

The Effect of a Wordwall-Assisted 7E Learning Cycle Model on Students' Critical Thinking Skills in Geography

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ABSTRACT

Purpose of the study This study examined the effect of a Wordwall-assisted 7E Learning Cycle model on students' critical thinking skills in Geography.

Methodology: A quantitative quasi-experimental study using a nonequivalent control group design was conducted with 68 eleventh-grade students at a public senior high school in Depok, Indonesia. The experimental group received the Wordwall-assisted 7E Learning Cycle model, while the control group received Discovery Learning. Data were collected using essay tests administered before and after the intervention, classroom observation sheets, and student response questionnaires.

Main Findings: The experimental group's mean score increased from 38.29 to 83.29, whereas the control group's mean increased from 49.00 to 79.11. An independent-samples t-test yielded a reported significance value of 0.021. However, the initial difference between groups requires further consideration when interpreting the treatment effect.

Novelty/Originality of this study: This study examines the integration of Wordwall with the 7E Learning Cycle model in Geography education. Its contribution lies in investigating this combination in a secondary-school context, although the novelty claim requires stronger comparison with previous empirical studies.

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1. INTRODUCTION

Critical thinking is an essential competency in contemporary education because it enables students to analyze information, evaluate evidence, solve problems, and make reasoned decisions. These abilities are particularly relevant to Geography learning, which requires students to interpret spatial patterns, examine relationships between human activities and the environment, and evaluate geographical phenomena from multiple perspectives [1], [2]. Developing critical thinking in Geography therefore requires instructional approaches that extend beyond factual knowledge and encourage students to engage actively with geographical problems [3]-[5]. Learning environments should provide opportunities for students to investigate questions, construct explanations, and evaluate possible solutions [6]-[8]. Integrating appropriate learning models with digital learning media may offer one approach to supporting these objectives [9].

Despite the importance of critical thinking, its development depends partly on the learning activities and opportunities provided in the classroom. Instruction that emphasizes information transmission and factual recall may provide limited opportunities for students to investigate problems, evaluate evidence, and construct independent arguments [10]-[12]. Interactive digital media may create additional opportunities for participation, practice, and feedback; however, the use of technology alone does not necessarily promote higher-order thinking [13]-[15]. The educational value of digital media depends on how its features are integrated into instructional activities and aligned with learning objectives [16]-[18]. Accordingly, Geography instruction requires a pedagogical approach that combines active knowledge construction with purposeful use of digital learning resources.

The Learning Cycle 7E model offers a constructivist framework that organizes learning through seven stages: elicit, engage, explore, explain, elaborate, evaluate, and extend. These stages can encourage students to activate prior knowledge, investigate phenomena, develop explanations, apply concepts, and evaluate their understanding [19], [20]. When learning activities require students to interpret information, justify conclusions, and examine alternative explanations, the model may support the development of critical thinking skill [21], [22]. Wordwall, an interactive digital learning platform, may complement this process by providing activities that facilitate student participation and immediate practice [23]-[25]. Nevertheless, engagement and motivation should not be equated automatically with improved critical thinking; the tasks delivered through Wordwall must also require meaningful analysis and reasoning [26].

Although previous studies have examined approaches to fostering critical thinking in secondary Geography education, the evidence highlights different instructional strategies rather than establishing the effectiveness of a Wordwall-assisted Learning Cycle 7E model. Davies and Esling [27] investigated Quality Talk as an approach to fostering critical-analytical thinking in a secondary Geography classroom. Similarly, Engelen and Budke [28] examined how secondary students developed arguments about complex geographical conflicts using internet-based information. Their findings indicate that access to digital information alone does not guarantee high-quality geographical argumentation. However, these studies do not directly establish whether combining the Learning Cycle 7E model with Wordwall produces different critical thinking outcomes from those achieved through Discovery Learning. Therefore, the research gap addressed in the present study is the need for comparative empirical evidence on the Wordwall-assisted Learning Cycle 7E model in secondary Geography education, particularly in relation to students' critical thinking outcomes. This gap provides the rationale for examining the combined instructional approach against an alternative learning model rather than assuming that digital media integration necessarily improves learning.

The novelty of this study lies in the comparative examination of a Wordwall-assisted Learning Cycle 7E model for developing students' critical thinking skills in secondary Geography education. Previous studies have examined critical thinking through classroom discussion in Geography [27] and students' use of internet-based information to construct arguments about geographical conflicts [28]. However, these studies do not directly examine the combination of the Learning Cycle 7E model and Wordwall in comparison with Discovery Learning. Therefore, the novelty of the present study is its integration of a structured learning cycle and interactive digital media within a comparative investigation of critical thinking outcomes in Geography. This study extends the discussion of technology-supported Geography instruction by examining whether the integrated approach produces different outcomes from Discovery Learning. Rather than presuming the superiority of this combination, the study provides empirical evidence from a quasi-experimental investigation in a secondary-school context in Indonesia.

Accordingly, this study aims to examine differences in students' critical thinking outcomes between a class taught using the Wordwall-assisted Learning Cycle 7E model and a class taught using Discovery Learning. Specifically, it examines students' critical thinking scores before and after the instructional intervention and compares the outcomes of the two groups. The study addresses the following research question: Do students taught using a Wordwall-assisted Learning Cycle 7E model demonstrate different critical thinking outcomes from students taught using Discovery Learning? The results are interpreted in relation to the quasi-experimental design and the initial characteristics of the participating groups.

2. RESEARCH METHOD

2.1. Research Site and Research Design

This study was conducted at Depok 5 Public High School, located on Bukit Rivaria Sector 4 Street, Bedahan, Sawangan District, Depok City, West Java, Indonesia, during the 2025/2026 academic year. A quantitative approach was employed using a quasi-experimental method with a nonequivalent control group design [29]. This design was selected because the study involved two existing classes without individual random assignment.

The experimental group received instruction using the Wordwall-assisted Learning Cycle 7E model, whereas the control group received instruction using the Discovery Learning model. Both groups completed a pretest before the instructional intervention and a posttest after the intervention to measure changes in students' critical thinking skills in Geography. The research design is presented in Table 1.

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental	O ₁	X	O ₂
Control	O ₃	Y	O ₄

Note: O₁ and O₃ represent the pretests administered to the experimental and control groups, respectively. O₂ and O₄ represent their respective posttests. X represents the Wordwall-assisted Learning Cycle 7E model, while Y represents the Discovery Learning model.

2.2. Population and Sample

The population consisted of all eleventh-grade students at Depok 5 Public High School during the 2025/2026 academic year, comprising 324 students. Purposive sampling was used to select the research participants based on recommendations from the Geography teacher and the suitability of the classes for the study. Two existing classes were selected: class XI.5, comprising 34 students, as the experimental group, and class XI.8, comprising 34 students, as the control group. Therefore, the total sample consisted of 68 students.

Because the participants were selected from existing classes without random assignment, differences between the groups may have existed before the intervention. The pretest was therefore administered to assess students' initial critical thinking skills before the instructional treatments.

Table 2. Research Participants

Group	Class	Number of students
Experimental	XI.5	34
Control	XI.8	34
Total		68

2.3. Research Instruments and Data Collection

Three instruments were used to collect the data: an essay test, observation sheets, and a student response questionnaire. The essay test was administered before and after the intervention to measure students' critical thinking skills in Geography. The observation sheets were used to document the implementation of learning activities in both groups, while the questionnaire was administered to obtain students' responses to the Wordwall-assisted Learning Cycle 7E model.

The essay test consisted of 10 questions designed to assess students' critical thinking skills in Geography. The specific theoretical framework and indicators used to construct the test, as well as the scoring rubric and score range, should be reported based on the original research instrument. The student response questionnaire was used to collect students' responses to the Learning Cycle 7E model assisted by Wordwall. The observation sheets documented the implementation of learning activities in the experimental and control groups, as described in the present manuscript.

Before data collection, the instruments should be described in terms of the validity and reliability procedures actually conducted. The validity assessment method, reliability testing procedure, and resulting coefficients must be reported using the original thesis documentation or empirical analysis records. These details are necessary to establish the quality of the instruments used in the study.

Table 3. Data Collection Instruments

Data collected	Instrument	Data collection procedure
Students' critical thinking skills	Essay test	Pretest and posttest
Implementation of learning activities	Observation sheet	Classroom observation
Students' responses to the experimental model	Questionnaire	Post-intervention survey

2.4. Instructional Procedure

The study involved two groups receiving different instructional treatments. The experimental group was taught using the Wordwall-assisted Learning Cycle 7E model, while the control group was taught using Discovery Learning. Both groups studied Geography over four instructional meetings.

In the experimental group, Wordwall activities were integrated into the Learning Cycle 7E stages to support the implementation of the instructional model. The activities were intended to complement the learning objectives and provide opportunities for students to engage with the learning materials. In the control group, learning activities followed the Discovery Learning model.

To improve comparability between the groups, the study should specify whether both groups received the same subject matter, instructional time, learning objectives, and assessment procedures. The implementation of each instructional model was monitored using observation sheets.

2.5. Data Analysis

The data were analyzed using IBM SPSS Statistics. Descriptive statistics were used to summarize the pretest and posttest scores of both groups. Before conducting inferential analyses, the distribution of the data and the relevant statistical assumptions were examined. The Shapiro–Wilk test was used to assess normality, and Levene’s test was used to assess the homogeneity of variances [30], [31]. An independent-samples t-test was conducted at a significance level of 0.05 to compare the mean scores of the experimental and control groups, where the assumptions for this analysis were satisfied [32], [33].

Because the study employed a nonequivalent control group design, the initial differences between the groups must also be considered when interpreting the posttest results. If the objective is to compare posttest scores while controlling for pretest scores, analysis of covariance (ANCOVA) may be considered, provided that its assumptions are satisfied. The selected analysis should be reported consistently with the actual procedure used and the research hypothesis. The findings were interpreted in relation to the observed differences in critical thinking scores, the instructional treatments, and the limitations associated with the quasi-experimental design.

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics of Students' Critical Thinking Scores

Pretest and posttest scores were analyzed to describe students’ critical thinking performance before and after the instructional intervention. As presented in Table 4, the experimental group obtained a mean pretest score of 38.29, whereas the control group obtained a mean of 49.00. Following the intervention, the mean posttest score increased to 83.29 in the experimental group and 79.11 in the control group. The descriptive results indicate that the experimental group achieved a higher mean posttest score than the control group, although the experimental group had a lower mean score at baseline.

Table 4. Descriptive Statistics of Students’ Critical Thinking Scores

Statistic	Experimental group	Control group
Number of students	34	34
Highest pretest score	68	88
Lowest pretest score	10	20
Mean pretest score	38.29	49.00
Median pretest score	36	48
Mode pretest score	36	34
Highest posttest score	96	98
Lowest posttest score	74	64
Mean posttest score	83.29	79.11
Median posttest score	83	80
Mode posttest score	80	80

The mean score increased by 45.00 points in the experimental group, from 38.29 to 83.29. In the control group, the mean increased by 30.11 points, from 49.00 to 79.11. These descriptive changes suggest a greater increase in the experimental group. However, statistical testing is required to determine whether the difference between the groups is statistically significant, while accounting for the initial difference in their pretest scores.

3.2. Implementation of the Learning Activities

Classroom observations were conducted during four instructional meetings to document the implementation of the learning activities in both groups. As shown in Table 5, the implementation percentages ranged from 90.90% to 100.00% in the experimental group and from 93.75% to 100.00% in the control group. All observed meetings were classified as “Very Good” according to the criteria used in the study.

Table 5. Percentage of Learning Implementation

Meeting	Experimental Class (%)	Control Class (%)	Category
1	90.90	94.11	Very Good
2	95.23	100.00	Very Good
3	100.00	93.75	Very Good
4	100.00	100.00	Very Good

The observation results indicate that the planned learning activities were implemented at a high level in both groups. These findings provide contextual information about the instructional implementation. Nevertheless, the observation percentages alone do not establish the effectiveness of either instructional model in improving critical thinking skills.

3.3. Tests of Statistical Assumptions

The Shapiro–Wilk test was used to examine the normality of the pretest and posttest scores. As reported in Table 6, all significance values exceeded 0.05, ranging from 0.179 to 0.804. Therefore, the normality test did not indicate a statistically significant departure from a normal distribution for the four score distributions.

Table 6. Results of the Shapiro-Wilk Normality Test

Variable	Class	Sig.
Pre-Test	Control	0.804
Post-Test	Control	0.179
Pre-Test	Experimental	0.554
Post-Test	Experimental	0.243

The homogeneity of variances was examined using Levene's test. The test produced a significance value of 0.857, which exceeded the 0.05 significance level. Thus, the test did not indicate a statistically significant difference in the variances of the groups for the outcome analyzed.

Table 7. Results of Levene's Test

Statistic	Value
Levene statistic	0.033
df1	1
df2	66
Significance value	0.857

These findings support proceeding with an independent-samples t-test for the relevant group comparison, provided that the other assumptions of the analysis are also satisfied. However, normality and variance homogeneity do not establish that the groups were equivalent before the intervention. The difference in pretest means must therefore be considered when interpreting the posttest comparison.

3.4. Results of Hypothesis Testing

An independent-samples t-test was conducted to compare the posttest scores of the experimental and control groups. The analysis yielded a two-tailed significance value of 0.021, which was below the predefined significance level of 0.05. The null hypothesis of equal population means was therefore rejected for this comparison.

As shown in Table 8, the experimental group obtained a mean posttest score of 83.29 (SD = 5.781), compared with 79.11 (SD = 8.530) in the control group. The observed mean difference was 4.18 points in favor of the experimental group.

Table 8. Group Statistics of Post-Test Scores

Group	N	Mean	Std. Deviation
Control Class	34	79.11	8.530
Experimental Class	34	83.29	5.781

Table 9. Independent Sample t-Test Results

Analysis	Result
Outcome compared	Posttest critical thinking scores
Mean difference (experimental – control)	4.18
Two-tailed significance	0.021
Significance level	0.05
Statistical decision	Reject the null hypothesis

The results indicate a statistically significant difference between the posttest mean scores of the two groups, with the experimental group obtaining the higher mean. However, because the experimental group had a lower mean pretest score than the control group, the posttest comparison should not be interpreted independently

of the baseline difference. Further analysis that accounts for pretest scores, such as ANCOVA when its assumptions are satisfied, would provide a more appropriate assessment of the between-group difference after the intervention.

The findings reveal a statistically significant difference in posttest critical thinking scores between students taught using the Wordwall-assisted Learning Cycle 7E model and those taught using Discovery Learning ($p = .021$). The experimental group achieved a mean posttest score of 83.29, compared with 79.11 in the control group, yielding a mean difference of 4.18 points. Descriptively, the experimental group also showed a larger increase from pretest to posttest (45.00 points) than the control group (30.11 points). However, these findings require cautious interpretation because the experimental group had a substantially lower mean pretest score (38.29) than the control group (49.00). Consequently, the posttest difference alone cannot establish that the intervention caused a greater improvement in critical thinking. The observed pattern is consistent with a potential benefit of the combined instructional approach, but an analysis controlling for baseline scores, such as analysis of covariance (ANCOVA), would provide stronger evidence regarding the between-group difference. Furthermore, the observed implementation percentages indicate that both instructional approaches were delivered at high levels across the four meetings; therefore, the outcome difference cannot be attributed simply to whether classroom activities were implemented. The findings should instead be interpreted as preliminary evidence of a difference in outcomes under the conditions of this quasi-experimental study.

The findings partly align with previous research on the Learning Cycle 7E model and interactive digital media, although the outcomes and instructional contexts differ. Ilhami and Laksono [34] reported significant differences in students' critical thinking skills and learning activities between a group using the 7E Learning Cycle model in online chemistry learning and a group receiving direct instruction. This supports the potential of the 7E framework to facilitate critical thinking, but the subject area and online learning context differ from the present study. In contrast, Zahra and Suparni [35], found that the Learning Cycle 7E model was not more effective than conventional instruction in improving critical thinking, demonstrating that positive outcomes should not be assumed across all settings. Research on Wordwall also provides relevant but indirect support. Lubis and Ponidi [36], reported significant differences in students' interest and academic achievement in social studies following the use of Wordwall-based interactive media. Similarly, Setyoningtyas and Nugraha [37], reported improvements in motivation and Geography learning outcomes through Wordwall implementation in classroom action research. These studies suggest that Wordwall may support engagement and learning outcomes, but neither finding by itself establishes an improvement in critical thinking attributable to the combination of Wordwall and Learning Cycle 7E. The present results extend this discussion by examining the combined approach in secondary Geography learning and comparing it with Discovery Learning. Nevertheless, differences in research design, subject matter, outcome measures, and comparison conditions mean that the findings should be considered complementary rather than directly equivalent.

The potential novelty of this study lies in examining the integration of the Learning Cycle 7E model and Wordwall in secondary Geography learning, with students' critical thinking scores as the outcome and Discovery Learning as the comparison condition. The 7E framework provides a structured sequence for activating prior knowledge, engaging students, exploring geographical phenomena, developing explanations, applying concepts, evaluating understanding, and extending learning. Wordwall may complement these stages by providing interactive tasks and opportunities for practice and feedback. Conceptually, this combination connects a structured inquiry-oriented learning sequence with digital activities that can support student participation. However, the contribution should not be framed as proof that the two components produce a synergistic effect, because the present design does not isolate the individual contributions of the 7E model and Wordwall. A stronger claim of originality also requires a systematic comparison with previous studies to establish whether this specific combination, outcome, subject area, and comparison model have already been investigated. Accordingly, the study's contribution is best described as context-specific empirical evidence concerning a Wordwall-assisted 7E approach in Geography, rather than an entirely new instructional theory or a definitive demonstration of superiority.

The findings have practical implications for Geography teachers considering the integration of interactive digital media into structured instructional models. The Wordwall-assisted Learning Cycle 7E approach may provide a practical way to organize learning activities that encourage students to engage with geographical concepts and participate in classroom tasks. However, teachers should ensure that digital activities require students to analyze geographical information, interpret evidence, justify conclusions, and evaluate possible solutions rather than merely recall facts or complete simple quizzes. The results may also inform instructional planning and the design of technology-supported Geography lessons, although the current evidence does not establish that the approach will produce the same outcomes in other contexts. Several limitations should be acknowledged. First, the sample comprised 68 students from two existing classes at a single public high school, limiting generalizability and leaving the possibility of pre-existing group differences. Second, the experimental group's lower pretest mean raises concerns about baseline comparability; further analysis controlling for initial scores is needed before drawing stronger conclusions about intervention effects. Third, the

intervention covered only four instructional meetings and a specific Geography learning context, so its longer-term effects remain unknown. Finally, the available results do not establish which components of the intervention contributed most to the observed difference. Future research should involve larger samples from multiple schools, longer interventions, clearly reported measures of critical thinking, and analyses that account for baseline differences. Studies comparing the 7E model alone, Wordwall alone, their combination, and an appropriate comparison model could also clarify the specific contribution of each component.

4. CONCLUSION

This study found a statistically significant difference in posttest critical thinking scores between students taught using the Wordwall-assisted 7E Learning Cycle model and those taught using Discovery Learning ($p = .021$). The experimental group achieved a higher mean posttest score (83.29) than the control group (79.11), with mean score increases of 45.00 and 30.11 points, respectively. These findings suggest that the Wordwall-assisted 7E Learning Cycle model has potential as an alternative approach to supporting critical thinking in Geography learning. However, the experimental group had a lower mean pretest score than the control group, indicating that the initial differences between the groups must be considered when interpreting the findings. From a practical perspective, Geography teachers may consider integrating Wordwall into the 7E Learning Cycle to provide more engaging learning activities that encourage students to analyze information, evaluate evidence, and develop reasoned conclusions. At the instructional level, these findings highlight the importance of aligning digital learning media with structured inquiry-based learning stages rather than relying on technology alone to promote critical thinking. Further research using larger samples, multiple schools, longer interventions, and statistical analyses that control for baseline differences is needed to establish the robustness and generalizability of the results.

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