



The Impact of Critical Thinking-Integrated Instruction on EFL Learners' Reading Comprehension: An Interventional Mixed-Methods Study

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Received: 2026/05/26

Accepted: 2026/06/16

Abstract: The evolving educational landscape of the 21st century demands the renewal of language teaching methodologies by integrating cognitive skills such as critical thinking (CT) to enhance learning outcomes and learner autonomy. Employing an exploratory sequential mixed-methods research design, this study examines the impact of CT-integrated instruction on English as a foreign language (EFL) learners' reading skills. An initial pool of 156 EFL learners was interviewed to identify their learning challenges, with a particular emphasis on reading skills. Subsequently, 107 of these learners were selected through convenience sampling, all of whom demonstrated comparable difficulties in reading English. The participants were divided into two groups of high and low critical thinkers in accordance with their performance on the Watson-Glaser critical thinking appraisal practice test. They were then randomly assigned to experimental and control groups. After a whole semester of CT-integrated instruction, scores taken from pre- and post-test were statistically analyzed. The results of Mixed ANOVA, Independent T-tests, and Paired Samples T-tests revealed significant improvements in the experimental group, underscoring the effectiveness of CT-integrated pedagogical approaches in fostering L2 reading comprehension. The qualitative analysis of the follow-up interviews with 46 EFL learners in the experimental groups further validated these results through thematic analysis, showing less reliance on any translation applications. The students advocated for the integration of CT into language instruction, underscoring the role of cognitive skills in improving reading skills and learner autonomy over external supports such as AI. The study offers theoretical and practical implications for the integration of CT abilities into teaching L2 reading skills in EFL contexts. The findings also highlight the need for future research to examine the cognitive processes that interact during critical reading, thereby advancing our understanding of the mechanisms through which critical thinking instruction contributes to EFL reading development.

Keywords: Critical Thinking (CT), 21st-Century Skills, Reading Skills, Renewed Methods, CT-Integrated Approach.

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Introduction

As international communication and global mobility expand, English proficiency has garnered noticeable attention for successful engagement in cross-cultural and professional interactions (Rose et al., 2021). However, mastering English—particularly reading complex texts such as academic texts—remains a challenging and arduous process (Goldenberg, 2020). Although EFL learners receive ample instruction, many of them struggle to comprehend technical and professional texts, urging them to utilize translation tools to grasp meaning (Liu & Chen, 2024). Beyond mastering vocabulary and grammar, reading comprehension is a crucial skill, requiring learners to navigate diverse texts that may encompass diverse disciplines, cultures, and discourse styles (Lyu et al., 2023). Accordingly, many EFL learners encounter challenges in reading comprehension, regardless of their English proficiency level (Ginting & Kuswando, 2020). Reading comprehension challenges may emanate from a lack of essential cognitive skills such as inference and text interpretation (Amano et al., 2023). This inability to interpret and analyze written content critically often directs learners to hinge heavily on external help such as translation tools and artificial intelligence (AI) (Liang & Wu, 2024). This reliance has significantly affected reading habits and made language learners more passive since they increasingly draw on external support that hinders their autonomy and interpretative cognitive skills (Hattan, 2024).

According to the abovementioned literature, a key factor in reading comprehension challenges is the inadequate integration of cognitive skills such as Critical Thinking (CT) into language instruction (Din, 2020; Moghadam et al., 2023). Prior evidence suggests that CT enables learners to interpret, evaluate, and synthesize information rather than passively decode text (Rodrigues et al., 2023; Van et al., 2023). CT is defined as decisive and self-reliant evaluations, including interpretation, analysis, and inference based on methodological and conceptual considerations (Dwyer et al., 2014). Moreover, it is deemed a higher-order cognitive strategy, which intends to attain positive outcomes (Halpern, 1998). It is asserted that CT plays a potent role in language learning programs (Su, 2025) since it can enhance diverse language skills and subskills, namely writing (Liu & Yao, 2019), speaking (Taheri et al., 2025), translation skills (Su, 2025), and reading performance (Fahim & Sa'ee pour, 2011).

In the quest for enhancing reading comprehension, prior studies have ascertained that incorporating CT into language education can enable language learners to critically analyze texts through fostering analytical engagement with texts (Esmaeil Nejad et al., 2022). As Din

(2020) noted, utilizing CT strategies can enhance students' reading comprehension. In this sense, language-teaching methodologies need renewal to be fully aligned with the cognitive dimensions of learning (Su, 2025). Reconstructing teaching approaches and integrating them with CT strategies can transform the language learning processes from passive reliance on technologies to active interpretation and critical engagement with written texts (Gu et al., 2022). This renovation (i.e., embedding CT skills) requires extensive investigation on the way to integrate CT into language instruction especially to improve English reading comprehension, ensuring language learners are equipped with both cognitive and linguistic competencies required in tackling reading comprehension challenges (Chew & Cerbin, 2021).

Despite the significance of embedding CT into language education (Su, 2025), the review of the literature illustrates that the effect of CT-integrated instruction on language learning has received scant attention. Furthermore, the role of CT-oriented interventions in EFL learners' reading comprehension is underexplored to date. Additionally, previous studies have adopted one-shot designs, and the longitudinal effect of CT-based interventions is uncharted. In response to these gaps, this study attempts to examine the role of the CT-integrated intervention program on EFL learners' reading comprehension through adopting an exploratory sequential mixed-methods research design. By investigating the role of CT in reading instruction, the findings can contribute to pedagogical advancements and provide educators with practical strategies to promote active engagement with texts and reduce reliance on translation tools. Additionally, enhancing learners' cognitive skills can prepare language learners for professional discourse, fostering greater participation in global knowledge exchange (Hyland, 2004). This study can bridge the gap between cognitive skill development and language instruction, offering policy-level implications for improving English language curricula.

Literature Review

This section reviews the theoretical and empirical foundations underlying the present study. It begins by examining the concept of critical thinking and its role in education, followed by a discussion of reading comprehension in EFL contexts and previous research investigating the relationship between critical thinking and language learning. The review provides the conceptual framework that informs the study and highlights the need for further investigation into the integration of critical thinking in EFL reading instruction.

Critical Thinking

CT is an elusive construct due to its complex and contentious nature (Moghadam et. al., 2023). Within this direction, an abundant number of definitions have been proclaimed to conceptualize the notion. For instance, Ennis (1985) described CT as reflective thinking, which determines what to believe or do. Ennis (1987) further maintained that CT entails diverse skills and dispositions, with the former including analyzing claims, judging the reliability of sources, or passing value judgments, and the latter entailing drawing on reliable sources, a desire to be well-informed, and striving for accuracy.

This foundational work has since been extended by frameworks such as Facione's (1990) Delphi Report, which conceptualizes CT as purposeful, self-regulatory judgment that involves interpretation, analysis, inference, evaluation, and explanation. It also describes the critical thinker as well-informed, judicious in making judgments, considerate, diligent in seeking relevant information, logical in addressing complex issues, and determined in reaching sound conclusions. These insights have been further expanded by integrated models that emphasize both skills and dispositions (Dwyer et al., 2014; Abrami et al., 2015).

Furthermore, Paul (1992) considered CT as vigorous and competent conceptualizing, analyzing, and assessing information collected from observation, experience, or communication. Moreover, Halpern (1998) noted that it is a cognitive strategy with the purpose of examining, analyzing, solving problems, and deciding based on logical perceptions and reliable evidence. In another definition, Halpern (2001) conceptualized CT as the utilization of cognitive skills to obtain optimal outcomes. For many academicians, CT is associated with higher-order thinking skills (Geertsen, 2003) and reasoning skills (Halpern, 1998). Collectively, all definitions regard CT as cognitive skills, including interpretation, evaluation, synthesis, inference, etc. It is also worth noting that CT is teachable and teachers should enhance students' CT by engaging them in CT processes to enhance academic outcomes (Pikkert & Foster, 1996).

Critical Thinking and L2 Education

Recent evidence indicates that CT has positive impacts upon EFL learners' language learning (Su, 2025) and should be integrated in language learning programs (Bezanilla et al., 2019). It is ascertained that helping students improve their CT can result in enhanced reading performance (Fahim & Sa'eepour, 2011). Additionally, Liu and Yao (2019) remarked that utilizing task-based cooperative writing instruction can enhance students' CT and accordingly, foster their writing performance. Similarly, student-centered collaborative

writing tasks can cultivate students' CT and enhance their writing abilities (Esmail Nejad et al., 2022). Given the significance of CT in language education, a growing number of studies focused on CT in relation to language skills and subskills. In a qualitative endeavor, Veliz and Veliz-Campos (2019) examined the role of CT in English language education by delving into teacher educators' and postgraduate students' perceptions of CT. In so doing, 5 teacher educators and five postgraduate students majoring in TEFL participated in semi-structured interviews. The results divulged that the students considered CT as an essential skill in academic success. However, some concerns were raised about the limited attention paid to these skills in teacher education programs.

In another study, Taheri et al. (2025) explored the effect of CT on EFL learners' speaking and writing. To this aim, 80 EFL learners were divided into experimental and control groups, with the former receiving CT-based instructions in speaking and writing and the latter being instructed through conventional approaches. The results revealed that students using CT strategies outperformed the control group and had a higher tendency to improve their productive skills. Similarly, Soleimani (2024) examined the role of explicit CT instruction on EFL learners' speaking and writing abilities. In so doing, 50 intermediate students were assigned to experimental and control groups with the former being taught through explicit CT instruction and the latter being taught through traditional instruction. The authors drew on independent samples t-tests and MANOVA to analyze the data. The results illustrated the positive effects of CT instruction on the writing and speaking abilities of learners. Recently, Su (2025) examined whether the incorporation of CT into translation instruction can positively affect EFL translation learners. To this purpose, 25 Chinese EFL learners were divided into experimental and control groups. The intervention lasted over 16 weeks, and the experimental group received CT-integrated instruction while the control group received a traditional translation instructional pattern. The results uncovered that the experimental group had better translation performance, indicating the positive impacts of CT on EFL translation learners.

Critical Thinking and Reading Comprehension

Cognitive analysis, interpreting, and internalizing textual information effectively demands sophisticated processes of comprehension (Rodrigues et al., 2023). Such processes start from basic decoding and recalling to higher-order processes of analysis, evaluation, inference, explanation, and interpretation—abilities that are needed in deep reading comprehension (Din, 2020). These cognitive capabilities are crucial in problem solving in reading as they

necessitate readers to note relevant information, synthesize various points of view, and make decisions based on evidence in a text. Critical approaches to reading, such as questioning, predicting, and cross-referencing, construct reflective readers who make efforts towards constructing meaning actively (Van et al., 2023). Research underscores that CT needs to be integrated in reading instruction since CT incorporation fosters students' engagement and analytical potential alongside their learning autonomy (Liu, 2020). Integrating CT in reading instruction can support reading comprehension and self-regulated learning (Le & Nguyen, 2024). It is argued that CT supports argument analysis and reflective questioning to enable learners to process texts cognitively and gain more in-depth comprehension without translating the text to their native language (Domke et al., 2024). Moghadam et al. (2023) contended that learners with higher CT competencies are more proficient in recognizing scholarly text structure, genre conventions, and specialist use of language. Such competencies allow learners to decode complex texts, recognize rhetorical devices, and distinguish primary from ancillary information, all of which are key to direct comprehension (Mulder et al., 2021).

It is ascertained that employing CT skills allows readers to engage in language, vocabulary learning, grammar enhancement, and comprehension of texts in a more integrated way (Liu, 2020). Similarly, critical reading enables learners to move beyond mere recognition of language to critically interpret, evaluate, and synthesize material to satisfy the growing need for sophisticated competencies in reading in today's world (Macaro et al., 2018). Such comprehension, however, requires instruction that is systematically integrated to synthesize learning of cognitive capabilities and learning of language (Grabe & Stoller, 2013). Li et al. (2024) highlighted that innovative instructional strategies can significantly enhance English learners' reading comprehension, supporting the need for approaches that promote deeper processing of texts and active engagement. It is acknowledged that explicit CT instruction in reading is inclined to enhance learners' academic achievements and better equip them to meet demands in international education and professional settings, such as business and analysis of research literature (Gedik & Akyol, 2022). Given this, there is a need to carry out more studies to determine how to apply CT in instructional practices to allow language instruction to move beyond mere memorization to analytical reading competencies and cognitive engagement.

However, notwithstanding the pivotal role of CT in reading comprehension and the need for its inclusion in language education (Afshar & Movassagh, 2017; Li et al., 2024), the effect of CT-integrated instruction on EFL students' reading comprehension has not been adequately explored to date. Reviewing the literature indicates that prior studies have mainly adopted one-shot designs, and few (if any) studies have attempted to explore the effects of CT-oriented intervention over a period of time. Moreover, previous studies have employed either quantitative or qualitative research designs and there is a dearth of studies employing mixed-method designs. Hence, to fill these lacunas, the present study intends to explore whether an instruction based on CT can affect EFL students' reading comprehension over a semester. In so doing, an exploratory sequential mixed-methods research design is adopted to obtain both quantitative results of the intervention on learners' reading and tap into their experiences before and after the intervention. Particularly, this study aims to address the following two research questions:

1. Does the integration of CT significantly affect the reading performance of EFL learners?
2. How do EFL learners perceive the role of CT instruction in improving their reading skills and overall comprehension?

Methods

Design of the Study

The present study adopted a sequential exploratory mixed-methods research design to gather quantitative and qualitative data for the purpose of reaching a triangulated view (Creswell, 2003). For the qualitative phase, semi-structured interviews were used. Then, a quantitative phase including a pre- and a post-test and a period of CT-integrated instruction in between was employed. The research ended with a follow-up interview as the complementary qualitative phase. Figure 1 shows the research design.

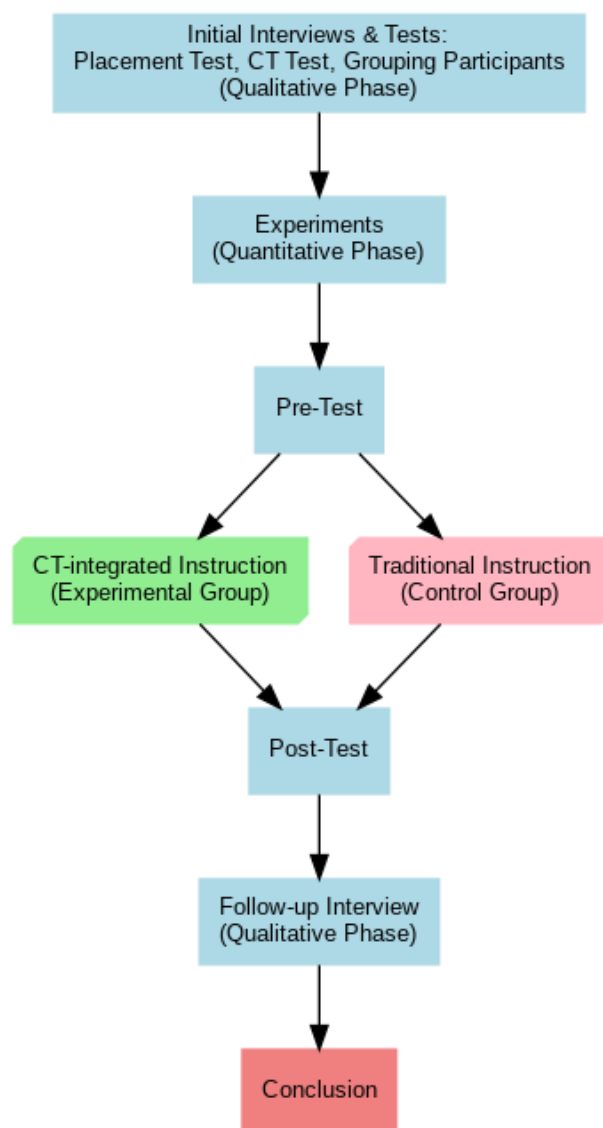


Figure 1. Research Design

Participants and Context

A sample including 107 EFL learners (50 males, 57 females), who were Persian native speakers aged from 22 to 37 years, participated in this study. They were learning English privately in non-governmental language institutes in Hamedan, Iran. Their proficiency level ranged from Upper-intermediate (B2) to Advanced (C1) as measured through the Oxford Placement Test. All participants considered direct comprehension of reading texts without resorting to translation tools as their long-lasting challenge. After ensuring homogeneity in terms of language proficiency, the participants were then sorted into high and low critical thinking groups based on their score on the Watson-Glaser CT appraisal (W-GCTA). This study also involved 10 experienced and well-trained EFL teachers, who carried out the CT-oriented instruction during the intervention. To provide instructional consistency, the

teachers went through five sessions of a CT-integrated instruction workshop, making them fully familiar with the renewed method and materials.

Instruments and Materials

Semi-structured Interview

Two rounds of interviews were conducted at the start and end of the study. The initial interview aimed to identify the specific difficulties EFL learners encounter when reading texts. Three open-ended questions focusing on reading approach, strategies, and challenges were asked from each of 156 participants ([Appendix A](#)). Each individual session lasted around 20 minutes. The responses were audio-recorded using a smartphone. The interviews were conducted in Persian in order to ensure that participants feel comfortable in expressing themselves fully and authentically. The interviews were held at times suggested by the participants in order to accommodate their schedules. Regarding the follow-up interview, which had the same format and procedure, three questions were asked from 46 EFL learners of the experimental group, focusing on how they perceived the impact of CT instruction on enhancing their reading skills and overall comprehension ([Appendix B](#)).

CT-Oriented Intervention

This phase of the study involved a pre- and a post- test to both the control and the experimental groups and an academic semester (twenty sessions, each lasting 90 minutes with a 10-minute break) of systematic CT-integrated instruction for the experimental group and traditional instruction for the control group. The intervention course involved different materials: 1) two sets of reading tests taken from IELTS mock tests administered as pre-and post-test. These tests were piloted and validated previously to confirm their reliability and validity within the Iranian setting. 2) a comprehensive CT pamphlet, which was used in the systematic CT-integrated instruction of this study. The pamphlet aligned with key CT components, including analysis, evaluation, inference, interpretation, explanation, and self-regulation. It was based on a thorough review of the relevant literature. The included activities were tailored to each component to effectively build learners' CT skills. Two experts checked the content, and after some revisions, approved the pamphlet. It is also noteworthy that the CT-integrated instruction followed a cyclical framework designed to improve students' mastery and application of domain-specific knowledge and skills. [Figure 2](#) shows the CT-integrated instruction process.

- **Presentation of Domain Knowledge and Skills:** The instructor presents the topic matter, providing students with the essential knowledge necessary for effective learning.
- **Internalization of Fundamental Concepts:** Students assimilate definitions and methods to establish a robust comprehension of the subject provided.
- **Illustration through Examples:** The lecturer exemplifies theoretical principles by demonstrating their practical applications in real-world circumstances.
- **Example Analysis:** Students rigorously analyze the examples to enhance their comprehension and investigate fundamental principles and methodologies.
- **Independent Homework:** Students are encouraged to apply their critical thinking ability to do assignments independently by finding similar examples.
- **Data Collection and Analysis Replication:** Students acquire pertinent data and duplicate analyses, thereby enhancing their practical and analytical competencies.
- **Practical Application and Feedback:** language learners work on hands-on tasks by applying their knowledge in real-world contexts. They receive guidance and corrections from the instructor.
- **Review and Feedback:** The instructors do constant evaluation by controlling students' work, and provide constructive feedback to support continuous improvement.

Figure 2. CT-integrated Instruction Process

The reliability and validity of these instructional cycles were confirmed by technical expert reviews and repeatedly conducted pilot tests. The cyclical framework was designed to ensure consistency in implementation and effectiveness in enhancing CT skills. Appropriateness and replicability of the pamphlet in the study context were verified by feedback from experts and trial applications.

Data Collection Procedure

Initially, 156 EFL learners were interviewed through semi-structured interviews to identify their major learning challenges. The analysis revealed that most learners experienced reading difficulties, heavily relied on translation, and lacked awareness of how to employ critical thinking strategies in their language learning. From this pool, 107 learners with comparable English proficiency levels and similar reported challenges were selected for the study. Prior to participation, informed consent was obtained from each student, and all ethical considerations were carefully observed. Their CT abilities were then measured using the

Watson–Glaser Critical Thinking Appraisal, and based on the results, they were divided into high and low critical thinking groups while maintaining equivalent English proficiency levels. Each group was further subdivided into experimental and control groups. A pre-test was administered to all participants, which confirmed that although their overall language proficiency was similar, learners with higher critical thinking ability showed slightly better reading performance. Subsequently, the experimental groups received reading instruction fully integrated with CT skills, whereas the control groups followed regular reading instruction. The intervention lasted for 20 sessions, each lasting 90 minutes with a short break. Upon completion, a post-test reading task was administered to compare the performance of the experimental and control groups. Finally, all participants from the experimental groups, who had received CT-integrated instruction, were re-interviewed to explore their perceptions and experiences of the intervention. The entire data collection procedure was reviewed and approved by the Ethics Committee of Eastern Mediterranean University (ETK00-2020-013-5). Both qualitative and quantitative data were analyzed to offer a triangulated view.

Data Analysis

Qualitative Data

The qualitative data obtained from two sets of interviews were analyzed thematically. The interviews were all transcribed verbatim. The researchers read the transcripts, got an overview of the data, and identified initial patterns or themes. [Swain's \(2018\)](#) framework was used to analyze interview data (Figure 3). This analysis was started by coding the data through breaking down responses into meaningful units such as words, phrases, and sentences. The codes were assigned labels to each unit. Then, selective coding was done to identify overarching themes that connect the categories to the research question. Through a thematic analysis of the responses, we identified different themes in both initial and follow-up interviews (Tables 1 and 2). Significant changes through comparisons between these phases of interviewing were analyzed. Figure 3 shows the stages of thematic analysis.

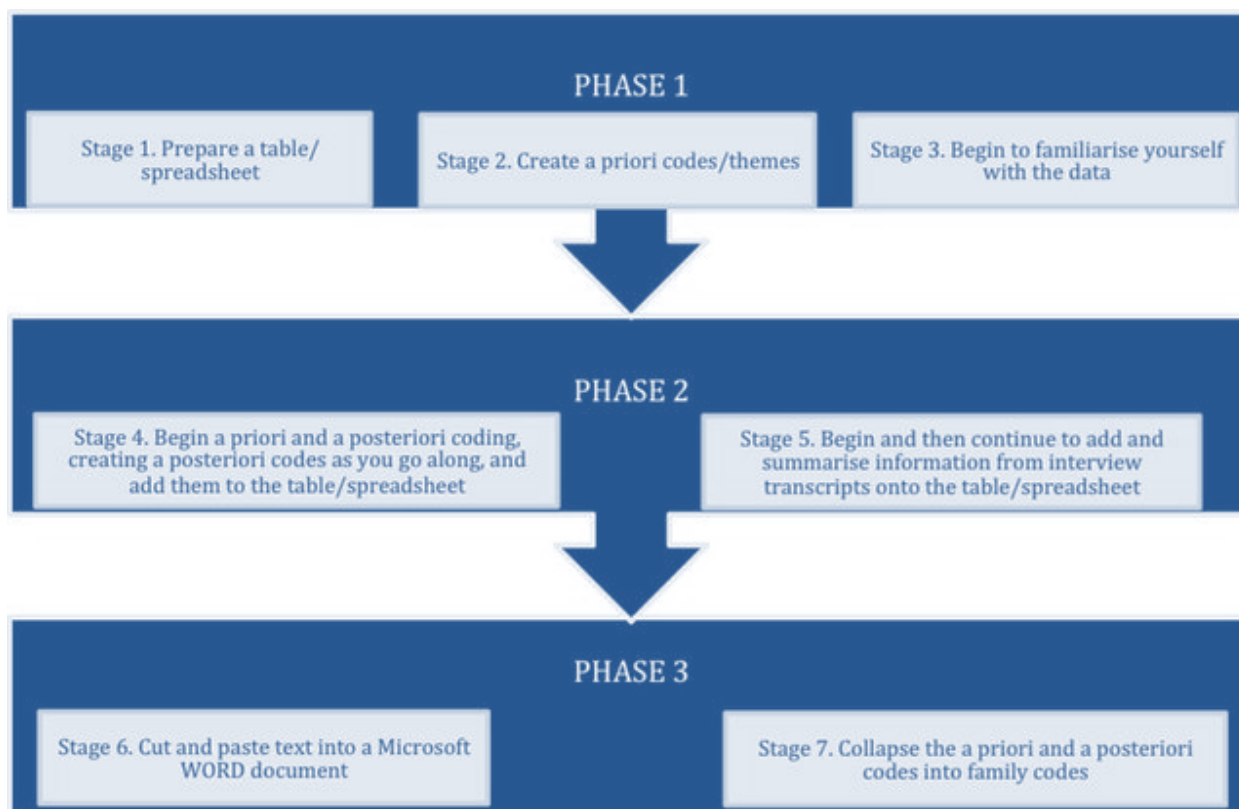


Figure 3. Stages of Thematic Analysis

To confirm the themes rigorously, inter-coder reliability was maintained by having multiple reviewers who cross-checked the thematic coding. The content and the construct validity of the interview questions were checked by pilot interviews. Furthermore, participant validation (also called member checking) was used by summarizing key points to participants and confirming their responses accurately reflected their experiences.

Quantitative Data Analysis

To analyze the quantitative data, different statistical methods and techniques were used in this study. SPSS (v. 22) was used to assess the impact of CT-integrated instruction on the English reading skills of Iranian EFL students. Due to the quantitative characteristics of the data, the importance of the distances from the zero point, and the normal distribution of the data that was confirmed by Levene's Test, yielding a p-value over 0.05, a parametric statistic was employed. From parametric statistical methods, a repeated measures mixed ANOVA was employed because the results of two groups (experimental and control groups) at two time intervals (pre- and post-test) were available for analysis. This method facilitates an extensive analysis by including both intergroup and intragroup variations across time. Independent

T-tests and Paired Samples T-tests were employed to assess differences in mean scores across groups and within groups, respectively.

Results

Qualitative Phase

The semi-structured interview data were analyzed thematically following Braun and Clarke's (2006) six-step framework. After transcribing, repeated readings, and systematic coding, five major themes emerged regarding the impact of CT-integrated instruction on EFL students' reading skills (Table 1). Each theme is presented with supporting excerpts from participants to illustrate the findings.

Comprehending Complex Language

A recurring challenge reported by participants was difficulty in understanding complex academic texts and specialized terminology. For instance, one participant noted, "When I read an academic article, I get lost in the difficult words and long sentences" (Participant 5). Similarly, another person explained, "The problem is not only vocabulary but also how the ideas are connected in the text" (Participant 11). This theme highlights that many learners perceived complex structures and technical terms as barriers to effective reading comprehension.

Navigating Substantial Content in Real-Time

Participants also expressed struggles with processing substantial content in real-time situations, such as following instructions or manuals. As one student stated, "When I read the manual for my new phone, I had to translate every line to make sense of it" (Participant 7). Another added, "Reading fast and understanding at the same time is very hard for me" (Participant 15). These accounts indicate that the immediacy of real-world reading tasks posed significant difficulties, often leading to misinterpretations and over-reliance on translation.

Dependence on Translation Technologies

A strong pattern across the interviews was the reliance on translation tools. Many learners admitted to using mobile apps or dictionaries as their primary strategy for dealing with English texts. For example, one participant reported, "Without Google Translate, I cannot finish my readings" (Participant 3). Another interview declared, "I always check with a

dictionary because I don't trust my own understanding" (Participant 12). This reliance reflects gaps in learners' ability to engage directly with English texts and illustrates a limited development of autonomous reading strategies.

Struggles in Argumentation

Several participants reported difficulty with inferencing and argument construction while reading. As one learner expressed, "I can understand the words, but when it comes to making a conclusion, I feel confused" (Participant 9). Another student also noted, "I don't know how to see the writer's point or argument clearly" (Participant 14). These responses suggest that higher-order reading skills, such as evaluation and interpretation, were particularly underdeveloped, underscoring the need for instruction that integrates CT into reading practice.

The Need for Structured CT Training

Finally, learners emphasized their need for structured guidance in developing CT strategies to improve reading comprehension. One participant highlighted, "If I learn how to analyze the text critically, I can understand more deeply" (Participant 2). Another person echoed this sentiment, stating, "Analyzing the text critically makes me ask questions about it, and that helps me focus on meaning rather than on words" (Participant 6). This theme indicates that learners recognized the potential of CT to enhance analytical reading and expressed a desire for formal instruction in this area.

The analysis of interview data revealed persistent challenges in comprehending complex language, managing substantial content in real-time, and engaging in argumentation. Participants' strong dependence on translation technologies further underscored their limited capacity for independent meaning-making. At the same time, learners consistently expressed an awareness of the value of CT, emphasizing that structured CT instruction could help them read more analytically and interact more meaningfully with texts. Collectively, these findings highlight both the obstacles EFL learners face in reading and the transformative potential of integrating CT skills into reading instruction. Table 1 summarizes the identified themes along with illustrative sample responses and their frequency of occurrence among participants.

Table 1. Major Extracted Themes

Theme	Sample Response	Frequency
Comprehending Complex Language	"When I read academic texts, I often struggle with long and complex sentences. Some words are unfamiliar, and I have to check the dictionary multiple times."	32
Navigating Substantial Content in Real-Time – Reading Focus	"During reading, I find it hard to follow everything. By the time I process the information in one section, I cannot move forward and connect the ideas."	27
Dependence on Translation Technologies	"I always use Google Translate or online dictionaries to understand my readings. Without them, I feel lost and cannot follow the main idea properly."	40
Struggles in Argumentation	"When read, I have ideas in my mind, but I cannot connect them in a structured way. My arguments feel disconnected, and I struggle with unknown vocabulary."	18
The Need for Structured Critical Thinking Training	"I believe if I had training in critical thinking, I could understand texts better. Right now, I read, but I don't always analyze the content deeply."	20

The interview findings revealed significant progress in learners' reading abilities across multiple dimensions, as demonstrated through pre-interview insights, follow-up interviews, and observed changes. The results indicate improvements in critical reading behaviors, comprehension, inferencing skills, and overall engagement and confidence. A breakdown of these changes is presented.

Analytical Reading

In the pre-interview stage, learners reported engaging in passive reading, often without questioning arguments or recognizing key details. However, during the follow-up interview, participants demonstrated active engagement with texts, including questioning claims and identifying unstated details. This shift reflects an enhanced ability to critically evaluate information and assess the reliability of sources.

Comprehension and Synthesis

Initially, many learners expressed difficulty in fully understanding reading texts and struggled to summarize or synthesize information. By the follow-up interview, they displayed improved ability to break down, paraphrase, and integrate information from texts. The observed change

indicates stronger comprehension skills and greater capacity for retaining and applying information.

Inferencing and Interpretation

Before the intervention, learners relied heavily on translation tools and focused mainly on surface-level understanding. In the follow-up stage, they exhibited the ability to infer meanings independently, recognize assumptions, and draw conclusions. This development demonstrates strengthened interpretative skills and deeper engagement with texts.

Engagement and Confidence

At the outset, participants frequently felt intimidated by complex readings, often leading to avoidance behaviors. After the intervention, their motivation increased, and they began applying active reading strategies. As a result, learners displayed greater confidence in managing complex texts and demonstrated a more positive approach toward reading tasks.

The findings are summarized in Table 2, which presents the observed changes in learners' reading abilities based on insights from the pre- and follow-up interviews.

Table 2. Observed Changes in Interviews

Category	Insights (Pre-Interview)	Insights (Follow-Up Interview)	Observed Changes
Analytical Reading	Passive reading with no questioning arguments or identifying details.	Active engagement with texts with questioning claims and recognizing unstated details.	Improved critical evaluation and engagement of texts and the reliability of sources.
Comprehension & Synthesis	Expressing difficulty in fully understanding and summarizing reading texts.	Ability to break down, synthesize, summarize, and paraphrase information.	Improved comprehension and active information retention.
Inferencing & Interpretation	Reliance translation tools and focus on surface-level understanding with no deeper analysis.	Ability to infer meanings independently and to identify assumptions and draw conclusions.	Strengthened skills for interpretation and deeper text engagement.
Engagement & Confidence	Ability to intimidate by complex readings, leading to avoidance.	Motivation and active reading strategies were improved.	Improved confidence in handling texts.

Quantitative Phase

The quantitative data analysis was done in two stages: first for the high critical thinking group and second for the low critical thinking group. In the first stage, the researchers analyzed the data gathered from the high critical thinking group to see if integrating CT significantly affected reading skills. Therefore, Mixed ANOVA was used to compare the results of both experimental and control groups at two points of time (pre-test and post-test). Prior to this analysis, some statistical assumptions were checked, such as the similar patterns of variation in groups, which was confirmed by Box's Test ($P < 0.05$), and the consistency of the scores over time, which was checked by Mauchly's Sphericity Test. In case this test shows a significant result ($P < 0.05$), it means that the assumption was violated, so the researchers used the Greenhouse-Geisser correction to adjust for it. In case the test is not significant ($P > 0.05$), it means that the assumption is held, and the researchers can report the reliable results. Overall, the findings showed that CT-integrated instruction had a significant impact on reading scores in the high critical thinking group. The results are reported in Table 3.

Table 3. The Mixed ANOVA in the High Critical Thinking group (HCT)

Source	df	Mean Square	F	Sig.	Partial Eta Squared
Time $\times$ Group	1	2.07	9.91	.003	—
Error (Time)	42	21.00	—	—	—

Note. Sphericity assumed.

It can be seen in the table that the results of the Mixed ANOVA were significant between group and time ($F = 9.91$, $p = 0.003$, $\eta^2 = 0.19$). This data was collected in order to analyze the change over time for two groups of experimental and control. The purpose was to compare these groups' performances at two different points in time in order to understand the effect of the intervention. Figure 4 shows group performances in high critical thinkers over time in the reading score.

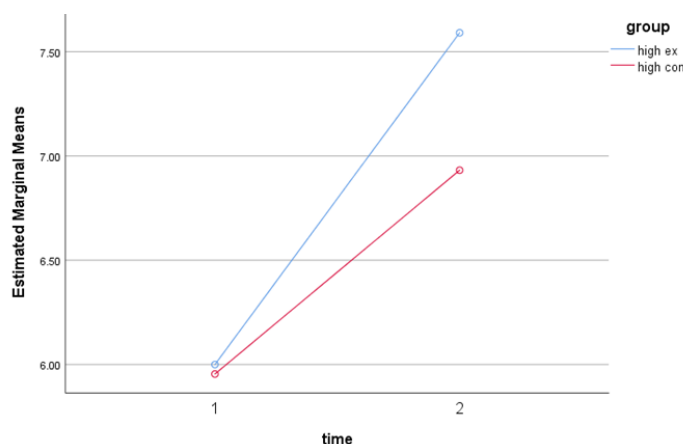


Figure 4. Interaction between Groups over Time

This figure shows the improvement over time for both groups; however, the experimental group showed better performance compared to the control group. Since the intervention proved significant, all the between-group and within-group variables were interpreted. First, an Independent T-test was employed to see if there was any significant difference between the pre-tests of the experimental and control groups within the high critical thinking group (HCT). The findings indicated no significant difference between the experimental and control groups in pre-test ($t=.26$, $df=42$, $p=0.80$). Then the same was done to analyze to see if there was a significant difference between the post-tests of the experimental and control groups. The findings indicated a substantial difference between the experimental and control groups in post-test ($t= 5.19$, $df=42$, $p= 0.001$). The scores of the post-test in high critical thinkers of the experimental group (7.59 ± 0.4) exceed those of the control group (6.93 ± 0.42). Table 4 presents the results of the Independent T-Test.

Table 4. The Independent T-test

Source	t	df	Sig. (p)	Mean Difference
Prereading (HCT)	0.00	42	1.00	0.00
Postreading (HCT)	3.35	42	.002	0.41

The statistical analysis was conducted by analyzing the difference between the pre-test and post-test in the high critical thinking experimental group. A dependent t-test was utilized, and the results reveal a significant difference between the pre-test and post-test ($t=-14.83$, $df=21$, $p=0.00$). The reading score in the experimental group increased from the pre-test (6.00 ± 0.41) to the post-test (7.59 ± 0.43). Then, a Dependent T-test was employed to analyze if there is a significant difference between the pre-test and post-test in the control group. The findings indicated a substantial disparity in the reading scores between the pre-test and post-test ($t=-6.00$, $df=21$, $p=0.00$). The scores of the high critical thinkers of the control group during the post-test (6.93 ± 0.42) exceeded the pre-test score (5.95 ± 0.71). Table 5 presents the findings.

Table 5. The Dependent T-test

Group	t	df	Sig. (p)
HCT (Experimental)	-14.83	21	.001
HCT (Control)	-6.00	21	.001

These results of the pre- and post-test of the experimental and control groups, highlighting the impact of an intervention on reading performance, are illustrated in the following figure. The experimental group demonstrates a significant improvement in post-test scores compared to the control group, suggesting the effectiveness of the applied treatment. Figure 5 shows the results.

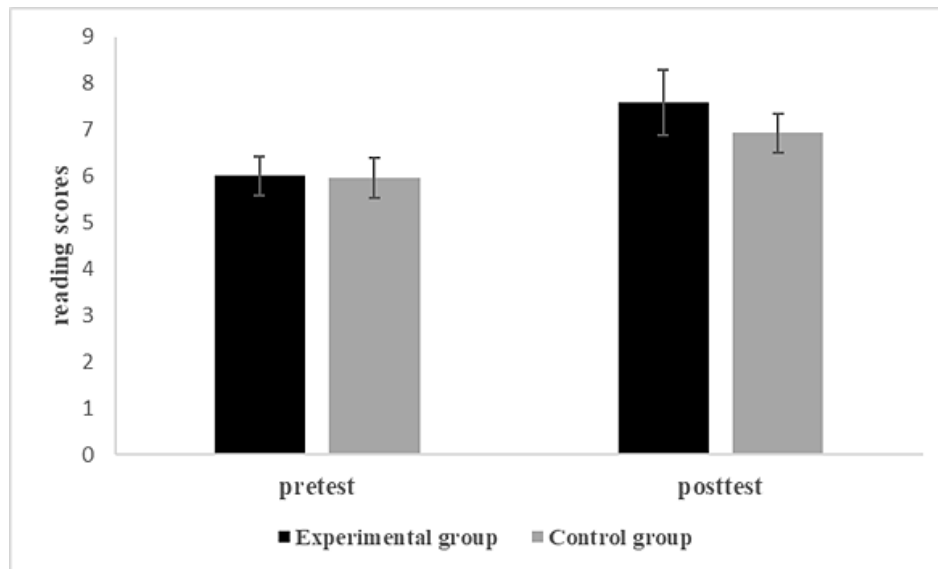


Figure 5. The Reading Scores of Experimental and Control Groups in the Pre- and Post-test

In the second stage of our statistical analysis, the researchers analyzed the data gathered from low critical thinkers to see if integrating CT significantly affected reading skills. The same tests and procedures that were done in the first stage were repeated in the second stage. Overall, the findings showed that CT integration had a significant impact on reading scores in the low critical thinking group, too. Table 6 reports the results.

Table 6. Mixed ANOVA in the Low Critical Thinking Group (LCT)

Source	df	Mean Square	F	Sig. (p)	Partial Eta Squared
Time × Group	1	1.24	4.88	.030	.10
Error (Time)	42	21.00	—	—	—

Note. Sphericity assumed.

It can be seen in the table that the results of the Mixed ANOVA were statistically significant between group and time ($F=4.88$, $p=0.03$, $\eta^2=0.10$). The following figure displays the interaction between group and time, comparing the performance of experimental

and control groups over two time points of pre- and post-test. Figure 6 shows the interaction between groups over time.

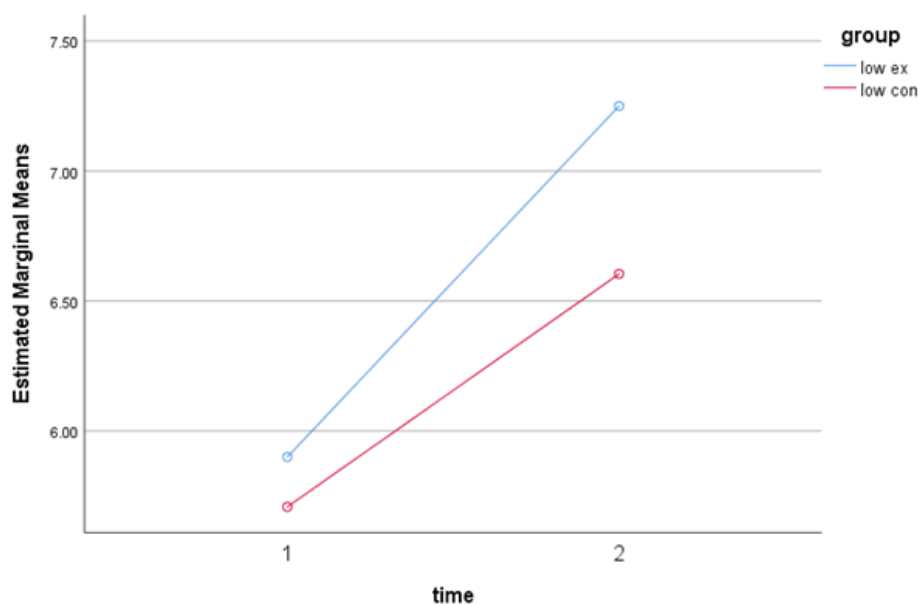


Figure 6. Interaction between Groups over Time

It demonstrates that both groups showed an upward trend in reading scores over time, but the experimental group demonstrated a steeper increase, indicating a greater improvement compared to the control group. This suggests that the intervention had a more significant effect on the experimental group. Given the significance of the interaction, all between-group and within-group factors were analyzed. Therefore, an Independent T-test was employed, and the findings indicate no statistically significant difference between the experimental and control groups ($t=1.03$, $df=46$, $p=0.31$).

The same Independent T-test was employed to see if there was a significant difference between the scores of the experimental group and the control group. The findings indicate a statistically significant difference between the experimental and control groups ($t= 3.44$, $df=46$, $p= 0.001$). The scores in the experimental group (7.25 ± 0.57) exceed those of the control group (6.60 ± 0.72) following a period of instruction. Table 7 presents the findings.

Table 7. The Independent T-test

Source	t	df	Sig. (p)	Mean Difference
Prereading (LCT)	1.03	46	.310	0.19
Postreading (LCT)	3.44	46	.001	0.64

The analysis went on by employing a dependent t-test to see if there was a significant difference between the scores of the pre-and post-test of the low critical thinking (LCT) experimental group. The findings indicate a statistically significant difference between the pre-test and post-test in the experimental group ($t=-8.86$, $df=23$, $p=0.001$). The scores in the experimental group increased from the pre-test (5.90 ± 0.63) to the post-test (7.25 ± 0.57).

The same dependent t-test was employed to see if there was a significant difference between scores of the pre-test and post-test in the control group. The findings indicate a statistically significant change in the scores between the pre-test and post-test ($t=-6.50$, $df=23$, $p=0.001$). The scores of the control group increased from the pre-test (5.71 ± 0.66) to the post-test (6.60 ± 0.72). Table 8 presents the findings.

Table 8. The Dependent T-test

Group	t	df	Sig. (p)
LCT (Experimental)	-8.86	23	.001
LCT (Control)	-6.50	23	.001

The results of the pretest and post-test reading scores for the experimental and control groups, highlighting the impact of an intervention on reading performance, are illustrated in the following figure. The experimental group demonstrates a significant improvement in post-test scores compared to the control group, suggesting the effectiveness of the applied treatment. Figure 7 shows the results.

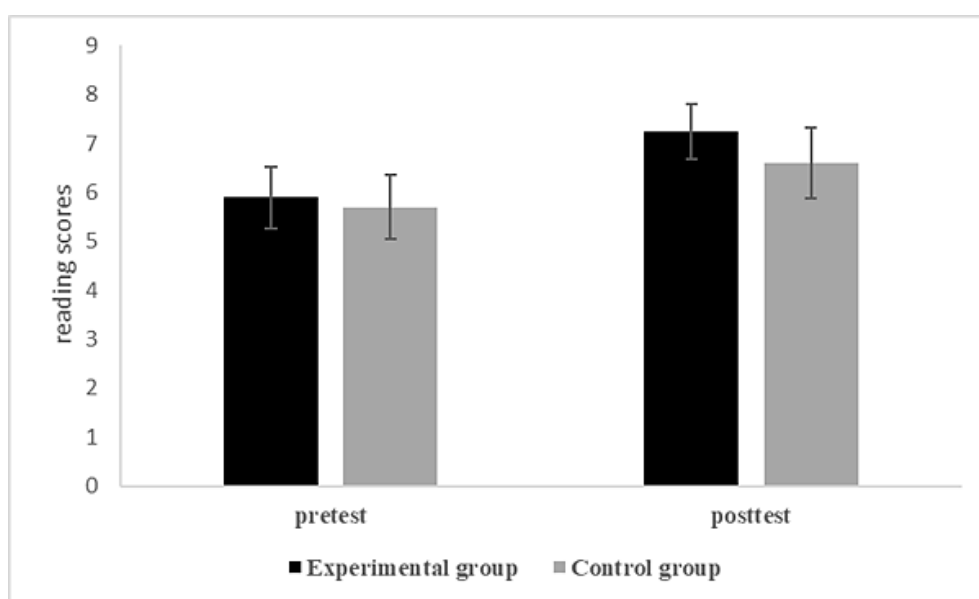


Figure 7. The Reading Scores of Experimental and Control Groups in the Pre- and Post-test

In sum, the quantitative results indicated significant differences between experimental and control groups in both high critical thinkers (HCT) and low critical thinkers (LCT). A repeated-measures ANOVA revealed a significant Time $\times$ Group interaction, indicating that participants' reading performance improved differently depending on the type of instruction they received. Independent samples t-tests further confirmed that, at the posttest stage, the experimental groups outperformed the control groups in both HCT and LCT categories, despite showing no significant differences at the pretest stage. This suggests that the integration of CT skills into reading instruction had a measurable impact on learners' reading outcomes. Paired samples t-tests provided additional support for these findings, showing that both experimental and control groups improved over time, but the magnitude of improvement was considerably greater in the experimental groups. Among HCT learners, the experimental group demonstrated a much larger gain compared to the control group, while a similar pattern was observed in the LCT learners, though with slightly smaller effect sizes. Taken together, these results indicate that while general reading instruction contributed to some progress, the integration of CT strategies substantially enhanced learners' reading proficiency across different levels of CT ability.

Discussion

This study intended to examine the effect of CT-integrated instruction on the improvement of Iranian EFL students' reading skills. The findings indicated that CT-integrated instruction significantly enhanced the participants' reading skills from pre-test to post-test. This outcome empirically supports previous studies, which declared that cultivating CT skills facilitates EFL learners' progression in reading skills acquisition and performance (Chew & Cerbin, 2021; Din, 2020; Su, 2025). The study also aligns with the broader educational initiative focused on shifting from conventional, teacher-centered methods to approaches that primarily emphasize CT and cognitive engagement (Amirian et al., 2023). An explanation for this finding could be the depth and efficacy of the treatment course for EFL learners' reading comprehension development. The instructors' teaching skills, expertise, and experience in engaging learners in critical courses may also justify the finding. The result can also be attributed to the personality traits of the participating EFL students, especially their preferences for criticality and CT, which possibly engrossed them in the course and reading texts. The study differs from prior research in terms of design and period of treatment. Perhaps these features had caused a significant change in students' reading skills after the intervention.

The findings from the experimental groups validate that the integration of CT into pedagogy can substantially enhance reading comprehension and underscore the broader relevance of CT for Iranian students (Fahim & Sa'eepour, 2011; Soleimani, 2024). These results corroborate the earlier assertion regarding the significance of CT in academic and professional success (Yapp et al., 2023). The dynamism of language skills, particularly reading, may explain this result. The experimental group improved in reading after going through the CT intervention, probably because of their interest in reading passages and receptive skills. Another explanation can be the perceived need and significance of reading for EFL students, a claim buttressed by previous studies (e.g., Amano et al., 2023; Din, 2020; Hattan, 2024; Liu & Chen, 2024). The study also underscores the constructive role of integrating cognitive skills like CT in L2 education (Su, 2025). It seems that the participants of the experimental group have been critical thinkers and CT-seekers, who engaged in the course and improved their reading skills.

The findings from the thematic analysis revealed that learners consistently struggled with comprehending complex academic language, navigating substantial content in real time, and constructing well-organized arguments. These difficulties echo earlier research showing that EFL learners often face cognitive overload when engaging with dense texts, especially when their proficiency is not yet sufficient to process information efficiently (Grabe & Stoller, 2013). The heavy reliance on translation technologies observed in this study further illustrates learners' limited ability to engage directly with English texts, reinforcing concerns raised by scholars about the overuse of digital translation tools in academic contexts (Chon & Shin, 2020). Together, these themes suggest that traditional reading instruction alone may not adequately equip learners to move beyond surface-level comprehension. At the same time, learners' strong recognition of the value of CT instruction indicates a clear pedagogical opportunity. Participants explicitly linked CT training with deeper analysis, better argumentation, and improved overall comprehension. This finding is consistent with previous studies highlighting the role of CT in fostering active reading and interpretive skills (Liaw, 2007; Yang & Gamble, 2013). The qualitative insights, therefore, provide an important explanatory layer to the quantitative results: while test scores confirm the measurable gains from CT-integrated instruction, the interviews reveal how students themselves perceived these gains in terms of greater autonomy, reduced dependence on translation, and increased confidence in handling complex texts. These findings underscore the importance of embedding CT strategies within reading curricula to address both cognitive and affective dimensions of EFL reading.

Taken together, the quantitative and qualitative findings present a coherent picture of the impact of CT-integrated instruction on EFL reading. While the quantitative results demonstrated significant gains in reading performance for experimental groups across both high and low critical thinkers, the qualitative insights revealed the underlying reasons for these improvements. Learners themselves articulated how CT instruction helped them overcome difficulties with complex language, real-time processing, and argument construction, while also reducing their reliance on translation technologies. This convergence of evidence highlights not only the measurable effectiveness of CT integration but also its perceived value by learners, reinforcing the conclusion that embedding CT in reading instruction is both pedagogically beneficial and experientially meaningful. Future research may build upon these findings by investigating the specific cognitive operations involved in critical reading, such as inference generation, evaluation of evidence, argument analysis, bias detection, and metacognitive monitoring, to further explain the mechanisms through which CT instruction enhances reading performance.

Conclusions and Implications

This study explored the contribution of a CT-oriented intervention to EFL students' reading comprehension development. The results highlight the constructive role of a CT-integrated pedagogical framework in improving reading as a receptive skill in the L2 learning process. Based on the outcomes, it is asserted that reading comprehension is dynamic and improvable if the students are provided with engaging and proper instruction and methods. It can also be concluded that CT has a wide spectrum of contributions and its scope is not limited to cognitive and mental skills of the learners, but covers language skills and sub-skills as well. The present study can practically help EFL teachers by informing them of CT as a systematic instructional strategy that can be implemented in teaching L2 reading skills in EFL settings and generate optimal outcomes. Teachers also understand the role of innovative teaching methods in causing change and development in learners' language performance. Through the CT-based pamphlet and findings reported in the study, teachers may also be encouraged to replicate the intervention in their future L2 classes. EFL students may find this study significant for raising their cognitive abilities, thinking skills, and criticality in the context of L2 education and reading. English curriculum designers may draw on this study and modify their plans to inject CT skills into the L2 education curriculum, enabling and boosting students' cognitive engagement during learning different language skills, especially reading. Teacher trainers may also use this study in their teacher training courses (TTCs) by explicitly

explaining and teaching the definition and contributions of CT and its injection into L2 education and practice. Practices and activities for integrating CT abilities in different language skills can be taught to novice teachers in such professional development courses.

Theoretically, the study enriches the academic debate about the use of CT in L2 education by providing empirical evidence that advocates for the incorporation of CT abilities into reading instruction. It also establishes a foundation for subsequent research to investigate the scalability and adaptation of CT-oriented pedagogical models across many educational environments and disciplines. This creates new opportunities for academic research, with the potential to improve and optimize the integration of CT in diverse educational environments. The study also advances the discussion on the implementation of CT-integrated language teaching in educational environments, particularly in EFL contexts such as Iran. Further studies may investigate the specific cognitive operations that interact during critical reading, such as inference generation, argument evaluation, bias detection, source credibility assessment, and metacognitive monitoring, to provide a more comprehensive understanding of the mechanisms through which critical thinking enhances EFL reading comprehension.

Limitations and Suggestions for Future Research

The study includes some limitations. The use of convenience sampling in selecting interviewees may have caused a risk of selection bias. The experimental design of the study may have created personal bias, human error, artificial responses, and variable manipulation. Other designs are then recommended to future researchers using random sampling techniques. Another limitation can be the possibility of behavior change in the experimental group after realizing that they are being studied in a research project (also known as the Hawthorn effect). The dynamism of CT and reading skills could have been deeply studied through a longitudinal research design rather than separated into short periods of data collection. The mediating role of extraneous and control variables, such as age, gender, overall language proficiency, educational background, discipline, etc., has been overlooked in this study. Future scholars can control these factors in their studies on CT and reading skills. The same treatment can be replicated in other cultural-educational contexts to reach a universal framework for integrating CT into L2 education, especially reading instruction. Other language skills and sub-skills can also be explored in light of CT-oriented courses in the future. The contribution of innovative technologies like artificial intelligence (AI) to the CT abilities of EFL students is also advisable for future researchers. More triangulation can

be achieved in future studies by using questionnaires, interviews, observations, diaries, and reflective journals. The findings also open new avenues for research into the cognitive processes underlying critical reading in EFL contexts.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Appendix (A)

1. How do you usually approach reading English texts (e.g., strategies, steps, or habits you follow)?
2. What strategies do you use when you face unfamiliar words, grammar, or complex ideas while reading?
3. What are the main challenges or difficulties you experience when reading English texts?

Appendix (B)

1. How has the critical thinking (CT) instruction influenced the way you approach reading English texts?
2. In what ways has CT instruction helped you improve your comprehension of English texts?
3. What specific changes or improvements have you noticed in your reading skills after receiving CT instruction?

