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The impact of WebQuest integration in the writing learning process on academic writing skills and critical thinking skills

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ABSTRACT

The study aims to investigate the WebQuest-based learning process on academic writing skills and critical thinking skills. The method used in this study was a quasi-experimental method involving 350 high school students. The instruments used were the California Critical Thinking Skills to measure critical thinking skills and an academic writing skills assessment form. The study employed the MANOVA and MANCOVA tests for data analysis to find out how using WebQuest affected students' academic writing and critical thinking abilities. The results of the research showed that WebQuest-based learning was more effective in improving academic writing skills and critical thinking skills than traditional face-to-face writing learning. In addition, this WebQuest-based writing learning provided short-and long-term effects on both competencies. The increase in academic writing skills that showed significant improvements occurred in all aspects, namely task achievement, cohesion and coherence, lexical and grammatical accuracy. Several aspects of critical thinking skills that showed significant improvements were aspects of analysis, evaluation, and deductive reasoning skills. This study implies that WebQuest-based learning can be used as an alternative learning strategy in improving academic writing skills while improving critical thinking skills.

Contribution/Originality: This study contributes to the knowledge of Web Quest-based technology media that can be used in academic writing teaching practices. The originality of this study is the use of integration of WebQuest-based technology media in writing instruction to improve academic writing skills as well as critical thinking skills.

1. INTRODUCTION

The ideal learning process is a learning process that can provide a learning environment that places students at the center of learning and encourages students to manage their learning process. Some characteristics of a learning environment that places students as the center of learning are encouraging students to be independent and responsible for their learning outcomes, teachers acting as guides and knowledge being used as a tool not as a goal (Lu & Xie, 2019; Wu, Yang, Scott Chen Hsieh, & Yamamoto, 2020). The learning technique used in regular classrooms tends to make students passive and makes learning challenging. Students and teachers do not expect that teachers play an optimal role in the learning process that takes place in regular classrooms. This is a challenge for teachers in designing and creating a learning process environment that focuses on students. Currently, various facilities can be used to support a more optimal learning process, including various types of Artificial Intelligence (AI), websites, and online applications (Awada, Burston, & Ghannage, 2020; Fathi & Rahimi, 2022; Wu et al., 2020).

These various facilities can be used by teachers to create a learning environment that encourages active student participation and is student-centered.

Students who adopt an online learning strategy can finish pre-class assignments more easily which will increase their readiness and engagement in the learning process. This online learning approach encourages teachers to facilitate students to be optimally involved in problem-solving activities and encourage students to use their knowledge in the process of completing their assignments (Awada & Diab, 2023; Huang & Jun Zhang, 2020). This online application also facilitates teachers to supervise the writing learning process in addition to focusing on students. An online learning application that can be used in writing learning is WebQuest. This application is founded on the ideas of constructivist educational theory and is targeted at activities that emphasize inquiry (Awada et al., 2020; Awada & Diab, 2023; Pham, 2022). WebQuest is a learning application that can be used in web-based writing learning that has a gradual learning structure and uses important World Wide Web resource links and provides authentic tasks (Kiziltaş & Kultas, 2025; Noroozi, Alqassab, Taghizadeh Kerman, Banihashem, & Panadero, 2025). WebQuest has a five-element structure, namely, introduction, task component, process component, conclusion, and evaluation component (Awada et al., 2020; Rahimi & Fathi, 2022).

Student engagement through open educational resources can facilitate students to develop their necessary knowledge and skills. The transformative process used in the WebQuest-based learning process will encourage students to use information well. Experts suggest a problem-solving process that can be used in the WebQuest-based learning process with the procedure of classifying, modifying, and integrating the information received (Chen, McClure, & Morris, 2024; Crook et al., 2025; Li & Hebert, 2024). Language researchers reveal that WebQuest plays an important role in improving the quality of the writing learning process by orienting it towards collaboration, constructivist activities, problem solving, social interaction, and the existence of a gradual learning process. This study investigates the impact of WebQuest-based learning on academic writing and critical thinking skills.

2. LITERATURE REVIEW

2.1. The Relationship between WebQuest and Critical Thinking Skills

One of the objectives of this study is to improve students' critical thinking skills through the WebQuest-based writing learning process by comparing it with face-to-face classes. Critical thinking ability is a high-level cognitive ability involving social and emotional dispositions. Critical thinking ability is a cognitive ability that includes several series of high-level thinking abilities in its process, including the ability to analyze, infer, evaluate, reason, and deductive and inductive abilities (Bonnamy, Bugeja, Morphet, Russo, & Brand, 2024; Li & Hebert, 2024; Sato, 2022). Disposition components include the search for truth, an open mind, systematic, analytical, curiosity, and self-confidence (Holdinga, van Drie, & Rijlaarsdam, 2025; ten Peze, Janssen, Rijlaarsdam, & van Weijen, 2024). Therefore, the ability to think critically and responsibly by using criteria, self-evaluation, and awareness of the learning situation is known as critical thinking. Critical thinking exercises can yield useful information and serve as a guide for critical thinking abilities. Students who possess critical thinking abilities can argue against standards using logical and reasonable reasoning or offer reasonable and recognized viewpoints (Babik et al., 2024; Evmenova, Regan, Mergen, & Hrisseh, 2024). This critical thinking skill in evaluation relies on the assessment of priorities, truth, and aspects of significance rather than being based on mechanical techniques. These standards serve as the foundation for evaluating critical thinkers' ability to evaluate, support, and refute assertions (Cotugno, 2018; Pu & Evans, 2019). This self-evaluation encourages critical thinkers to use critical thinking processes in using analysis procedures. The level of student sensitivity to context depends on the use of criteria developed with various contexts.

This critical thinking ability will help students pay attention to the context that produces ideas and actions. Critical thinking ability will also make students doubt quick solutions, single answers to problems and claims that

have a universal nature (Pui, Yuen, & Goh, 2021; Rahimi & Fathi, 2022). Students' thinking becomes open and seeks several alternatives in solving problems through critical thinking ability. The development and disposition of critical thinking will help teachers in developing students' critical thinking abilities (Cuevas et al., 2024; Dousti & Amirian, 2023). Students with ideal critical thinking abilities are students who are accustomed to several characteristics, including having broad knowledge, being accustomed to curiosity, believing in rational and logical reasons, having an open mind, being flexible, being fair in evaluating, being wise in evaluating, reconsidering, thinking calmly when facing difficult problems, focusing on investigation, and trying to find the most objective results possible (Pu & Evans, 2019; Pui et al., 2021). Previous studies have revealed that WebQuest includes investigation-oriented activities that can improve generally high-level thinking skills and specifically critical thinking skills (Awada et al., 2020; Kiziltaş & Kultas, 2025).

2.2. The Role of WebQuest in Academic Writing Learning

Numerous earlier research have demonstrated a strong relationship between language acquisition and thinking abilities (Awada et al., 2020; Kiziltaş & Kultas, 2025). The purpose of this study is to examine how students' academic writing and critical thinking abilities are affected by WebQuest-based and in-person language instruction. According to several earlier research, high-level thinking abilities can help pupils improve their writing abilities (Fathi & Rahimi, 2022; Rahimi & Fathi, 2022). Therefore, the use of critical thinking skills can improve academic writing skills , and vice versa. Current academic writing assessments are tested in various formats, such as essay writing which is needed to improve academic writing skills. Task completion, writing coherence and cohesiveness, vocabulary, and grammatical precision are some of the characteristics that are included in academic writing (Cotugno, 2018; Pui et al., 2021).

WebQuest-based learning provides students with the opportunity to provide peer-to-peer corrective feedback and corrective feedback from teachers that will improve the quality of students' writing skills (Khosravi, Dastgoshadeh, & Jalilzadeh, 2023; Kiziltaş & Kultas, 2025; Mohammed & Khalid, 2025). Therefore, students will be more motivated through this process. According to earlier research, WebQuest-based courses can raise student participation levels, learning attitudes, and academic proficiency (Evmenova et al., 2024; Sato, 2022). From these findings, the learning process becomes a structured flipped class using WebQuest and is considered an effective learning design in improving several of these components. Other studies have also revealed that WebQuest has an impact on initial writing skills, reduces writing anxiety, and perceptions of writing learning are more positive (Awada et al., 2020; Evmenova et al., 2024; Kiziltaş & Kultas, 2025; Sato, 2022). These findings outperform writing instructions in traditional learning. The difference between this study and previous studies is that this study integrates WebQuest in language learning to improve students' academic writing skills as well as critical thinking skills. Based on this explanation, the researcher formulates several problem formulations as follows:

a) How does WebQuest-based language learning affect academic writing skills and critical thinking skills?
b) How is the comparison of the effectiveness of traditional writing learning and WebQuest-based writing learning in improving students' academic writing skills and critical thinking skills?

3. METHODOLOGY

3.1. Design and Participants

This study employed a quasi-experimental research design to examine the impact of WebQuest-based learning on enhancing academic writing and critical thinking abilities. 350 high school students were recruited at random from high school classes 7–9. Their initial level of academic writing proficiency was assessed using an online adaptive diagnostic web-based assessment. Participants were divided into two groups of 175 students each: the experimental group learnt to write via WebQuest, while the control group received in-person instruction. The Common European Framework of Reference for Languages (CEFR) served as the basis for scoring. The two

groups' evaluation findings showed that the students' academic writing proficiency was at level B1. Furthermore, none of the students in this study had any prior WebQuest learning experience. The consent form was completed by each participant in the study indicating that they were all willing to participate. Additionally, this study has been approved by Muhammadiyah University Professor Dr. Hamka and the participating schools, demonstrating that it complies with research ethical guidelines. The information gathered is anonymized and utilized exclusively for research to protect study participants' privacy.

3.2. Research Materials and Instruments

The researcher selected the California Critical Thinking Skills Test from Facione (1993) to measure students' critical thinking skills. The ability to analyze, evaluate, infer, and use both deductive and inductive reasoning are among the five critical thinking skills that are examined by this instrument. There are 35 multiple-choice questions on the critical thinking skills testing tool. The critical thinking skills evaluation has a maximum score of 35 points and a minimum score of 0. Correct answers are worth one point, while erroneous responses are worth zero. One to three different critical thinking skills can be evaluated at the same time by each question. For instance, the second question assesses the capacity to evaluate and deductive reasoning, while the third question assesses the ability to analyze and inductive reasoning. For each sub-critical thinking skill, the highest possible score is nine points for analysis, fourteen for evaluation, eleven for inference, sixteen for deduction, and fifteen for inductive reasoning. This test satisfies the requirements and demonstrates construct validity by appropriately assessing the object under evaluation with a reliability rating of 0.78. Academic writing assignments 1 and 2 are used to demonstrate academic writing abilities. Students are required to use their own terminology to explain, characterize, or summarize a graph, table, chart, or diagram in academic writing assignment 1. Additionally, students are expected to explain the steps in a process or the operation of an item or event. Students are required to write a response essay that presents an argument or point of view on a topic as part of academic writing assignment 2. The format of the academic writing assessment is similar to that of language exams.

The following four components make up the description of the academic writing assessment: task accomplishment, vocabulary, coherence and cohesiveness, and range or grammatical accuracy. The task achievement aspect presents the main features, the presentation of accurate information, and the number of words. The cohesion and coherence aspects include the organization of information, paragraph suitability and conjunctions. The lexicon aspect includes the use of correct language, collocation, and errors. Grammar range and accuracy include language structure, tense, punctuation, and the number of errors. The range of values for each aspect is 1-9 points. Academic writing task 1 contributes 40 percent of the total score and academic writing task 2 contributes 60 percent. Academic writing ability is the total of all scores for the eight aspects of academic writing tasks 1 and 2 with an interval of 0.5. Inter-rater reliability testing was conducted to minimize subjectivity and bias in assessment. Based on the results of the reliability test, inter-rater consistency showed a value of r = .92 and met the criteria.

3.3. Procedure

The researcher conducted several stages of the research procedure, including first using a form designed to serve as a pre-test score. The researcher evaluated the participants' critical thinking and academic writing abilities. Academic writing assignments 1 and 2 were given to students. In academic writing assignment 1, students were asked to explain and analyze information contained in a table. Students were asked to write with a word count of 150 words in 25 minutes. Furthermore, in academic writing 2, students were asked to respond to a problem in the form of a written argument with a minimum of 250 words in 45 minutes. The researcher used WebQuest in the writing learning process in the experimental group to improve academic writing skills and critical thinking skills. In the first stage, students were given training in learning to use WebQuest through videos accompanied by technical explanations of WebQuest. Several materials in various formats, such as videos, e-learning materials,

general explanations, and websites are included in WebQuest for students to study so that students can study them before taking part in class learning so that students feel more prepared. Encouragement of students to use their writing and critical thinking skills might be more effective when they are prepared.

The teacher also facilitates students to explore the necessary information through the WebQuest for collaboration and open editing of writing. Writing instructions are carried out in a process-oriented manner with the first stage being the provision of topics and problems in both writing assignments to find solutions. Students are also given the opportunity to search for relevant references to improve their writing and critical thinking competencies through the WebQuest. The task of analyzing, synthesizing information, and finding solutions is continued at home. Furthermore, students conduct discussions or share information from the search results and make improvements to the academic writing that they have made. The stages of the WebQuest-based writing learning process with the components of introduction, assignment, process, assessment, and conclusion are presented in Table 1 using the conventional in-person learning method to the control group to enhance their critical thinking and academic writing abilities. Students are instructed to learn about topics pertaining to academic writing and critical thinking abilities in the traditional classroom. The subject of academic writing assignments 1 and 2 as well as a number of difficulties that need to be resolved are presented to students in the following step: Students have the chance to work on printed tasks and review resources pertaining to academic writing and critical thinking. Students review their completed assignments and, if needed, edit their writing in the final step.

Table 1. Brief explanation of the web-quest design in the writing learning process

Components	Activity
Introduction	Students are introduced to several activities that familiarize them with critical thinking skills through activities of analyzing, evaluating, inferring, and deductive and inductive reasoning skills. In addition, aspects that can improve the quality of writing are also introduced, including task achievement, coherence, cohesion, lexicon, and grammatical accuracy. Students are encouraged to improve all aspects of these skills through various writing activities and assignments.
Task	Students are given the main tasks that must be completed and the completion process. Additionally, WebQuest writing tasks 1 and 2 explain how students can develop their critical thinking and academic writing abilities.
Process	Students are given guidance in following the WebQuest-based writing learning process through several steps, namely, a) students are given scaffolding through videos to stimulate their critical thinking skills. b) Students are given an understanding of academic writing assignments 1 and 2 through various relevant material modes such as videos and online modules. c) Students discuss the steps of writing and discuss the results of watching videos. d) Students share information in pairs.
Evaluation	The California Critical Thinking Skills Test evaluates critical thinking abilities in five areas: reasoning, analysis, assessment, and inference using both deductive and inductive methods. A writing evaluation form that takes into account vocabulary, grammar, cohesion and coherence, and task achievement is used to evaluate academic writing abilities. First, the assessment is explained to the students.
Conclusion	The value of academic writing and critical thinking abilities in assisting students' educational journeys is emphasized to them.

The WebQuest design encourages students to provide input, generate interactions, and outputs that are essential in the acquisition of writing skills. Input in WebQuest-based learning is generated from Web resources while input in traditional classes comes from printed materials. Interaction in the WebQuest-based learning process occurs in the interaction of students with technology media, students with teachers and between students while interactions in traditional classes only occur between students and teachers and between students. The output produced from the writing assignments of both groups and both academic writing 1 and 2 is the essay writing produced.

Table 2. Academic writing tasks in all phases (pre-and post-tests)

Phases	Task	Topics	Word-number	Time
Pre-test	Task 1	Explaining tables	150	25
	Task 2	Giving arguments	250	45
Post-test	Task 1	Explaining pie charts	150	25
	Task 2	Explaining cause and effect relationships	250	45
Follow-up phase	Task 1	Explaining line charts	150	25
	Task 2	Explaining problems and solutions	250	45

Table 2 presents the task intervention procedures used in WebQuest and conventional face-to-face learning with three stages. In the first stage, or pre-test, students are given two tasks, namely the task of explaining a table and providing arguments for a problem. In the second stage, or post-test, students are given two tasks, namely the task of explaining a pie chart and explaining the cause and effect of an event. In the last stage or follow-up, students are given the task of explaining a line chart and the task of analyzing a problem and presenting a solution. All of these procedures are carried out in both groups (experimental and control). The only difference lies in the learning media used by the experimental group (WebQuest) and the control group (conventional face-to-face).

3.4. Data Analysis

Academic writing and critical thinking abilities are the two dependent variables in this study while WebQuest-based learning and conventional in-person instruction are the independent variables. The researcher tested the differences between the pre-test and post-test on academic writing and critical thinking skills in both groups using a one-way MANOVA analysis based on these variables. Additionally, MANCOVA analysis was employed to test the effects of WebQuest-based writing instruction and in-person instruction on critical thinking and academic writing abilities using pre-test scores as covariates and comparing them with the outcomes in the post-test and follow-up test phases. They satisfied multiple requirements for parametric tests, including having intervals and normally distributed data. These two data analysis tests were employed. The Kolmogorov-Smirnov test was used for data normality. The findings showed that all of the pre-test, post-test, and follow-up test data were normal and not outliers.

3.5. Ethical Consideration

All participants involved in this study were given anonymous data that would only be used for research purposes. All participants filled out a consent form to participate in this study so that participants participated in this study voluntarily. This study has received permission from the Al-AzharBSD@Metland Junior High School educational institution in Bogor Regency. In addition, this study has also received approval from the Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia as an affiliate of the researcher. The Ethics Committee of Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia and Al-Azhar Junior High School BSD@Metland Bogor, Indonesia approved this research at the beginning of the odd semester of the 2024/2025 academic year.

4. RESULT

A one-way MANOVA test shown in Table 3 was used to examine the differences in pre-test scores of academic writing and critical thinking abilities between students in the experimental and control groups. The analysis's findings showed that the two groups' critical thinking and academic writing abilities differed little. Additionally, a one-way MANOVA analysis was performed and the results are shown in Table 4. Table 4 shows that throughout the pre-test period, there was no discernible difference between the two groups' academic writing and critical thinking abilities. This suggests that both groups started off with the same set of skills. Before doing a one-way MANCOVA test, the homogeneity of covariance and regression slope was analyzed. The analysis's findings demonstrated that the variables (pre-test), WebQuest-based learning, and the interaction effect of the post-test and

follow-up test did not significantly correlate linearly. This satisfies the requirements to perform a one-way MANCOVA test. Table 5 displays the findings of the one-way MANCOVA test which was used to examine how WebQuest-based learning and conventional classroom instruction affected students' critical thinking and academic writing abilities. The analysis's findings showed that the WebQuest-based writing learning intervention outperformed conventional classrooms in terms of academic writing and critical thinking abilities. These results suggest that the WebQuest-based learning approach is superior for developing academic writing and critical thinking abilities.

Table 3. Differences in the average initial ability scores

Variables	Groups	Mean	Std. deviation	N
Critical thinking (pre-test)	Experiment	3.809	2.145	175
	Control	3.745	1.530	175
Writing (pre-test)	Experiment	3.811	0.892	175
	Control	3.789	0.856	175

Table 4. Analysis of differences in academic writing skills and critical thinking skills

Variables	Type III sum of squares	Df	MS	F	Sig.
Critical thinking (pre-test)	0.043	1	0.040	0.015	0.912
Writing (pre-test)	0.014	1	0.015	0.023	0.891

Table 5. Analysis of the between-subject effect test of the mean difference between the posttest and follow-up test phases before the pretest control

Competencies	Groups	M	SD	N
Critical thinking (post-test)	Experiment	9.513	2.451	175
	Control	7.814	1.854	175
Writing (post-test)	Experiment	8.435	0.637	175
	Control	6.146	1.024	175
Critical thinking (delayed-post-test)	Experiment	10.245	2.583	175
	Control	8.143	2.291	175
Writing (delayed-Post)	Experiment	7.815	0.785	175
	Control	5.914	0.956	175

A multivariate test employing Wilk's Lambda was used to assess how WebQuest-based learning affected students' academic writing and critical thinking skills. The results of the multivariate analysis are shown in Table 6. The results of the investigation show that WebQuest-based learning has a major impact on students' academic writing and critical thinking skills. An inter-subject impact test was then used to assess the effects of traditional learning methods and WebQuest-based writing learning interventions on academic writing and critical thinking abilities. The analysis's findings revealed that WebQuest-based writing training considerably boosted students' academic writing and critical thinking abilities more than traditional instruction did.

Table 6. Test of multivariate via Wilk's Lambda effect of intervention on both competencies

Impact	Value	F	Hypothesis df	Error df	Sig.
WebQuest-based and traditional	0.304	8.418	5.012	14.015	0.003

Table 7. Inter-subject effect test of the impact of the intervention on both competencies

Variables	Type III sum of squares	Df	Mean square	F	Sig.
Critical thinking (post-test)	35.856	1	35.856	10.451	0.009
Writing (post-test)	9.145	1	9.145	13.431	0.004
Critical thinking (follow up)	42.524	1	42.572	8.092	0.018
Writing (delayed- post-test)	17.612	1	17.645	29.175	0.000

Table 8. Analysis of the between-subject effect test of the mean difference between the posttest and follow-up test phases after pretest control

Variables	Groups	Mean	Std. error	95% confidence interval	
				Lower	Upper
Critical thinking (post-test)	Ex	10.452	0.756	9.065	11.835
	Co	7.634	0.631	5.530	9.036
Writing (post-test)	Ex	8.456	0.262	5.834	7.465
	Co	6.073	0.234	4.620	6.321
Critical thinking (delayed post-test)	Ex	10.672	0.782	7.456	11.516
	Co	7.214	0.783	5.573	7.451
Writing (delayed- post-test)	Ex	7.854	0.254	7.283	8.354
	Co	4.465	0.252	4.425	5.426

The mean differences between the post-test and follow-up periods as shown in Tables 7 and 8 were examined using an intersubjective effect test analysis. The results of the research demonstrated that the experimental group outperformed the control group in terms of mean scores for academic writing and critical thinking abilities. In the follow-up and post-test phases, the experimental class outperformed the control group. Thus, when it comes to improving academic writing and critical thinking abilities, WebQuest-based learning performs better than conventional in-person instruction. Over time, WebQuest-based learning has a major impact on both competencies. However, critical thinking abilities are the only long-term benefit of traditional schooling. Each aspect of academic writing and critical thinking abilities was further examined using MANOVA and MANCOVA tests. Cohesion and coherence characteristics, lexical resources, range, and grammatical precision, critical thinking ability encompasses the ability to analyze, evaluate, infer, and reason deductively and inductively while academic writing ability involves task achievement.

Table 9. Descriptive analysis of differences in the pretest mean of critical thinking ability and academic writing ability

Aspects of critical thinking skills	Groups	Mean	Std. deviation	N
Analyze	Experiment	0.824	0.831	175
	Control	0.035	1.042	175
Evaluate	Experiment	1.104	0.846	175
	Control	1.121	0.914	175
Infer	Experiment	0.805	1.022	175
	Control	0.902	0.865	175
Reasoning deductively	Experiment	0.912	0.978	175
	Control	0.904	0.882	175
Reasoning inductively	Experiment	1.022	0.958	175
	Control	1.312	0.621	175
Task achievement aspect	Experiment	3.200	0.932	175
	Control	3.300	0.836	175
Coherence and cohesion aspect	Experiment	2.845	0.845	175
	Control	2.312	0.765	175
Lexicon aspect	Experiment	4.522	0.835	175
	Control	4.346	0.821	175
Grammatical accuracy aspect	Experiment	4.516	1.142	175
	Control	4.348	1.045	175

A one-way MANOVA test was used to examine the details of the differences between the academic writing skill and critical thinking components. Table 9 displays the findings of the one-way MANOVA test. The findings of the research showed that the two groups' pre-test averages differed little. The average value of each component of critical thinking abilities was marginally higher than the average value of all critical thinking skills in both the experimental and control groups. This happened as a result of the critical thinking ability evaluation questions incorporating one to three sub-critical thinking skills. Additionally, Table 10 displays the findings of the one-way MANOVA to examine the variations in pre-test scores between the two groups. According to the analysis's

findings, the two groups' pre-test scores on academic writing and the five components of critical thinking skills did not differ significantly.

Table 10. Inter-subject effect test of students' pretest differences in all aspects

Variables	Type III sum of squares	Df	Mean square	F	Sig
Analyze	0.438	1	0.532	0.604	0.490
Evaluate	0.000	1	0.000	0.000	1.000
Infer	0.062	1	0.054	0.073	0.907
Reasoning deductively	0.000	1	0.000	0.000	1.000
Reasoning inductively	1.704	1	1.814	4.121	0.092
Task achievement aspect	0.062	1	0.062	0.082	0.875
Coherence and cohesion aspect	0.063	1	0.063	0.096	0.872
Lexicon aspect	0.061	1	0.061	0.073	0.835
Grammatical accuracy aspect	0.224	1	0.224	0.189	0.678

The results of the study showed that WebQuest-based writing learning is more effective than traditional writing learning in improving academic writing skills and critical thinking skills. The MANCOVA test was used to test the differences between the two groups' final abilities in each area of academic writing and critical thinking skills, using pre-test scores as covariates. Almost all aspects of the experimental group's academic writing and critical thinking skills outperformed every aspect of the control group's skills, and the experimental group's post-test score was lower than the control groups, suggesting that this growth did not occur in the inductive reasoning ability component. This significant difference occurs because the structure of WebQuest-based writing learning is different from traditional learning. In WebQuest-based writing learning, students have more time to study the material independently before class starts. Interaction with various materials with various formats, interaction with teachers and other students is more intense in WebQuest-based learning than in traditional learning. Significant differences are seen in every aspect of the two competencies.

5. DISCUSSION

Investigating the effects of WebQuest-based writing instruction and conventional in-person instruction on academic writing and critical thinking abilities was the aim of this study. With the exception of the inference component, practically every critical thinking skill increased over the post-test and follow-up stages. Furthermore, both short-term and long-term impacts of the intervention were discovered. Students' critical thinking abilities were relatively poor during the pre-test phase. The California Critical Thinking Skills Test developed by Facione (1993) can identify basic deficiencies in critical thinking abilities supports this conclusion of inadequate critical thinking abilities (Fathi & Rahimi, 2022; Wu et al., 2020). However, it can facilitate students to improve their critical thinking skills through the intervention of WebQuest-based writing learning. This finding is in line with previous studies which found that critical thinking skills can be improved through learning by presenting various formats of material online by giving students the opportunity to explore various critical thinking skills, such as analyzing, evaluating, inferring and so on (Awada et al., 2020; Mohamadi Zenouzagh, 2020).

The increase in critical thinking skills is more significant using WebQuest than traditional classes in this study; there is a different class structure. In addition, WebQuest-based learning elements can explore critical thinking skills with various stages of the learning process starting from the introduction, process, assignments, evaluation, and conclusion stages and the presence of various materials and instructional videos that guide students (G. Awada et al., 2020). The stages of learning that explore critical thinking skills are reinforced by previous studies that reveal that the learning process that presents various stages and materials in various formats is more optimal in developing student competencies (Kiziltaş & Kultas, 2025; Mayordomo, Espasa, Guasch, & Martínez-Melo, 2022). This is reinforced by the constructivist theory which explains that learning by involving students directly with

various stages of the process will be more optimal in achieving learning goals (Awada & Diab, 2023; Noroozi et al., 2025). The increase in critical thinking skills is due to the distinctive features of WebQuest which presents content so that students have a deep understanding through the use of high-level thinking. A person's critical thinking skills can be improved through valid information. This is in line with WebQuest-based writing learning that presents reliable sources of information so that it can improve critical thinking skills (Cotugno, 2018; Pui et al., 2021). This finding is also in line with previous studies that web-based learning can provide a learning environment that can improve students' high-level thinking skills (Bailey & Almusharraf, 2022; Dousti & Amirian, 2023).

Students' high-level thinking skills are successfully improved through WebQuest-based writing learning because the learning process is oriented towards investigations that promote high-level thinking skills. This WebQuest-based writing learning process facilitates students being involved in the process of problem- solving, evaluation, synthesis, and analyzing information that can train high-level thinking skills. Students are given materials in the form of sites, videos, and modules that can be accessed online as materials for writing in this study. The materials are instructed to students to explore them through analyze, evaluate, infer, and deductively and inductively reasoning so that they are believed to be able to significantly improve critical thinking skills (Alves, Sousa, Gama, Jorge, & Gonçalves, 2024; Sang & Zou, 2023). Another finding in this study is that WebQuest-based writing learning can also improve students' academic writing skills in the form of essays with various forms of instructions such as explaining tables, diagrams, providing arguments, explaining causal relationships, and explaining problems and solutions. This improvement in writing skills occurs in the WebQuest-based learning process. Students are trained to analyze, evaluate, infer, conduct deductive and inductive reasoning with various information presented either in the form of text or websites provided in WebQuest. The findings of this study are in line with the findings of previous studies which revealed that the learning process involving several critical thinking sub-skills in it contributes significantly to students' writing skills, especially in writing scientific texts (Mohammed & Khalid, 2025; Sato, 2022; Shulgina, Costley, Shcheglova, Zhang, & Sedova, 2024). WebQuest-based writing learning also encourages students to provide responses from various situations and perspectives on the issues or problems presented to improve critical thinking skills as well as academic writing.

The study's findings show that WebQuest-based writing instruction is superior to conventional in-person instruction in terms of enhancing academic writing abilities and producing both immediate and effects over time on academic writing and critical thinking skills. The rise in academic writing skills is attributed to the advanced thinking skills that WebQuest-based learning fosters. Class discussions between students and teachers as well as between students in understanding information through various activities like analysis, evaluation, inference, and reasoning, as well as discussion of various writing skills, improve the quality of students' essays (Awada et al., 2020; Lu & Xie, 2019). Students get reliable information in practicing writing skills through the WebQuest-based learning structure. Therefore, students can plan their writing by making a draft first and then improving it by paying attention to aspects of task achievement, cohesion and coherence, lexis, and grammatical structure. This finding is in line with previous findings, which revealed that web-based and patterned learning instructions are more effective in improving writing skills and other language learning because the learning pattern is able to explore the necessary skills and more independent learning opportunities that make students more prepared (Fathi & Rahimi, 2022; Wu et al., 2020). This study implies that WebQuest-based writing learning can be used to optimize academic writing skills and critical thinking skills because the structure of the learning pattern can explore critical thinking sub-skills that contribute significantly to writing skills.

6. CONCLUSION, IMPLICATION, AND RECOMMENDATION

According to the study's findings, WebQuest-based writing instruction outperforms conventional in-person writing instruction in terms of enhancing students' academic writing and critical thinking abilities. Furthermore, WebQuest-based writing instruction has both immediate and long-term impacts on both skills. This increase occurs

because the WebQuest-based learning structure pattern has a pattern that can hone high-level thinking skills, which include the introductory stage, task components, process components, conclusions, and evaluation components. High-level thinking contributes significantly to students' academic writing skills. In addition, students have more time to study the material independently before class starts in WebQuest-based writing learning. Interaction with various materials with various formats, interaction with teachers, and other students is more intense in WebQuest-based learning than in traditional learning which makes the experimental group's competence better than the control group. All of the critical thinking and academic writing skills are significantly different. The analysis, assessment, inference, and deductive and inductive reasoning skills are some of the critical thinking skills that have significantly improved. However, a less significant increase in the critical thinking ability aspect was found in the inference and inductive reasoning abilities in the posttest phase. This happened because the WebQuest-based learning pattern gave students the opportunity to learn independently before class, so that students were accustomed to studying the material in general first (deductive) before concluding (inductive). In contrast to critical thinking skills, the increase in academic writing skills that showed a significant increase occurred in all aspects, namely task achievement, cohesion and coherence, lexical and grammatical accuracy.

This study implies that WebQuest-based writing learning can be used as an alternative learning strategy in improving academic writing skills while improving critical thinking skills. This study has several limitations, including participants who focus on high school, competencies that only focus on academic writing and critical thinking skills, aspects of critical thinking skills and academic writing skills that are still limited, the type of web that focuses on WebQuest, and comparisons that are only made in face-to-face classes. Based on these limitations, this study recommends several suggestions for further research, including participants need to involve students at the tertiary level, competencies need to be expanded with other competencies that are closely related to academic writing skills, for example, reading skills or reading strategies, critical sub-skill aspects need to be expanded, and academic writing skill aspects need to be expanded.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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