The Effectiveness of Guided Inquiry Based E-LKPD to Improve Metacognitive Skills on Reaction Rate Material

Selfi Novia Ardani, Utiya Azizah*
S1 Pendidikan Kimia, Jurusan Kimia, Universitas Negeri Surabaya
*E-mail: utiyaazizah@unesa.ac.id

ABSTRACT

Students' metacognitive skills on reaction rate material are still low, so it is necessary to innovate digital-based teaching materials that can facilitate the process of planning, monitoring, and evaluating learning. This study aims to evaluate how well guided inquiry-oriented e-LKPD improves students' metacognitive skills on reaction rate material. Students of SMA Negeri 1 Slahung were used as research subjects. This study used a one-group pretest-posttest design and was pre-experimental. The results of the pretest and posttest of metacognitive skills were used to collect research data. The method used for data analysis was the Paired Sample t-Test. The results of the Paired Sample t-Test showed a significance value of 0.000 (<0.05). Therefore, it can be said that guided inquiry-based e-LKPD successfully improved students' metacognitive skills on reaction rate material.

Keywords: Student Worksheet; Guided Inquiry; Metacognitive Skills; Reaction Rate.

ABSTRAK

Keterampilan metakognitif peserta didik pada materi laju reaksi masih rendah sehingga diperlukan inovasi bahan ajar berbasis digital yang mampu memfasilitasi proses perencanaan, pemantauan dan evaluasi belajar. Penelitian ini bertujuan untuk mengevaluasi seberapa baik e-LKPD berorientasi inkuiri terbimbing dalam meningkatkan keterampilan metakognitif peserta didik pada materi laju reaksi. Peserta didik SMA Negeri 1 Slahung dijadikan subjek penelitian. Penelitian ini menggunakan desain pretest-posttest satu kelompok dan bersifat pra-eksperimental. Hasil pretest dan posttest keterampilan metakognitif digunakan untuk mengumpulkan data penelitian. Metode yang digunakan untuk analisis data adalah Paired Sample t-Test. Hasil Paired Sample t-Test menunjukkan nilai signifikansi 0,000 (<0,05). Oleh karena itu, dapat dikatakan bahwa e-LKPD berbasis inkuiri terbimbing berhasil meningkatkan keterampilan metakognitif peserta didik pada materi laju reaksi.

Kata kunci: Lembar Kerja Peserta Didik; Inkuiri Terbimbing; Keterampilan Metakognitif; Laju Reaksi.

INTRODUCTION

Education is an individual learning process that develops character in terms of ethics, norms, and customs. In Indonesia and other worldwide societies, education is a vital aspect of daily life (Purwanti, 2021). By implementing the Independent Curriculum, Indonesia has shown that it is committed to raising the standard of education. Phase F covers the subject of response rates in accordance with the Independent Curriculum. Reaction rates are one of the subjects covered in this learning objective. "This learning result serves as the basis for the learning phase, which includes using observation, data collecting, analysis, and conclusions to visualise and explain a phenomena. Chemistry is the subject that examines transformations and the energy needed, and Phase F gives students the opportunity to learn more about chemical principles both theoretically and experimentally" (Andriani, 2023).

Students complained that chemistry lessons were difficult for a variety of reasons,

including the fact that there were too many formulas, the information was unclear and the teacher only provided a cursory explanation, making it difficult for the students to understand, the teachers' teaching strategies were difficult for the students to understand, and the learning materials were limited to books   (Priliyanti et al., 2021). According to the findings of a pre-research survey given to 20 students at Slahung 1 State Senior High School, 60% of them said that chemistry classes were hard to grasp, particularly when it came to learning reaction rates. Reaction rates are a difficult subject for chemistry students, mainly because the idea is abstract and requires firsthand observation of the occurrences in order to comprehend (Yunita & Silfianah, 2024). The subtopic of variables influencing reaction speeds is hard for students to grasp. Because reaction rates are strongly tied to the events they observe in their environment, it is vital to give students an opportunity to develop their knowledge through metacognitive skills when studying them.

In the 21st century, students are required to possess various essential skills such as critical, creative, collaborative, and communicative thinking (the 4Cs), as well as metacognitive skills. Through these skills, students are expected to be able to manage their learning process independently, reflectively, and adaptively according to their characteristics and needs. Therefore, developing metacognitive skills is a crucial aspect in realizing the goals of the independent curriculum and equipping students with relevant skills for the 21st century (Lubis et al., 2023). The implemented independent curriculum emphasizes student-centered learning, fostering independence, and differentiated learning, making it highly relevant to the development of metacognitive skills. Knowledge of cognitive awareness and human learning is referred to as metacognitive skills. A person thinks by transforming or changing information in their mind, which necessitates intricate connections with mental functions including logic, creativity, and problem-solving (Divina et al., 2022).

Planning, monitoring, and evaluating are examples of metacognitive skills, according to (Pulmones, 2008). To solve difficulties, people need to have metacognitive skills. "Students that use metacognitive skills during the learning process might become more self-reliant. A crucial element of academic achievement, metacognition helps students grasp the meaning of a subject and makes learning more meaningful" (Divamita & Azizah, 2022).

The number of pupils of 20 at SMA Negeri 1 Slahung have metacognitive skills in the planning skills indicator, according to the findings of a pre-study on chemistry instruction, only 25% of students had monitoring skills, and 15% of students had evaluating skills. This was obtained from teacher interviews, which indicated that metacognitive skills were not taught to students. In learning activities, teachers must foster metacognitive skills in students.

In order to assist students comprehend the chemical material being covered, these issues can be resolved by using instructional methodologies and pertinent teaching materials. The guided inquiry learning paradigm is one that complements the Independent Curriculum and its elements of metacognitive skills (Sari & Muchlis, 2022). "This aligns with the phases of the guided inquiry learning model: (1) educating students about the inquiry process and focusing their attention; (2) presenting phenomena; (3) assisting students in developing hypotheses; (4) motivating students to gather information; (5) developing explanations; (6) reflecting on problem scenarios and thought processes" (Arends, 2012). The guided inquiry learning strategy actively involves students in the educational process by having them create and discover concepts that will help the content stick in their minds longer, hence improving student learning results (Sarumaha & Harefa, 2023).

The implementation of learning models must be adapted to the teaching materials used. The way the learning process is implemented might be influenced by the teacher's capacity to create instructional materials. Electronic Student Worksheets (E-LKPD) are a commonly utilized instructional resource. E-LKPD is an electronic teaching resource that incorporates audio, video, graphics, and pictures to enhance its effectiveness and interactivity. This media provides a number of benefits, including being user-friendly, useful, and possessing a number of elements that might add interest to e-LKPD. In LKPD, teachers can include materials, learning videos, links, audio, and various types of questions such as multiple choice, short answer,

drop & down, and others (Lathifa et al., 2021). Firtsanianta & Khofifah (2022) "states that E-LKPD is a digital learning tool that can be easily accessed via PC/laptop or smartphone. E-LKPD data can be supported by images and videos of oral questions and can be answered at that time". The use of E-LKPD in the learning process is very influential in optimizing student activities in learning and to encourage students to find their activities (Lusiana et al., 2021). LKPD that utilizes electronics can be used to improve students' metacognitive skills (Tazkia & Hidayah, 2023).

One platform that can be used to develop e-LKPD is liveworksheet. Liveworksheet is an online platform that allows students to create interactive worksheets using Google Chrome. By displaying content in the form of pictures, videos, and other captivating symbols, liveworksheet may pique students' attention and excitement. This can assist educators in converting worksheets on paper or in print into interactive online activities and offer automated correction (Arisandi, 2022). E-LKPD assisted by liveworksheet has the advantage of being very practical because it can be accessed anytime and anywhere using an internet connection (Firtsanianta & Khofifah, 2022).

The goal of this study was to enhance students' metacognitive abilities based on the issue analysis. "The Effectiveness of Guided Inquiry-Oriented e-LKPD to Improve Students Metacognitive Skills on Reaction Rate Material" is the title of this study, and it is anticipated that teachers would utilize the e-LKPD as a reference or as one of the useful teaching tools to enhance metacognitive skills. Additionally, students may utilize it as a study tool to enhance the caliber of their chemistry education and inspire them to understand the subject.

RESEARCH METHODS

A guided inquiry-oriented electronic student worksheet was used in this study to help students develop their metacognitive skills when it came to response rate content. This kind of study employed a pre-experimental research design, more precisely a pretest-posttest design with a single group. Figure 1 depicts the research design.

This study was conducted on 20 students at SMA Negeri 1 Slahung. A pretest and posttest sheet for metacognitive skills was the tool utilized to gather the data. There were eleven response rate-related items in the pretest and posttest questions utilised for descriptive questions, with an emphasis on factors that affect reaction rate. The planning, monitoring, and evaluating skills questions on the pretest and posttest assessed students' metacognitive skills. These questions were taken from the Pulmones indicators. Experts validated these questions.
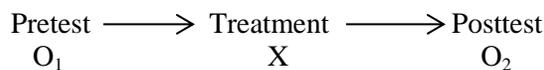
Pretest $\longrightarrow$ Treatment $\longrightarrow$ Posttest
O_1 X O_2

Figure 1. Research Design (Sugiyono, 2019)

Description:
O_1: Pretest score, to determine student abilities before treatment.
X: Treatment: the learning process using guided inquiry-oriented e-LKPD.
O_2: Posttest score, to determine student abilities after treatment.

The methodology for analyzing the outcomes of students' pretest and posttest evaluations was one way to practise metacognitive skills. While the posttest assessed the efficacy of the guided inquiry-oriented e-LKPD, the pretest gauged students' starting competency level. On the pretest and posttest sheets, paired sample t-tests were used to examine the data pertaining to metacognitive skills. It is essential to do a normality test because paired sample t-tests need normally distributed data.

RESULTS AND DISCUSSION

Students took metacognitive skills exams both before and after learning using the guided inquiry-oriented e-LKPD (pretest and posttest, respectively). While students' posttest results satisfied the full requirement, their pretest results showed incomplete criteria. With a maximum completeness of 100, students' average posttest score was 85.73 and their average pretest metacognitive skills score was still low at 36.17. The posttest score is greater than the pretest score, indicating a discrepancy between the students' pretest and posttest results. This discrepancy in scores resulted from the usage of

an e-LKPD liveworksheet that was guided inquiry-oriented.

Students develop a phenomena, conduct direct and indirect experiments to monitor it, and then observe and assess it as part of an e-LKPD. To determine the completeness of the students' metacognitive skills indicators, see Table 1.

Table 1. Pretest and Posttest Result of Metacognitive Skills

Indikator Keterampilan Metakognitif	Pretest	Posttest	N-gain	Kategori
Planning Skills	48.65	82.00	0,65	Sedang
Monitoring Skills	38.41	85.00	0,76	Tinggi
Evaluating Skills	39.15	88.00	0,80	Tinggi
Rata-Rata			0,74	Tinggi

"The N-Gain score is interpreted based on Hake's criteria, namely g > 0.7 (High), $0.3 \leq g \leq 0.7$ (Medium), and g < 0.3 (Low)" (Hake, 1998).

Following the intervention, the average score increase for each metacognitive skills indicator is displayed in Table 1. The indicators for assessing and tracking skills shown the most increase, with N-Gain ratings of 0.80 and 0.76, respectively, classified as high. With N-Gain values of 0.65, the planning skills indicator demonstrated a moderate improvement. Metacognitive abilities had an overall N-Gain of 0.74, which is considered high. These findings offer preliminary proof that students' metacognitive skills improved as a result of using guided inquiry-oriented student worksheets.

The degree to which the pretest and posttest findings for the two groups showed an improvement in the students' metacognitive skills was examined using a paired sample t-test, which was conducted using the SPSS program. A normality test was conducted before the paired sample t-test to determine whether or not the pretest and posttest data were normally distributed. The data are said to be regularly distributed and to satisfy the normality assumption if the sig. value is > 0.05. The normality assumption is broken and the data are not normally distributed if the sig. value is < 0.05. Table 2 displays the findings of the normalcy test.

Table 2. Results of the Normality Test for Pretest and Posttest Metacognitive Skills

	Statistic	Df	Sig
Pretest	.943	20	.273
Posttest	.913	20	.074

The sig. values for the pretest and posttest are 0.273 and 0.074, respectively, according to Table 2. The assumption of normalcy has been satisfied as both sig. values are higher than 0.05, implying a regular distribution of the pretest and posttest data. When the premise of normality is met, the paired sample t-test can be applied appropriately.

The hypothesis about the enhancement of metacognitive skills following the usage of the guided inquiry-oriented e-LKPD was assessed using the paired sample t-test. Additionally, This test was used to assess the significance of the difference between the pretest and posttest results. To ascertain if the difference in paired means between samples 1 and 2 was larger than the predicted difference, the paired sample t-test was used in this investigation. The hypotheses used were as follows.

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 \neq \mu_2$

Description:

H_0 = There is no difference in the average pretest and posttest scores for students' metacognitive skills.

H_1 = There is a difference in the average pretest and posttest scores for students' metacognitive skills.

A sig. < 0.05 is the basis for the decision-making criterion; if H_0 is rejected and H_1 is approved, then H_0 is accepted and H1 is rejected. On the other hand, H_0 is allowed and H_1 is refused if the sig. is less than 0.05. The test findings are used to form conclusions. Table 3 displays the outcomes of the paired sample t-test conducted with SPSS.

The sig. value derived from the data analysis above is 0.000, or less than 0.05. As a result, H_1 is approved and H_0 is refused. This demonstrates that employing the guided inquiry-oriented e-LKPD resulted in a considerably higher posttest score than the pretest score. This demonstrates the effectiveness of the designed guided inquiry-oriented e-LKPD in enhancing

metacognitive skills related to the reaction rate material. Students' metacognitive skills improved after utilising the e-LKPD, as seen by the posttest's average score of 85.73, up from the pretest's average of 36.17. It has been demonstrated that including the guided inquiry learning paradigm into the educational process enhances students' comprehension and metacognitive skills. Students can develop their metacognitive skills while studying by using the guided inquiry learning paradigm.

Schraw and Dennison's (1994) "questionnaire was modified for the student metacognitive assessment. If a student receives a score of ≥ 61 in the good or very good category, their metacognitive skills are deemed well-trained". Figure 2 shows the average percentage of each component's results on the student metacognitive inventory questionnaire.

Table 3. Paired Sample t-Test Results

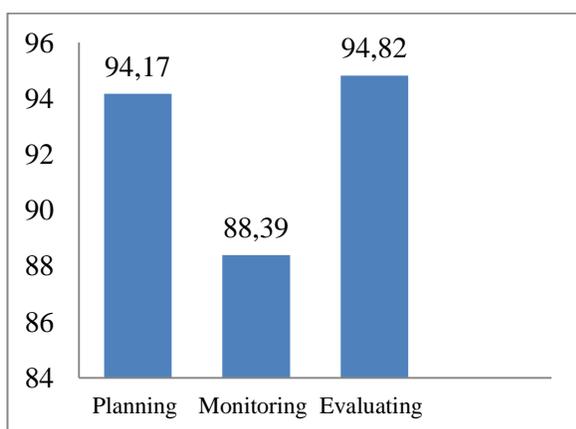|	Paired Samples Test							
	Paired Differences							
	Mean	Std. Deviation	Std. Error	95% Confidenc Interval of Difference		T	Df	Sig
				Lower	Upper			
Pretest-Posttest	-49.13450	-4.91959	1.10005	-51.43694	-46.83206	-44.666	19	.000

Figure 2. Diagram of the Improvement of Each Component Metacognitive Skills

The assessment skills component received the greatest average score on the metacognitive inventory questionnaire, while the monitoring skills component received the lowest, as seen in Figure 2 above. These outcomes are consistent with the metacognitive skills test findings, which showed that the evaluative skills component had the highest average score across the several metacognitive skills components. According to the results, students' metacognitive skills in the response rate material are enhanced by the guided inquiry-oriented e-LKPD liveworksheet.

CONCLUSION

The study's findings show that students' metacognitive skills in the reaction rate content may be effectively enhanced by guided inquiry-oriented electronic e-LKPD. A higher posttest score than the pretest score, which shows a gain in students' metacognitive skills, and the attainment of the three markers of metacognitive skills following learning serve as evidence of this efficacy. The average pretest score in the poor group was 36.17, while the average posttest score in the excellent category was 85.73. Given that the paired samples t-test yielded a p-value of 0.000 (< 0.05), it was decided to reject H_0 and accept H_1. As a result, metacognitive skills before and after the use of guided inquiry-oriented e-LKPD in reaction rate learning differ significantly. Based on the research results, learning with guided inquiry-oriented e-LKPD liveworksheet has an influence on students' metacognitive skills in the reaction rate material, so that the guided inquiry-oriented e-LKPD liveworksheet developed to improve students' metacognitive skills are declared suitable for use as one of the teaching materials to improve students' metacognitive skills in the reaction rate material.

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