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The Impact of Online Cognitive-based Instruction through Bloom's Taxonomy on Iranian EFL Learners' Reading Comprehension Ability and Critical Thinking Skill

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A B S T R A C T

Purpose: This study examined the simultaneous impact of online cognitive-based instruction through Bloom's Taxonomy on Iranian EFL learners' reading comprehension ability and critical thinking skill.

Methods and Materials: Eighty-four homogeneous intermediate Iranian EFL learners were selected via Oxford Placement Test (OPT) and randomly assigned into experimental (n=41) and control (n=43) groups. Both groups participated in pretesting, twelve sessions of online instruction via Adobe Connect, and post-testing. The experimental group received instruction designed using Bloom's Taxonomy levels across reading texts, while the control group received instruction based on the conventional Grammar Translation Method. Data were collected using a validated researcher-made L2 reading comprehension test and the California Critical Thinking Skills Test (CCTST). Data analysis was conducted using SPSS, employing One-Way ANCOVA and Paired-samples T-tests.

Findings: The results indicated that cognitive-based online instruction significantly improved both reading comprehension ability ($F(1,81)=17.03$, $p<.01$, partial $\eta^2=.174$) and critical thinking skill ($F(1,81)=122.97$, $p<.01$, partial $\eta^2=.603$) in the experimental group compared to the control. Additionally, the experimental group showed a significantly greater improvement in reading comprehension ($M=15.48$, $SD=3.22$) compared to critical thinking skill ($M=12.41$, $SD=3.21$), $t(40)=4.53$, $p<.05$, Cohen's $d=.980$, highlighting stronger gains in reading.

Conclusion: Results suggest that reading comprehension improves more substantially than critical thinking skills under such instructional conditions. This approach offers valuable insights for language curriculum developers, teachers, and policy makers aiming to improve language instruction quality and prepare learners for 21st-century educational challenges.

Keywords: *Online English instruction, Bloom's Taxonomy, Iranian EFL learners, Reading comprehension ability, Critical thinking skills*

1. Introduction

In today's increasingly interconnected world, English has emerged as a dominant language in academia, international communication, and technological innovation. As a result, the ability to effectively comprehend English texts is a vital skill for English as a Foreign Language (EFL) learners who aim to succeed in educational and professional domains (Bozan, 2024; Crystal, 1999). Reading comprehension not only facilitates access to information but also serves as a foundation for higher-order thinking, particularly critical thinking, which is indispensable in the information-rich age of the 21st century (Facione, 2023; Piñero & Cañedo, 2024).

Despite the recognized significance of reading comprehension, many Iranian EFL learners at the tertiary level face considerable challenges in mastering this skill (Ahmadian et al., 2024; Kamali & Fahim, 2011). These challenges include difficulties in decoding meaning, identifying implicit messages, and drawing inferences from texts—skills that are intrinsically linked to cognitive engagement and critical thinking (Amiri & Maftoon, 2010; Huyen & Ngoc, 2024). In the context of second language acquisition, reading is not merely a mechanical process of word recognition but an active, interpretive, and metacognitive task that requires learners to critically engage with textual content (Gimeno-Sanz, 2016; Magliano & et al., 2011).

The outbreak of the COVID-19 pandemic and the ensuing shift to online education have further compounded the complexity of EFL instruction (Song, 2021; Wolhuter & Jacobs, 2021). However, this shift has also offered a unique opportunity to incorporate educational technologies and innovative pedagogies, such as cognitive-based instruction and Bloom's Taxonomy, into digital learning environments (Derakhshan, 2021; Lemay & et al., 2021). Bloom's Taxonomy, originally proposed in 1956 and later revised by Anderson and Krathwohl, presents a hierarchical model of cognitive processes that range from basic recall to advanced evaluative and creative tasks (Anderson & Krathwohl, 2001; Krathwohl, 2002). This taxonomy has been widely adopted as a framework for fostering both lower-order thinking skills (LOTS) and higher-order thinking skills (HOTS) in educational settings (Ceylan & Akar, 2018; Lourdusamy et al., 2022).

Integrating Bloom's Taxonomy into EFL instruction has shown potential in cultivating students' critical thinking abilities while simultaneously enhancing their language proficiency (Pujawan et al., 2022; Setyowati et al., 2022). Particularly in online environments, the taxonomy provides structured learning pathways that help students engage deeply with learning materials, apply learned concepts to new contexts, and evaluate the credibility of information (Huang & et al., 2024; Hui, 2024). The layered cognitive approach advocated by Bloom's Taxonomy encourages a transition from passive reception to active construction of knowledge, a vital requirement for fostering analytical thinking in reading (Nguyen & Nguyen, 2023; Thornhill-Miller & et al., 2023).

Parallel to this, recent studies underscore the strong correlation between reading comprehension and critical thinking in EFL contexts, suggesting that improvements in one area can directly influence the other (Huyen & Ngoc, 2024; Melati & Rasyid, 2023). Researchers argue that EFL learners with higher critical thinking skills are better equipped to interpret complex texts, recognize underlying themes, and critically assess arguments (Divsar, 2019; Zhang, 2018). As such, instructional models that combine these two competencies hold significant promise for comprehensive cognitive and linguistic development.

In Iran, traditional methods like the Grammar Translation Method (GTM) remain prevalent in university-level English programs, often emphasizing rote memorization and literal translation over analytical engagement (Akbari et al., 2021; Richards & Renandya, 2003). However, this conventional pedagogy may fall short of preparing students for modern academic challenges that demand higher-order skills such as analysis, synthesis, and evaluation (Abosalem, 2016; Chandio et al., 2021). In contrast, Bloom's Taxonomy-based instruction offers a scaffolded approach that aligns well with the learning needs of the 21st-century student, particularly in an online educational environment (Abdollahi & Moiinvaziri, 2023; Nurmatova & Altun, 2023).

Advancements in digital technology have made it increasingly feasible to implement Bloom's Taxonomy in online classrooms. Platforms such as Adobe Connect, Big Blue Button, and Zoom enable real-time interaction and collaborative learning, allowing teachers to design cognitively rich tasks aligned with Bloom's hierarchical levels (Ayoub et al., 2024; Paesani, 2020). These digital environments also support multimedia resources and interactive tools that can further enrich learners' engagement and motivation (Asih & Ria, 2024; Troussas et al., 2022). Moreover, when combined with well-structured pedagogical frameworks, such as the flipped classroom model or task-based learning, online cognitive-based instruction can

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significantly improve educational outcomes in EFL learners (Etemadfar et al., 2020; Mundir et al., 2022).

Empirical evidence from previous research highlights the success of integrating Bloom's Taxonomy into EFL instruction for enhancing critical thinking and reading comprehension. For instance, Horvathova and Naďová (2021) demonstrated how systematically applying Bloom's levels to reading texts led to noticeable improvements in learners' cognitive processing and interpretative skills (Horvathova & Naďová, 2021). Similarly, Abbasian and Modarresi (2022) reported the positive impact of synchronous online learning using Bloom's framework in fostering both critical reading and reflective thinking among Iranian EFL learners (Abbasian & Modarresi, 2022). Furthermore, Abdulrahman (2023) found that Bloom-enriched instruction enhanced writing performance in academic settings by encouraging analytical and evaluative thinking (Abdulrahman, 2023).

Nevertheless, few studies have explored the simultaneous application of Bloom's Taxonomy to both reading comprehension and critical thinking skills within an online Iranian EFL context. This gap is noteworthy given the increasing relevance of these two skill sets in global academic and professional landscapes (Normuratova, 2024; Yusuf & et al., 2024). The integration of these skills not only prepares learners for academic success but also equips them with cognitive resilience and adaptability in a world characterized by rapid change and information overload (Gilakjani & Sabouri, 2016; Shaikh et al., 2021).

Moreover, online education, though initially adopted as a crisis response during the pandemic, is now being increasingly recognized as a sustainable model for flexible and inclusive learning (Bao, 2020; Najafi & et al., 2021). Research indicates that well-planned online instruction that utilizes cognitive frameworks such as Bloom's Taxonomy can lead to equivalent or even superior learning outcomes compared to traditional face-to-face teaching (Chen, 2019; Gacs et al., 2020). This pedagogical transformation underscores the urgency of equipping teachers with the skills to design, deliver, and evaluate cognitively engaging online instruction (Ferris & Hedgcock, 2023; Lai & Kritsonis, 2006).

Given these considerations, the present study seeks to investigate the simultaneous impact of online cognitive-based instruction through Bloom's Taxonomy on Iranian EFL learners' reading comprehension ability and critical thinking skill.

2. Methods and Materials

2.1. Study Design and Participants

Conducting a quantitative data collection, the present study employed a quasi-experimental design. Likewise, in line with Field (2024), the effect of independent variable of the study (cognitive-based learning) on the dependent variables (EFL learners' reading comprehension ability and critical thinking skills) was taken into account.

The participants of the study were 84 intermediate level male (n=36) and female (n=48) B.A. students within the age range of 18-25 majoring in different fields taking a three-credit general English course at Sama Vocational and Technical College of Dezful city. The participants were chosen based on their performance in a standard version of Quick Oxford Placement Test (OPT) administered to 110 EFL learners who had been initially chosen by convenience sampling. The sample size is in line with Krejcie and Morgan's (1970) table of determining sample size for research activities. The students whose scores were within one standard deviation above and below the mean served as the study's main participants. The students who did not meet the criteria were nonetheless permitted to participate in the study due to the nature of the convenience non-random sampling, but their scores were excluded from the data analysis.

The research participants were divided into two almost equal groups; one experimental group (i.e., Cognitive Learning Group, n=41) and one control group, n=43) receiving the conventional Grammar Translation Method (GTM) which is the most frequently used method in EFL courses in Iranian universities (Fathi & Afzali, 2020; Ghaffari Saravi et al., 2022; Nazarzade zare et al., 2021; Nourinezhad et al., 2020). Then, the participants went through the process of pretesting, intervention, and post-testing for the effect of cognitive based learning presented through Adobe Connect, on their reading comprehension ability and critical thinking skills.

2.2. Measures

Three main instruments were utilized in the study to collect the data including a standard version of QOPT, a researcher-made and validated reading comprehension test, California Critical Thinking Skills Test; Form B (CCTST) (Facione & Facion,1993).

The QOPT was used to homogenize the participants prior to the intervention phase. According to Cronbach's alpha, the

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test is highly reliable (α=.91) (Berthold, 2011, p. 674). Wistner et al. (2009) and Motallebzadeh and Nematizadeh (2011) report that the test has high construct validity based on factor analysis of the data and the credence it receives due to its widespread international use. In the present study, the QOPT enjoyed a KR-21 reliability index of .86 which considered as "appropriate" as noted by Fulcher and Davidson (2007, p. 107).

A 30-item multiple-choice reading test was developed based on eight lessons of the students' course book; e.g., "Read This! Intro Student's Book: Fascinating Stories from the Content Areas" (Mackey et al., 2012). To score the test sheets, one correct answer was considered for each item; a zero point was given to choices that were wrong. As a result, the highest score of each participant was 30. The test was put to the scrutiny of three TEFL PhD holders teaching in Islamic Azad University to ensure the test's content validity. Piloting the test online among a group of 30 EFL participants with the same characteristics, the Cronbach's Alpha reliability index for the pilot study of RC test was α=0.843.

Regarding the last instrument, the valid and reliable Persian version of CCTST (Facione & Facion,1993; Facione, 2023), which contains 34 Multiple-choice items and takes 45 minutes to complete, was used to measure EFL learners' critical thinking skills. The reliability index of the CCTST was reported as ".69 based on KR-20" (Facione, 1990, p.13). However, Bakhtiarpour (2012) reported the total reliability index of α=0.73 based on Cronbach's alpha. Facione and Facione (1993) note that a KR-20 reliability at the range of 0.65 to 0.75 for this instrument is acceptable. The content validity of the scale was also confirmed through expert judgement validity (Facione, 1990a; Knox, 2018).

2.3. Procedure

The study participants were chosen at the first stage of the pretest phase. In order to homogenize them with regard to their proficiency level in English, 110 EFL learners were first given the standard edition of the OPT. Out of those students, 84 whose scores were within one standard deviation (-/+1SD) above and below the mean, were chosen as the study participants. The selected participants were divided into two almost equal groups; one experimental group (i.e., Bloom' s taxonomy Group, n=41) and one control group, n=43) receiving the conventional Grammar Translation Method (GTM) which is the most frequently used method in EFL courses in Iranian universities (Fathi & Afzali, 2020; Ghaffari Saravi et al., 2022). After assigning into two online classes, the participants in both groups received the pretests of reading comprehension, which had been developed, piloted, and validated before, along with the CT questionnaire (i.e., CCTST). The means of the learners' scores in the two groups were compared together to assure their relative homogeneity in terms of critical thinking and reading skills prior to the treatment.

The study was carried out in the autumn semester of the university and followed its schedule. All the classes were held in Adobe Connect for both experimental and control groups emphasizing synchronous online interactions among the teacher and learners. The first two sessions were devoted to administering the pretests and briefing the students about the classroom conducts and research purposes. The third through fourteen sessions (i.e.,12 sessions) were allocated to the intervention, and the final session was saved for the administration of the posttests. The class met once a week for a total of 16 weeks during the semester, with each session lasting 120 minutes, for both groups; including a 20-minute break at the middle of the class. The researcher had to consider the university's curriculum which was to be covered during the semester, in addition to breaks and midterm exams. The classes in the control and experimental groups therefore received an equal amount of training and practice time.

The experimental group learners were exposed to Bloom's taxonomy-based learning which relied on reading the texts and the application of Bloom's taxonomy in designing tasks and posing questions and eliciting answers with regard to the texts presented in the course book, for example: listing the features of the strange places in the text, comparing a normal teenager with Louisa' s life in the text of Sleeping Beauty, evaluating the schools' decision in Late Start text, and creating new ideas and solutions to be stress free in the text First Write. Accordingly, the learners in the experimental group worked with the texts using question and answer technique to cover all six levels of the taxonomy.

To translate theories into practices, the cognitive based syllabus used in the present study, the researcher needed to focus on operationalizing the sophisticated views of educational philosophers such as Bloom (1956), Ekalia et al. (2022), and Anderson and Krathwohl (2001). Hence a practical syllabus was designed to employ Bloom's Taxonomy in the reading classroom, assuming that this syllabus will pave the ground for the development of EFL learners' analytical look on reading skills. Moreover, it was assumed that this syllabus will enhance critical thinking of the target learners. The classroom activities, tasks, question

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techniques, and the interactions aimed at presenting cognitive-based learning for critical reading comprehension aligned with the six thinking levels of Blooms' taxonomy including remembering, understanding, applying, analyzing, evaluating, and creating in present study.

The control group was exposed to the Grammar Translation Method (GTM). Hence, the researcher provided the instruction advocating the principles of GTM which emphasized the use of reading the text and translating them.

After the treatment sessions were completed, all the learners in the two groups through LMS sat for the RC posttest which was the same validated reading pretest whose items and the choices in each item were rearranged in order to minimize test effects. The collected quantitative data were fed into SPSS version 26 and the results were reported. It was administered with a hope to measure the participants' probable development in reading comprehension ability. In this phase the reading performance and CT questionnaire scores of the participants in the posttest were considered for quantitative data analysis. Accordingly, the means of the learners' scores in the posttests of reading comprehension and CT skills components were compared to measure their EFL learners' reading ability and CT skills development after the treatment.

2.4. Data Analysis

To analyze the data, SPSS software, version 26 was employed and a number of statistical techniques were employed to analyze the data collected in this study; namely, Paired-Samples t-test for comparing two groups' means and One-Way ANCOVA for comparing the groups' means on overall reading comprehension ability and critical thinking skill.

3. Findings and Results

The results of the statistical analyses are discussed in this section. Before reporting the results, it should be noted that the reliability, and construct validity of the instruments were probed. The normality of the data, and other assumptions required by One-Way ANCOVA, i.e., linearity, homogeneity of regression slopes and homogeneity of variances of groups were also checked and retained. Table 1 shows the experimental and control groups' means on posttest of reading comprehension after controlling for the effect of pretest. The results showed that the experimental group (M = 23.07, SE = .886) had a higher mean than the control group (M = 17.95, SE = .865) on posttest of reading comprehension.

Table 1

Co Descriptive Statistics for Posttest of Reading Comprehension by Group with Pretest

Group	N	Mean	SD	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Experimental	41	23.078[a]	7.70	.886	21.315	24.841
Control	43	17.955[a]	6.82	.865	16.233	19.676

a. Covariates appearing in the model are evaluated at the following values: Pretest = 15.50.

As shown in Table 2, ($F(1, 81) = 17.03$, $p < .01$, partial $\eta 2 = .174$ representing a large effect size) the experimental group outperformed the control group on posttest of reading comprehension after controlling for the effect of pretest. Figure 1 shows the two groups' means on posttest of reading comprehension after controlling for the effect of pretest. It is essential to highlight that the results were reported at .01 levels precisely because the assumption of homogeneity of variances was not upheld. It is worth mentioning that the results were reported at .01 levels due to the fact that the assumption of homogeneity of variances was not retained.

Table 2

Tests of Between-Subjects Effects for Posttest of Reading Comprehension by Groups with Pretest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Pretest	310.598	1	310.598	9.697	.003	.107
Group	545.508	1	545.508	17.031	.000	.174
Error	2594.416	81	32.030			
Total	38689.205	84				

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Figure 1

Means On Posttest of Reading Comprehension by Groups with Pretest

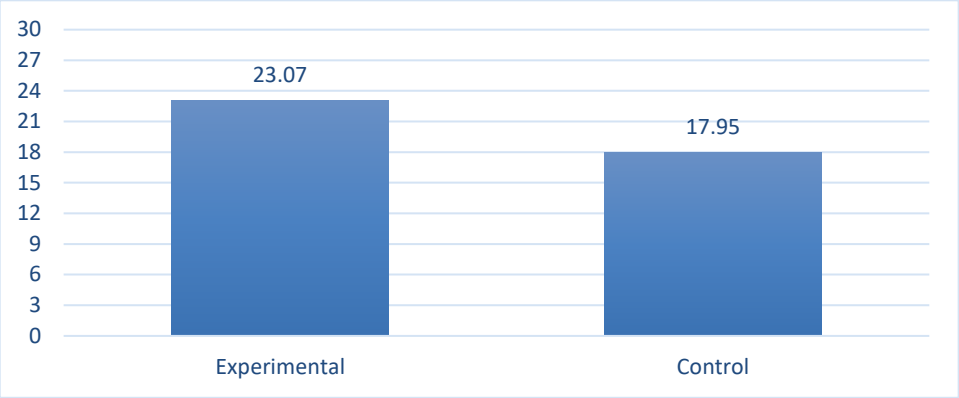

Table 3 indicates the means of the experimental and control groups on the posttest of critical thinking after controlling the pretest effect. The results of the findings cleared that the experimental group (M = 21.35, SE = .517) outperformed the control group (M = 13.31, SE = .505) on posttest of critical thinking.

Table 3

Descriptive Statistics for Posttest of Critical Thinking by Group with Pretest

Group	N	Mean	SD	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Experimental	41	21.350[a]	5.31	.517	20.320	22.379
Control	43	13.318[a]	3.29	.505	12.313	14.323

a. Covariates appearing in the model are evaluated at the following values: Pretest = 12.50.

Based on the results shown in Table 4, (F (1, 81) = 122.97, p < .01, partial η2 = .603 representing a large effect size) indicated that the experimental group significantly outperformed the control group on posttest of critical thinking after controlling for the effect of pretest. Figure 2 shows the two groups' means on posttest of critical thinking after controlling for the effect of pretest. It is worth mentioning that the results were reported at .01 levels due to the fact that the assumption of homogeneity of variances was not retained.

Table 4

Tests of Between-Subjects Effects for Posttest of Critical Thinking by Groups with Pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pretest	700.810	1	700.810	64.113	.000	.442
Group	1344.266	1	1344.266	122.978	.000	.603
Error	885.404	81	10.931			
Total	27740.000	84				

Figure 2

Means On Posttest of Critical Thinking by Groups with Pretest

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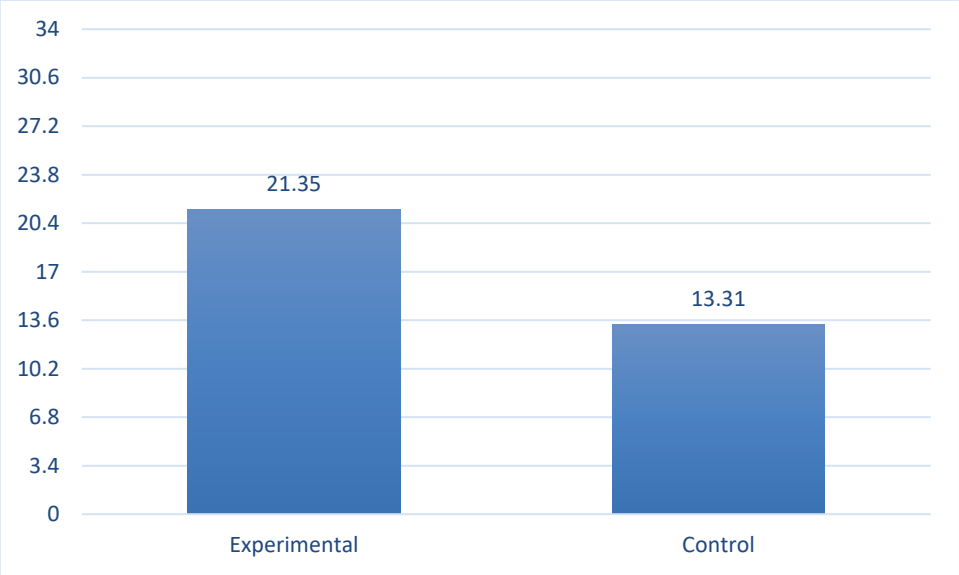

Paired-Samples t-test was run to compare the experimental group's means on posttests of reading comprehension and critical thinking. Since the number of items on two tests were different, the scores were converted to an equal proportion of 20. As shown in Table 5, the experimental group (M = 15.48, SD = 3.22) had a higher mean on posttest of reading comprehension than posttest of critical thinking (M = 12.41, SD = 3.21).

Table 5

Descriptive Statistics for Posttests of Reading Comprehension and Critical Thinking (Experimental Group)

	Mean	N	Std. Deviation	Std. Error Mean
Reading Comprehension	15.48	41	3.220	.503
Critical Thinking	12.41	41	3.128	.489

Table 6 shows the results of Paired-Samples t-test. The results (t (40) = 4.53, p < .05, Cohen's d = .980 representing a large effect size) indicated that the experimental group had a significantly higher mean on posttest of reading comprehension than posttest of critical thinking. Figure 3 indicates the mean scores of the experimental group on posttests of reading comprehension and critical thinking.

Table 6

Paired Samples t-test for Posttests of Reading Comprehension and Critical Thinking (Experimental Group)

Paired Differences					T	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
3.069	4.335	.677	1.701	4.438	4.533	40	.000

Figure 3

Means On Posttests of Reading Comprehension and Critical Thinking (Experimental Group)

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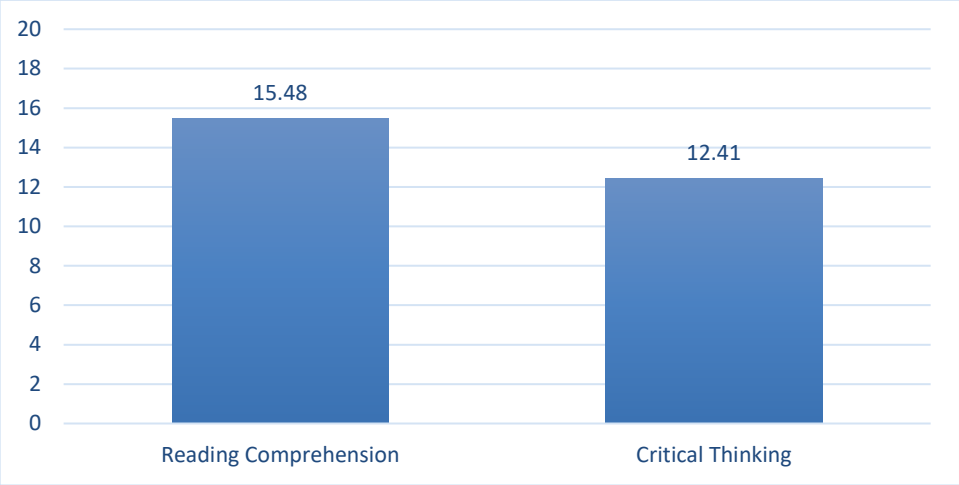

4. Discussion and Conclusion

The findings of the current study indicated that online cognitive-based instruction using Bloom's Taxonomy significantly enhanced both reading comprehension ability and critical thinking skills among Iranian EFL learners. Specifically, participants in the experimental group, who were exposed to Bloom's hierarchical levels of thinking during 12 sessions of reading instruction, outperformed their peers in the control group who received traditional Grammar Translation Method (GTM) instruction. The improvement was statistically significant for both variables; however, the gains in reading comprehension were more substantial than those in critical thinking skills. These outcomes underscore the value of using Bloom's Taxonomy as a cognitive scaffold in online language instruction and further support the effectiveness of technology-enhanced cognitive models in facilitating key academic skills.

The observed improvement in reading comprehension aligns with a large body of literature emphasizing the centrality of cognitive engagement in language learning. Previous research has shown that reading is not a passive decoding process but an active, strategic endeavor that requires higher-order cognitive processes such as analyzing, evaluating, and synthesizing (Amiri & Maftoon, 2010; Magliano & et al., 2011; Melati & Rasyid, 2023). Bloom's Taxonomy provides a systematic approach to fostering such skills by guiding learners through a progression from basic understanding to deeper textual analysis and critical interpretation (Anderson & Krathwohl, 2001; Krathwohl, 2002). The present findings also mirror those of Horvathova and Naďová (2021), who demonstrated that applying Bloom's levels to reading tasks can significantly enhance comprehension by encouraging learners to go beyond surface-level meaning and engage with the text critically and creatively (Horvathova & Naďová, 2021).

In terms of critical thinking development, the experimental group also showed a notable improvement, suggesting that integrating Bloom's framework into reading tasks does not only reinforce language proficiency but also promotes analytical reasoning. This is consistent with the claims of Huyen and Ngoc (2024), who emphasized that EFL learners with stronger critical thinking skills perform better in text interpretation and inference-making (Huyen & Ngoc, 2024). Facione (2023) and Thornhill-Miller et al. (2023) similarly stressed that critical thinking is a multifaceted construct that benefits from structured instructional approaches, especially those involving questioning, debating, evaluating evidence, and decision-making—all cognitive tasks emphasized in Bloom's Taxonomy (Facione, 2023; Thornhill-Miller & et al., 2023).

Moreover, the superiority of cognitive-based instruction over GTM in both measured domains reflects the ongoing pedagogical shift from rote learning to meaningful engagement in EFL classrooms. In line with the findings of Abdollahi and Moiinvaziri (2023), this study affirms that a structured, cognition-oriented syllabus is more effective than grammar-focused translation approaches in promoting both academic and cognitive growth (Abdollahi & Moiinvaziri, 2023). In addition, the results confirm the arguments by Ceylan and Akar (2018) and Stevani and Tarigan (2022), who showed that Bloom's Taxonomy-based questions not only assess comprehension effectively but also help learners practice and internalize higher-order thinking skills through reading activities (Ceylan & Akar, 2018; Stevani & Tarigan, 2022).

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The relatively higher gains in reading comprehension compared to critical thinking can be attributed to the nature of language instruction in the Iranian educational context, where students often have more experience and exposure to reading-based tasks than to reflective thinking exercises. While Bloom's Taxonomy offers a powerful structure for both skills, its application to reading might yield faster results due to learners' familiarity with this domain. This is consistent with findings by Nurmatova and Altun (2023) and Zhang (2018), who reported that learners often exhibit quicker improvement in language-specific skills when cognitively enhanced instructional strategies are introduced, while critical thinking requires a longer period of sustained practice (Nurmatova & Altun, 2023; Zhang, 2018).

Another key finding of the present research was the successful implementation of the instructional model in a fully online environment using Adobe Connect. This supports the growing consensus in post-pandemic educational research that online platforms, when used with structured pedagogical models, can effectively support both cognitive and linguistic development (Ayoub et al., 2024; Gacs et al., 2020). Moreover, this study resonates with previous studies by Lemay et al. (2021) and Bao (2020), who noted that educational technologies facilitate new forms of learner engagement, including collaborative tasks, multimedia use, and interactive questioning, all of which align well with Bloom's hierarchical thinking (Bao, 2020; Lemay & et al., 2021). The synchronous nature of the online sessions in this study may have further supported critical thinking development through live discussions, peer feedback, and immediate teacher scaffolding, as observed in the research by Abbasian and Modarresi (2022) (Abbasian & Modarresi, 2022).

In addition to aligning with cognitive theories, the results also find theoretical support from sociocultural learning models, particularly Vygotsky's emphasis on mediated learning and the zone of proximal development. Online cognitive-based instruction allowed learners to work collaboratively, receive scaffolding from instructors, and internalize cognitive strategies—all essential components of mediated learning. This collaborative atmosphere was supported by platforms like Adobe Connect, which enabled dialogic interaction and group reflection, creating a conducive environment for both reading comprehension and critical thinking (Ni et al., 2023; Song, 2021).

Furthermore, the study's findings add to the growing body of literature that stresses the integration of cognitive frameworks such as Bloom's Taxonomy into teacher training and curriculum design for EFL instruction (Maani & Shanti, 2023; Pujawan et al., 2022). Teachers who are equipped with knowledge about hierarchical cognitive structures are better able to design instructional tasks that challenge learners at different levels of thinking, from simple recall to critical analysis. This idea is echoed in the works of Saragih et al. (2022) and Setyowati et al. (2022), who argue for the revision of curriculum content and test items in accordance with Bloom's cognitive levels to enhance learner engagement and intellectual growth (Saragih et al., 2022; Setyowati et al., 2022).

From a practical standpoint, the findings reinforce the notion that instructional innovation must go hand-in-hand with digital transformation in education. As Lai and Kritsonis (2006) noted, online learning in EFL classrooms presents both opportunities and challenges, but its success largely depends on the pedagogical framework in use (Lai & Kritsonis, 2006). When online tools are used to deliver cognitively rich content—as they were in this study—the result is a more meaningful and impactful learning experience. This sentiment is supported by Ferris and Hedgcock (2023), who emphasize that effective L2 composition and comprehension teaching must engage learners cognitively and socially (Ferris & Hedgcock, 2023).

Despite its promising results, this study is not without limitations. First, the intervention was limited to a 12-week period, which might not be sufficient to observe the full developmental trajectory of critical thinking skills. Secondly, the study relied on a quasi-experimental design using convenience sampling, which may limit the generalizability of the findings. Additionally, the scope of the research was confined to a single geographical location and focused only on intermediate EFL learners, excluding beginner and advanced proficiency levels. Another limitation lies in the use of only one online platform (Adobe Connect), which restricts conclusions about the comparative effectiveness of different digital tools. Finally, while efforts were made to validate instruments and standardize testing procedures, individual learner differences such as motivation, background knowledge, and digital literacy may have influenced the outcomes.

Future studies should consider conducting longitudinal research to examine the sustained impact of Bloom's Taxonomy-based instruction on critical thinking and reading comprehension. Comparative studies using multiple online platforms such as Zoom, Google Meet, and Big Blue Button may also help determine which environments are most conducive to cognitive-based instruction. Additionally,

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future research could explore how demographic variables such as age, gender, academic major, and prior experience with online learning influence the effectiveness of cognitive instructional models. A mixed-methods approach incorporating qualitative data—such as interviews or learner diaries—could yield deeper insights into learners' perceptions and cognitive engagement processes. Researchers might also investigate the role of teacher training in implementing Bloom's-based instruction successfully across various educational contexts.

Based on the findings of this study, several practical implications can be drawn. Curriculum designers and policy-makers should consider embedding Bloom's Taxonomy in the core structure of EFL syllabi to ensure a balance between language acquisition and cognitive skill development. Teachers should receive specialized training in cognitive pedagogy and be encouraged to design learning activities that target different levels of Bloom's hierarchy. Additionally, educational institutions should invest in the technological infrastructure and digital literacy training necessary to support cognitively-rich online learning. Finally, assessment tools should be redesigned to evaluate both reading comprehension and critical thinking, thus reflecting a more holistic view of language competence.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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