

## The Effectiveness of Self-Organized Learning Environments Model to Enhance Students' Critical Thinking



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**ABSTRACT:** Self-Organized Learning Environments (SLE) is one of several models recommended by the Ministry of Education and Culture (MEC) as an innovative learning model to stimulate students' critical thinking in learning History. This study aims to verify the effectiveness of the SLE model on students' critical thinking in learning History. The study used a quantitative experimental method with one group pre-post test design using multiple-choice tests. The research participants were second-grade students of Social Science major at Public Senior High School 2 of Tanggul in the 2022/2023 academic year. The effectiveness was hypothesized in reference to the relative effectiveness test formula which sought to identify the difference between the participants' pre-and post-test scores divided by the standard deviation. The analysis result marked a relative effectiveness test of 2.85, which implied a relatively high effectiveness of the instructional model. The research implications highlight the value of SLE as a reference to improve History teachers' pedagogical competence as the precursor to achieving interactive, fun, and flexible learning experiences empowered by technology.

### INTRODUCTION

The SLE model is one of the innovative models recommended by MEC in 2020. This model allows students as a group to engage in problem-solving with the aid of technology and teachers as facilitators (Mitra & Crawley, 2014; Zakwani & Gleaves, 2019). Since 2010, schools around the world have begun to show interest in SLE (Research Excellent Framework, 2014). According to Mitra et al. (2010), any subject at any grade within a specific educational level can integrate this instructional model. Furthermore, SLE has been acknowledged to be a fine fit for schools striving for 21st-century learning.

Mitra et al. (2010) point out SLE principles as the aggregate of the following desiderata: (1) given sufficient autonomy, students will be enabled to learn the material better than being directed by teachers and curriculum demands; (2) students learn to work collaboratively to improve social skills and explanatory discourse; (3) students can build their understanding of new concepts or knowledge; (4) students can practice their critical thinking skills quickly through independent learning; and (5) teachers need to limit their active role and talks in the class. Esteban and Peart (2014) attest to these principles, arguing that SLE can reduce stress on monotonous learning routines, expand learning resources, and transform teachers' paradigms as the sage on the stage.

As SLE emphasizes student-centeredness, it appears relevant for History learning which is oriented to 21st-century skills, including critical thinking skills. As a strategic subject in global education, History learning demands adaptive and responsive learning designs with a student-centered learning approach (Umamah, 2015; Umamah, 2017; Umamah, 2020a; Umamah, 2020b; Ningsih, et al. 2021; Asiyah, Sumardi, & Umamah, 2022). Critical thinking skills are needed to examine various History narratives along with their causal and chronological correlations, invite students to engage in authentic learning, and explore History sources beyond what is presented in textbooks (Waring & Robinson, 2010; Fitriarningsih, Umamah, Naim, 2015; Wahyuningtyas, 2019; Irani, P, Sumardi, & Umamah, N. 2022). The sophisticated analysis involved in such a learning experience puts substantial value on critical thinking skills in learning history. This orientation to higher-order thinking skills has been taken up in the formulation of History learning objectives in the second grade of senior high school in the 2013 curriculum. Nine of the ten basic competencies driving these learning objectives tap upon the analytical process. Even in the 2020 curriculum, analytical skills constitute 100% of basic competencies formulated within an analytical process as one of the dimensions of critical thinking skills.

In the current *Merdeka* (independent) curriculum, learning outcomes are developed with specific orientation to help students develop their ability to perform analysis and evaluation as necessitated in the five proficiency standards for History instruction (MEC regulation no. 033 of 2022). These standards involve (1) history conceptual skills; (2) history thinking skills; (3)

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history consciousness; (4) history research; and (5) history practical skills. Engaging students in tasks that involve higher-order critical thinking skills is imperative to help them master these five standards.

Critical thinking skills are one of the prioritized skills in learning, in addition to three other skills, namely creativity, collaboration, and communication. Given their critical roles in 21st-century learning, studies estimate that these skills will take prominent roles in 2025. However, several previous researchers show that students' critical thinking skills are low. Sulthon (2019) suggests that students have difficulty interpreting, arguing, and evaluating. Rahmawati (2019) further states that an average of 34% of students are in the sub-critical category. In the same vein, Jannah (2019) states that critical thinking skills are still low. These empirics implicate the necessity to implement SLE to optimize the activation of critical thinking skills.

The syntax for the SLE model is questioning, investigating, and reviewing (Mitra, 2010; Kemendikbud, 2020). Previous studies have demonstrated the efficacy of the SLE model with Google Cardboard virtual reality and Google Apps for Education (GAPE) to excel students' learning (Baylor, 2017; Chi Wang & Yang Kuo, 2014). Another study reveals that SLE can improve students' critical thinking skills (Esteban & Pearth research, 2014). Reminiscence of the prevalent necessity of critical thinking skills in History learning, this research specifically examines the effectiveness of the SLE model on students' critical thinking skills in History learning.

**Table 1. The Syntax of SLE**

Stage	Teacher's activities	Students' activities
Questioning	Giving questions to familiarize students with the material being taught. In this model, there is a "Big Question". These questions are then classified into more specific inquiries	Paying attention to the teacher's explanation and the "Big Question"
Investigation	<ul style="list-style-type: none"> <li>- Guiding students to form groups of 4-5 members. The number of members is determined according to the number of students in the class;</li> <li>- Guiding students to discuss (in person/virtually) the answers to the questions;</li> <li>- Monitoring students' discussion.</li> </ul>	<ul style="list-style-type: none"> <li>- Selecting the group members at their disposal</li> <li>- Discussing and exchanging information while learning from what other groups are doing;</li> <li>- Working together using electronic devices to find answers to the questions</li> </ul>
Reviewing	<ul style="list-style-type: none"> <li>- Providing opportunities for each group to present their learning outcomes;</li> <li>- Conducting reviews, making clarifications, and giving feedback</li> </ul>	<ul style="list-style-type: none"> <li>- Presenting their answers to the "Big Question" based on the results of their discussion and online research;</li> <li>- Responding to the other groups' presentations by raising critiques, suggestions, or questions</li> </ul>

**Source:** Mitra, 2010:3; Moy-Low, 2016:4; MEC, 2020:64

### RESEARCH METHOD

This quantitative experimental research employed a one-group pre-posttest design. The research instrument was a 25-item multiple-choice test which was developed in accordance with Facione's (2015) critical thinking skills indicators, i.e., interpretation, analysis, inference, and explanation, which had also been tested for validity and reliability. The pre-test and post-test results were analyzed to test the hypothesis. It should be noted that the items for both tests were different but remained at the same cognitive level (C4, analysis) to avoid research bias. The research sample involved second-grade students of Social Science major at Public Senior High School 2 of Tanggul, and they were taught using the SLE model. The sample was selected based on the results of the homogeneity test and the average of their learning performance. The selected learning outcomes were the required materials designated to the second grade (Phase F), which was concerned with analyzing and evaluating the proclamation of Indonesian independence. The learning outcomes were related to the following competencies (1) developing History concepts to study the proclamation of Indonesian independence; (2) identifying the progress of national figures in the proclamation of Indonesian independence; (3) identifying the proclamation of Indonesian independence and drawing its relation to global historical events in the same period; (4) identifying and analyzing patterns of development, continuity, change, and repetition in the proclamation of Indonesian independence; (5) developing diachronic (chronological) and/or synchronic concepts to describe the proclamation of Indonesian independence. This learning material was selected based on the required level of cognition, i.e., analyzing and evaluating. The lessons specifically aimed at drawing the link between the proclamation and the constellation of

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social, economic, cultural, and educational dimensions of student life. The link between the two was presumed essential so that they can think contextually. The research was carried out in the following order: the pre-test, a three-meeting instruction with the SLE model, and the post-test.

The hypothesis test applied the effectiveness test, which was calculated using Effect Size (d) based on the average difference between the two tests divided by the standard deviation of the average participant scores. These two values can be seen in the output of Paired Sample T-test mean and standard deviation.

$$ER = \frac{M_{\text{post-test}} - M_{\text{pre-test}}}{\text{standard deviation}}$$

The effect size (d) was determined using Cohen's (2007) classification of effect size as follows.

**Table 2. The effect size criteria**

Effect Size (d)	Description
0-0,20	Low
0,21-0,50	Fair
0,51-1,00	Moderate
>1,00	High

Source: Cohen, 2007

## RESULT AND DISCUSSION

### a. Tests of Analysis Requirements

#### (1) Validity Test

The validity test was carried out to ensure that the test instruments involving 25 pre-test questions and 25 post-test questions were valid and related to the critical thinking skill indicators to be measured. This test was performed using SPSS version 23 for Windows with the following decision-making criteria: (a) first, if the *r* reported by SPSS is greater than that listed in Pearson's Correlation table, the item is declared valid, and *vice versa*; (b) second, based on the confidence interval of 5%, if *p* is smaller than 0.05, then the item is declared valid, and *vice versa*. What follows are the results of the validity test for the test instruments.

**Table 3. The results of validity test**

Item	Pre-test		Post-test		<i>r</i> (Pearson correlation table)	Description
	<i>r</i> (SPSS)	Sig	<i>r</i> (SPSS)	sig		
1	369*	0,041	391*	0,030	0,355	Valid
2	562**	0,001	390*	0,030	0,355	Valid
3	453*	0,011	622**	0,000	0,355	Valid
4	577**	0,001	560**	0,001	0,355	Valid
5	548**	0,001	485**	0,006	0,355	Valid
6	555**	0,001	551*	0,001	0,355	Valid
7	429*	0,016	386*	0,032	0,355	Valid
8	393*	0,029	431*	0,016	0,355	Valid
9	500**	0,004	456*	0,010	0,355	Valid
10	562*	0,001	434*	0,015	0,355	Valid
11	368*	0,042	435*	0,014	0,355	Valid
12	377*	0,036	360*	0,047	0,355	Valid
13	372*	0,039	625*	0,000	0,355	Valid
14	370*	0,040	394*	0,028	0,355	Valid
15	368*	0,042	425*	0,017	0,355	Valid
16	521**	0,003	470**	0,008	0,355	Valid
17	498**	0,004	358*	0,048	0,355	Valid
18	355*	0,050	410*	0,022	0,355	Valid
19	389*	0,030	385*	0,032	0,355	Valid
20	355	0,050	391*	0,030	0,355	Valid
21	444*	0,012	444*	0,012	0,355	Valid

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Item	Pre-test		Post-test		<i>r</i> (Pearson correlation table)	Description
	<i>r</i> (SPSS)	Sig	<i>r</i> (SPSS)	sig		
22	476*	0,007	394*	0,028	0,355	Valid
23	368*	0,042	434*	0,015	0,355	Valid
24	413*	0,021	410*	0,022	0,355	Valid
25	460*	0,009	411*	0,021	0,355	Valid

The analysis used *r* of 3.55 based on Pearson's correlation table as this study involved 31 participants. All of the items are found to have higher *r* value as reported by SPSS, in comparison to the former. Then, the *p* value of all items is below 0.05. By implication, all test items in both the pretest and post-test were declared valid.

### (2) Reliability test

A reliability test was carried out to find out whether the research instruments were consistent and trustworthy in measuring pre-determined variables (Creswell, 2012: 160). The reliability test can use several types of statistical analysis, such as Cronbach's alpha, Spearman-Brown, Flanagan, and Hoyt tests. This study used Cronbach's Alpha analysis for the reliability test, coupled with Guilford's (1956) reliability criteria as follows.

**Table 4. Reliability levels**

Reliability	Description
-1,00 < r ≤ 0,20	Unreliable
0,20 < r ≤ 0,40	Low
0,40 < r ≤ 0,60	Fair
0,60 < r ≤ 0,80	High
0,80 < r ≤ 1,00	Very high

Source: Guilford, 1956

The results of the reliability test for both tests are presented in the following table.

**Table 5. The results of the reliability test**

Variables	N	Cronbach's Alpha	Description
Pre-test scores	31	0,866	Very high
Post-test scores	31	0,847	Very high

Table 4 above shows that the pre-test and post-test were declared reliable with a value of 0.866 and 0.847. The value on the pre-test instrument was 0.866 ( $0.80 < 0.866 \leq 1.00$ ), implying very high reliability. Likewise, the value on the post-test instrument was 0.847 ( $0.80 < 0.847 \leq 1.00$ ), another indicator to very high reliability. The analysis results thus confirmed that the pre-test and post-test were found consistent and reliable for measuring students' critical thinking skills indicators.

### (3) Normality test

The normality test involved a t-test before testing the effectiveness of SLE. The normality test was analyzed using the Kolmogorov-Smirnov test. When *p* is greater than 0.05, then the data is declared normally distributed ( $H_0$  is accepted). In contrast, the data is declared not normally distributed ( $H_a$  is accepted) when *p* is smaller than 0.05. The results of the normality test are listed below.

**Table 6. The results of the normality test**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Pre-test	0,14	31	0,125	0,948	31	0,136
Post-test	0,149	31	0,076	0,899	31	0,007

a. Lilliefors Significance Correction

The magnitude of *p* value in the pre-test is 0.125, and that of the post-test is 0.076, each of which is greater than 0.05. This concluded that the pre-test scores and post-test scores were normally distributed.

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### (4) Homogeneity test

Referring to the Levene test, the homogeneity test was carried out to find out if the pre-test data came from the same (homogeneous) data source. When  $p$  value is greater than 0.05, then the data is declared homogeneous. However, if  $p$  value is less than 0.05, then the data is not homogeneous. The results of the homogeneity test are presented below.

**Table 7.** The results of homogeneity test

Levene Statistic	df1	df2	Sig.
0,342	1	60	0,561

Table 7 above describes the Levene test statistic at 0.342 with  $p$  value, 0.562, greater than 0.05. This concluded that the pre-test scores were not significantly different. As the prerequisite tests were through, further testing was thence performed.

### b. The results of the effectiveness test of SLE

Following the prerequisite tests, a t-test was then carried out to see the effectiveness of the SLE model on students' critical thinking skills. Paired Sample T-test was used as a reference to see the difference in the average pre-test and post-test scores and the standard deviation to be used in the effectiveness test. The decision-making criteria in the t-test are: (a) if  $p$  value (2-tailed) is greater ( $>$ ) than 0.05, the data are not significantly different; (b) if  $p$  value (2-tailed) is smaller than ( $<$ ) 0.05, the data are significantly different. The results of Paired Sample T-test are presented below.

**Table 8.** The results of Paired Sample T-test

Pair	Post- test	-	Paired Differences		Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
			Mean	Std. Deviation		Lower	Upper			
1	Pre-test		39,742	13,912	2,499	34,639	44,845	15,906	30	,000

The  $p$  (0.000) in the table above is lower than 0.005, which confirms that the students' post-test scores differ significantly from their pre-test scores. Afterward, the effect size test shows the magnitude of the effect before and after the treatment of the SLE model, which is 39.74. The distribution of student's scores in the standard deviation is 13.912. Then, the effectiveness value test is obtained as follows.

$$ER = \frac{M_{\text{post-test}} - M_{\text{pre-test}}}{\text{standard deviation}}$$

$$ER = \frac{39,742}{13,912} = 2,85$$

Referring to Cohen's (2007) criteria, the effect size above, 2.85, falls in the high category. The results indicate that the SLE model is effective in improving students' critical thinking skills, especially focusing on interpretation, analysis, inference, and explanation. These findings are coherent with the theoretical study stating that learning engagement in SLE is strongly related to critical thinking skills, creative thinking skills, problem-solving, and collaboration (Moyer, 2018:1; Kubricka, 2020:87; Sarifudin, n.d.:1-5).

## DISCUSSION

The research findings have demonstrated that the SLE model supports the optimization of critical thinking skills through independent learning. The first syntax which draws students' attention to big questions is a trigger to pique their interest in the upcoming lesson. Furthermore, the investigation as the core of this model involves the process of collecting data, organizing data, and drawing conclusions based on student inquiries. These investigation stages reflect part of the History research sub-skills in the curriculum. The investigation powered by digital learning resources requires students to search and select valid and reliable information. To carry out investigations, they need to know and use History concepts to study a historical account. The third stage, reviewing, is related to the ability to write or communicate historical stories as a part of History proficiency standards.

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The effectiveness test results in this study resonate with studies reporting on the advantages of SLE model. Mitra et al. (2010:8) and Esteban and Peart, (2014:5-6) contend that SLE offers the following advantages to students (1) reducing stress on monotonous study routines; (2) optimizing skills in asking, explaining, and social skills; (3) encouraging the use of technology to expand learning resources; (4) practicing self-study skills, e.g., creating groups, learning from what other groups are doing, managing discussion, and reflecting on other groups' progress to improve their progress; (5) changing the teacher paradigm as the sage on the stage; (6) celebrating students' mistakes as learning opportunities. These dimensions of the learning experience canvas interactive, flexible, and creative learning.

The learning process involving critical thinking skill indicators in the SLE model indicates that critical thinking skills do not appear instantly, but rather requires sustained scaffolding in everyday learning and taught by teachers (Eklof, 2005: 131; Santosa et al., 2018:15). In harmony, Pratama, Connie, and Risdiyanto, (2021:1-12) point out that the SLE model has a relationship with students' critical thinking skills. In addition, Mitra (2013) and Sharma (2020) underscore that with this model students learn to explore, test, and debate information found on the internet more critically. The SLE model that is integrated with technology can provide access to a large number of learning resources on the internet. However, the credibility of these learning resources can be doubtful, so teachers must make explicit the criteria for good and appropriate learning resources.

The second step of the SLE model, investigation, engages students in the analysis, interpretation, and inference of the information they have collected. Then in the reviewing stage students also perform an evaluation process carried out by the students and teachers and explanation through oral or written modality. The analysis, interpretation, inference, evaluation, and explanation are included in the critical thinking skills indicator.

The SLE model with the "Big Questions" can help stimulate students to debate and think critically about topics being discussed (Weisblat & Jeff McClellan, 2017:310; Zakwani & Gleaves, 2019:101). The "Big Question" is a general and open question so that students can answer using a specific concept they deem relevant. As they ponder different aspects or points of view within this concept, they will further generate diverse opinions, therefore making the discussion optimal.

The study has also demonstrated the potential of SLE to improve critical thinking skills and student learning outcomes (Esteban & Peart, 2014:8; Sharma, 2020:31; Sholichah, 2019:4). The findings indicate that SLE can train higher-order thinking processes and improve collaboration, effective completion strategies, and the mastery of content learning. In this study, students are encouraged to explore varied reading materials to accrue constructivist learning. To this end, Suciati (2021:1) confirms that the SLE improves students' content learning. Increased achievement of learning objectives clearly illustrates that students in the class have mastered the learning material. The study by Pratama (2021: 19-30) concerning the development of Augmented Reality-based Self-Organized Learning Environments reports that 76.26% of students confirm the effectiveness of such learning engagement on their learning achievement, and this has also been affirmed by 77.92% of teachers. The linkage between SLE and technology lends credence to the active and creative learning experience which makes the utmost advantage of digital sources.

Given the theoretical and empirical accounts in previous studies and the present findings, this study attests to the potential of SLE for improving students' Critical Thinking Skills. The characteristics and syntax of this model are in line with the demands of learning outcomes as well as elements of History understanding, as mandated in the process skills endorsed by the current curriculum. By extension, the SLE model can help teachers and students to develop meaningful learning experiences by which they can critically reflect on past, current, and future events as the springboard for having a better future. In this regard, History learning plays a vital role in helping students develop critical thinking skills as they gradually become adults, with deepening historical awareness and decent characters.

### CONCLUSION

The results of this study indicate that the SLE model is a proven effective strategy to elevate students' critical thinking skills in History learning, as evinced by the effect size of 2.85 which falls in the high category. The results of this study are relevant to the theoretical studies of the model developers as well as some of the results of previous studies. The SLE model is expected to be an alternative learning model for History teachers to improve students' 21st-century skills, which tap upon critical thinking skills, creative thinking, collaboration, and communication skills.

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