Literasi Matematis Siswa SMP Pada Materi Bangun Datar. Biormatika: Jurnal ilmiah fakultas keguruan dan ilmu pendidikan, 8(1), 63–73.

OECD. (2023). PISA 2022 Results (Volume 1): The State of Learning and Equity in Education (Vol. I). Paris: OECD Publishing.

Pramartha, I. N. B., Dewi, K. H. S., Rathintara, I. A. L., & Astapa, I. G. (2023). Melalui Instrumen Tes Tipe Higher Order Thinking Skills (HOTS). Jurnal Review Pendidikan dan Pengajaran, 6(2), 326–333.

Puspita, V., & Dewi, I. P. (2021). Efektifitas E-LKPD berbasis Pendekatan Investigasi terhadap Kemampuan Berfikir Kritis Siswa Sekolah Dasar. Jurnal Cendekia: Jurnal Pendidikan Matematika, 5(1), 86–96.

Rozali, D., Suyanti, R. D., & Dewi, R. (2024). Development of science LKPD based on inquiry training on HOTS-science literacy skills. Inovasi Kurikulum, 21(2), 1099-1112.Rozali, D., Suyanti, R. D., & Dewi, R. (2024). Development of science LKPD based on inquiry training on HOTS-science literacy skills. Inovasi Kurikulum, 21(2), 1099-1112.

Safrizal, Yulia, R., Anastasha, D. A., Husnani, & Rahmi, S. (2021). Gambaran Kemampuan Literasi Sains Siswa Sekolah Dasar di Kota Padang (Studi Kasus Siswa di Sekolah Akreditasi A). el-Ibtidaiy:Journal of Primary Education, 4(1), 55–64.

Safrizal, Zaroha, L., & Yulia, R. (2020). Kemampuan Literasi Sains Siswa Sekolah Dasar di Sekolah Adiwiyata (Studi Deksriptif di SD Adiwiyata X Kota Padang). Journal of Natural Science and Integration, 3(2), 215–223.

Sarah, S., Aswita, D., Ainun, N., Maulidar, M., & Azzarkasyi, M. (2022). The development of HOTS-based assessment instruments on educational statistics. International Journal of Trends in Mathematics Education Research, 5(1), 38–43.

Setyarini, S., Salim, H., & Harto, S. (2021). Investigating Higher Order Thinking Skills (HOTS)-based Literacy Assessment Implemented by An EFL Teacher at A Junior High School in Indonesia. Proceedings of the Fifth International Conference on Language, Literature, Culture, and Education (ICOLLITE 2021), 595, 647–653.

Sharon, A. J., & Tsabari, A. B. (2020). Can science literacy help individuals identify misinformation in everyday life? Science Education, 104(5), 873–894.

Suryaningsih, S., & Nurlita, R. (2021). Pentingnya Lembar Kerja Peserta Didik Elektronik (E-LKPD) Inovatif dalam Proses Pembelajaran Abad 21. Jurnal Pendidikan Indonesia, 2(7), 1256–1268.

Tasman, F., Dewanti, A., Hutapea, D. W., SN, P. A. K., & Lubis, A. S. (2022). Pengaruh Model Pembelajaran Reading To Learn Terhadap Kemampuan 65 Literasi Matematika Siswa Pada Materi Persamaan Kuadrat. Jurnal Program Studi Pendidikan Matematika, 11(3), 1749-1759. doi:https://doi.org/10.24127/ajpm.v11i3.4535

Widiningsih, & Abdi, J. (2021). Pembelajaran Menyenangkan dan Bermakna pada Kondisi Khusus. Jakarta Selatan: Direktorat SMA, Direktorat Jenderal PAUD, DIKDAS dan DIKMEN.

Widyastuti, T., Awaliah, Y. R., & Hardini, T. I. (2020). Reading to Learn Strategy in Teaching and Learning Writing for the Students of

Sundanese Language Education Department, 424(Icollite 2019), 68–72.

Wulandari, A. T., & Jahro, I. S. (2023). Pengaruh Metode Reading To Learn Dan Rangkuman Terhadap Hots-Literacy Sains Siswa Pada Materi Laju Reaksi. Pediaqu: Jurnal Pendidikan Sosial dan Humaniora, 2(1), 289–295.

Yusmar, F., & Fadilah, R. E. (2023). Analisis Rendahnya Literasi Sains Peserta Didik Indonesia: Hasil Pisa Dan Faktor Penyebab. LENSA (Lentera Sains): Jurnal Pendidikan IPA, 13(1), 11–19.