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Exploring L2 Grammatical Knowledge Automatization from an SCT-Inspired Approach in A/Synchronous Virtual Settings: The SCOBA-Based Model

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Abstract

According to Skill Acquisition Theory (SAT), for declarative knowledge to become automatized, it needs to be clearly understood and practiced. Vygotsky (1978) viewed this process as fundamentally collaborative and mediational. Recent L2 research has employed Schemas for Complete Orienting Basis of an Action (SCOBA) as mediational tools to mediate underlying cognitive processes leading to use of targeted lexico-grammatical features. The present study explored EFL learners' development of automatized grammatical knowledge of English tense-aspect concepts through SCOBA-based mediation. The adopted SCOBAs were essentially informed by Cognitive Grammar (CG) to mediate L2 learners' conceptual understanding of the intended English features. The study used convenience sampling to recruit and randomly assign a cohort of 63 pre-intermediate EFL learners to an experimental (online/synchronous) and a comparison (offline/asynchronous) group. The experimental group received real-time intervention via Skype, while the comparison group had offline treatment through WhatsApp. The study employed a mixed-methods approach comprising Elicited Imitation Tests (EIT) and semi-structured interviews for data collection. Results of pretest-posttest comparisons indicated that both groups improved significantly after the instruction; however, subsequent ANCOVA results showed that the online group outperformed the offline group in their attainments of automatized grammatical knowledge regarding English tense-aspect application. Finally, participants' retrospective perceptions in the online setting attributed their better performance to real-time characteristics of online learning environments such as timely feedback and enhanced collaborative learning engagement. In conclusion, a synthesis of SCOBAs and online affordances was demonstrated to be useful tools for mediating L2 grammatical automaticity.

Keywords: automatized grammatical knowledge, concept-based language instruction, SCOBA, virtual language learning, a/synchronous setting

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INTRODUCTION

The development of implicit/automatized knowledge is the ultimate goal of second/foreign language (L2) learning (Suzuki, 2023, 2024). Implicit/automatized knowledge is central to automated language processing (Ellis & Roever, 2018). This knowledge enables rapid language comprehension and production through cognitive efficiency and accelerated processing speed (e.g., Doe, 2025; Johnson, 2008; Segalowitz, 2010). However, a critical challenge in English-as-a-Foreign-Language (EFL) classrooms is how to effectively foster this type of automatized knowledge. Research has indicated that L2 learners first develop explicit knowledge of target structures, which subsequently becomes automatized through practice (e.g., DeKeyser, 2020; Maie & Godfroid, 2025; Suzuki, 2023).

Theoretically, SAT provides a plausible justification for this as it advocates explicit teaching of declarative knowledge (e.g., grammar rules) followed by systematic practice (or reactivation) to promote automatization (DeKeyser, 2020). Declarative knowledge involves knowledge about language rules whereas procedural/automatized knowledge reflects the ability to use those rules fluently in real-time communication (Suzuki, 2024). In alignment with Paradis (2009), this study equates declarative knowledge with explicit knowledge (rule-based understanding) and procedural knowledge with implicit knowledge (automatized knowledge).

According to SAT, initial explicit knowledge and extensive meaningful practice are two key elements for successful L2 automatization, particularly in EFL contexts (Suzuki, 2023). DeKeyser (2010) defined practice as "engaging in an activity with the goal of becoming better at it" (p. 50). Furthermore, SAT emphasizes that explicit L2 knowledge must be fully comprehended to achieve automatization (Criado, 2016).

However, pedagogical materials and approaches toward teaching grammar often place too much emphasis on L2 forms (or 'grammar') at the expense of helping students realize the "meaningfulness of grammatical constructions" (Niemeier & Reif, 2008, p. 326). Given the complexity of tense-aspect system

in English, in such meaning-impoverished settings, intermediate and advanced L2 learners happen to obtain knowledge about the forms, but fail to develop a deep comprehension of the "semantic implications of morphosyntactic choices at a conceptual level" (Gánem-Gutiérrez & Harun, 2011, p. 99). Therefore, effective L2 pedagogy is expected to incorporate systematic, meaning-focused explicit grammar instruction to establish a foundation for developing automatized knowledge.

Concept-Based Language Instruction (C-BLI) is a Vygotsky-inspired, meaning-based pedagogical approach that uses visual schemas to teach abstract language concepts through guided conceptual mediation (Masuda et al., 2025). This approach systematically guides learners from explicit conceptual knowledge to internalization through meaningful practice (Poehner & Lantolf, 2024). In C-BLI, SCOBAs, or goal-oriented graphic representations of conceptual knowledge, serve as mediational tools to materialize abstract L2 concepts (Lantolf, 2011). Such mediation reflects Vygotsky's (1978) foundational principle that tools shape cognitive development.

While multiple studies (e.g., Fazilatfar et al., 2017; Gánem-Gutiérrez & Harun, 2011; Garcia, 2012; Kissling, 2023) have investigated C-BLI's effectiveness, particularly SCOBAs, for developing L2 grammatical knowledge, empirical evidence remains scarce regarding its impact on EFL learners' automatization of grammatical knowledge. This study investigated the efficacy of C-BLI (with specific focus on SCOBAs) for developing EFL learners' automatized grammatical knowledge of the English present simple tense and progressive aspect. Furthermore, this study adopted van Lier's (2004) ecological perspective toward second language acquisition (SLA), which highlights that learners benefit from environmental affordances and scaffolding. It employed both online or synchronous (Skype) and offline or asynchronous (WhatsApp) virtual learning modalities to examine how such digital affordances could optimize technology-mediated instructional design and pedagogy.

LITERATURE REVIEW

L2 Automaticity: Theory and Research

Automaticity in the context of SLA can be defined as the ability to understand and produce communicative messages rapidly and efficiently (Johnson, 2008). Accordingly, since L2 learning demands rapid message processing and production (DeKeyser & Criado, 2012), SAT conceptualizes it as a skill-acquisition process involving three stages: initial learning, gradual development, and ultimate automatization (DeKeyser, 2020). According to SAT, L2 knowledge automatization is often relied on acquisition of declarative knowledge which can become automatized through subsequent extensive practice (Suzuki, 2022).

However, achieving full automatization (implicit procedural knowledge) demands substantial time and practice (Suzuki & DeKeyser, 2017). Therefore, L2 pedagogy often targets automatized explicit knowledge, which is declarative knowledge that has become rapid through practice but remains potentially accessible to awareness (Suzuki & DeKeyser, 2017), as an achievable milestone. Research has indicated that learners frequently rely on such automatized explicit knowledge for fluent performance (Saito & Plonsky, 2019). Furthermore, automatized explicit knowledge may function similarly to procedural knowledge in communicative contexts (Suzuki, 2023). Consequently, some scholars argued that true procedural knowledge and automatized explicit knowledge may not be distinguishable in practice (Ellis & Roever, 2018). Thus, automaticity in L2 proficiency emerges from both procedural knowledge and automatized explicit knowledge (N. Ellis, 2015; R. Ellis, 2009). In this study, automaticity is operationalized as the development of automatized explicit knowledge.

Suzuki (2022, 2023, 2024) investigated L2 automatization and found that judicious explicit instruction accelerates this process which fundamentally depends on establishing form-meaning relationships through well-structured declarative knowledge (DeKeyser & Criado, 2012). Cognitive Grammar (CG), a linguistic theory that views grammar as inherently meaningful,

emerges as an optimal framework for this purpose. CG offers conceptually precise grammatical explanations and demonstrates strong theoretical synergy with C-BLI through their shared focus on form-meaning mappings and systematic declarative knowledge presentation (Lantolf, 2011).

C-BLI and SCOBA-Based Instruction: Theory and Research

Gal'perin's (1969) Systemic Theoretical Instruction (STI), a model of cognitive development through knowledge materialization, was adapted for L2 pedagogy as C-BLI (Figure 1). C-BLI operationalizes Vygotskian Sociocultural Theory (SCT) through three main stages: 1) materialization, where abstract concepts (e.g., tense-aspect) are made tangible via SCOBAs (goal-oriented graphic representations of conceptual knowledge); 2) verbalization, in which learners articulate their understanding through guided discourse (e.g., metalinguistic explanations); and 3) internalization, the gradual automatization of knowledge through structured practice. This approach begins by assessing learners' Zone of Proximal Development (ZPD), the gap between a learner's current abilities and their potential development when supported by expert guidance through talk-in-mediation or in collaboration with more capable peers. Then, learners' ZPD is systematically mediated and scaffolded through materialization and verbalization.

A key principle in SCT is mediation (Lantolf & Thorne, 2006). We employ physical or psychological tools to mediate our cognitive development (Vygotsky, 1978). Accordingly, SCOBAs, when used as mediational tools, can help L2 learners materialize abstract L2 concepts. As tactile-visual aids, SCOBAs offer holistic mediation unattainable through verbal instruction alone (Lantolf, 2011).

C-BLI highlights the importance of focusing on meaning of L2 concepts rather than their structure though acknowledging that structure is still crucial (Poehner & Lantolf, 2024). Therefore, C-BLI should rely on a comprehensive linguistic theory (e.g., CG) that can effectively convey L2 concepts both

semantically and visually. According to CG, linguistic form serves to convey meaning rather than being an end in itself (Langacker, 2008).

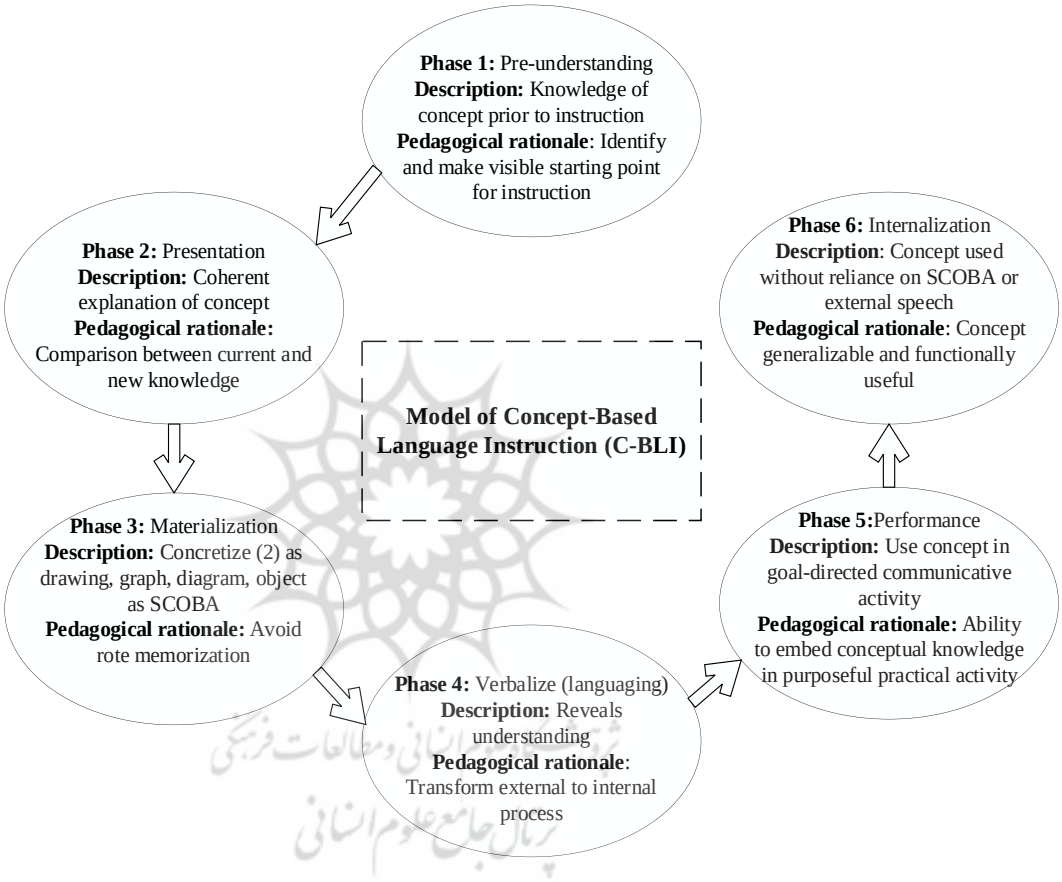


Figure 1: A modified model of C-BLI

Note. Adapted From *Sociocultural Theory and Second Language Developmental Education* (p. 19), by M. E. Poehner and J. P. Lantolf, 2024, Cambridge University Press. Copyright 2024 by Matthew E. Poehner and James P. Lantolf.

Lantolf and Thorne (2006) demonstrated how C-BLI and CG, as meaning-based frameworks, can be effectively merged in L2 pedagogy. This integration is operationalized through SCOBAs, which transform abstract concepts into tangible visual representations (Lantolf, 2011). Unlike traditional rule-of-thumb approaches, CG provides meaning-based grammatical explanations enhanced by visual representations (Bielak & Pawlak, 2013), which makes it particularly valuable for C-BLI implementation (Poehner & Lantolf, 2024).

Another mediational tool in C-BLI is verbalization or languaging (Mirzaei & Eslami, 2015; Swain, 2006). As Poehner and Lantolf (2024) argued "verbalization reflects the importance of speaking in the mediation of mental activity" (p. 25). By verbalization, L2 learners verbalize their understanding of the target concepts, resulting in self-awareness of their knowledge and identification of areas requiring further development (Lantolf et al., 2021).

A number of classroom-based studies have investigated the efficacy of C-BLI in L2 grammar teaching (e.g., Fazilatfar et al., 2017; Gánem-Gutiérrez & Harun, 2011; Garcia, 2012; Kissling, 2023). Gánem-Gutiérrez and Harun (2011) found that C-BLI facilitated profound conceptual understanding of English tense-aspect marking among EFL learners, highlighting the role of verbalization as a regulatory tool in cognitive development. Garcia (2012) indicated how verbalization improved learners' understanding of verb aspect in EFL contexts. Kissling (2023) demonstrated that C-BLI effectively developed metalinguistic awareness of Spanish aspect, with SCOBAs and verbalization serving as key mediational tools to help learners achieve non-prototypical tense-aspect mappings resembling advanced proficiency. In the context of Iran, Fazilatfar et al. (2017) compared C-BLI with traditional grammar teaching for English tense-aspect learning. The C-BLI group achieved significantly better results in tense-aspect understanding than those receiving traditional instruction, emphasizing the effectiveness of SCOBAs and verbalization as mediational tools. However, research has yet to examine whether this SCT-based approach facilitates L2 grammatical automatization for EFL learners, especially in virtual learning environments.

Virtual Language Learning

According to ecological approaches to SLA (e.g., van Lier, 2004), technology can provide learning opportunities and affordances for L2 learners. Furthermore, a significant amount of L2 learning can take place outside of the classrooms (Chun, 2011). Interestingly, a study by Manegre and Sabiri (2022) revealed that English teachers in virtual classrooms perceived L2 learners to progress at a comparable or even accelerated pace compared to traditional face-to-face instruction.

Virtual learning environments can be categorized into two primary modalities: synchronous learning, characterized by real-time online education; and asynchronous learning, which involves the utilization of virtual platforms or channels with not simultaneous interaction (Cervatiuc, 2018).

Research on virtual learning modalities revealed mixed findings that reflect the complex interplay between instructional formats and contextual factors. The meta-analysis by Zeng and Luo (2023) demonstrated distinct pedagogical advantages for each modality. They reported that synchronous learning facilitates higher engagement through real-time interaction, while asynchronous learning provides valuable flexibility for self-paced study. However, these benefits come with significant trade-offs. Synchronous formats may create accessibility challenges for learners with technological limitations and potentially increase anxiety due to the pressure of immediate participation (Chen & Rodway, 2023). Similarly, asynchronous models present their own challenges, particularly learner disengagement without proper instructional scaffolding (Perveen, 2016).

Cervatiuc (2018) found that asynchronous learning environments promoted better knowledge retention, yet noted that asynchronous learning can sometimes lack the personal connection and real-time interactions of online instruction, potentially affecting student engagement and motivation. His study demonstrated that although asynchronous learning enhances cognitive processing and long-term L2 retention, combining it with

synchronous online interaction remains crucial for developing interactive language skills. He then recommended blended models for comprehensive L2 acquisition.

Furthermore, in the context of Iran, Nami (2022) compared blended (synchronous + asynchronous) and fully synchronous technical English courses for university students. The results indicated that both approaches improved language skills, but the synchronous group achieved significantly better results. The findings demonstrated that real-time interaction better facilitated technical language acquisition than blended formats. However, the study noted that blended courses can be equally effective with careful design emphasizing interaction opportunities.

The current study extends the research in two critical directions. First, it examined how instructional modality affects L2 grammatical automatization, a key predictor of L2 fluency (DeKeyser, 2020). Whereas vocabulary acquisition and writing development in virtual settings have been extensively studied (e.g., Hanafiah et al., 2022; Zhang & Liu, 2023), research on L2 grammatical automatization in virtual learning environments remains limited. Second, it investigated how learners' perceptions of online, synchronous versus offline, and asynchronous environments may reveal a deeper understanding of the relationship between content, pedagogy, and technology (Koehler & Mishra, 2005).

PURPOSE OF THE STUDY

One of the major obstacles faced by L2 learners is mastering the temporal system of the target language (Kennedy, 2003). As Fazilatfar et al. (2017) have maintained, in the context of Iran, EFL learners often lack a comprehensive understanding of the English temporal system, typically receiving only structural overviews and brief usage descriptions found in school textbooks. Research has confirmed C-BLI's effectiveness for developing L2 temporal-aspectual understanding through SCOBAs (e.g., Fazilatfar et al., 2017; Kissling, 2023), yet its impact on developing

automatized grammatical knowledge remains unexamined. To address this gap, this study investigated C-BLI's role in developing EFL learners' automatized grammatical knowledge of the English present simple tense and progressive aspect, with a focus on SCOBAs as the primary mediational tool. Furthermore, it explored how synchronous and asynchronous virtual modalities might optimize L2 grammar instruction. More specifically, the following questions guided this study:

1. Does the implementation of SCOBA-based instruction via virtual settings have any significant effects on EFL learners' automatized grammatical knowledge attainment regarding appropriate English tense-aspect application?
2. Is there any significant difference between a/synchronous groups in terms of their automatized grammatical knowledge attainment?
3. How do EFL learners perceive the virtual learning environments in both a/synchronous settings?

METHOD

Participants

Based on convenience sampling, 63 L2 learners were recruited from two intact classes at a language institute in Southwest of Iran. They were all Persian-speaking males, due to Iran's gender-segregated educational system, with the age-range of 18-26 (M = 21.79, SD = 2.62). None of them had already traveled to any English-speaking country, and they enrolled for a pre-intermediate EFL course. The *Oxford English File* series were taught two times a week, 60 minutes per session. The class with 33 learners (52.39%), held on even days, was randomly assigned to the experimental group (i.e., online, synchronous) and that with 30 (47.61%), held on odd days, was assigned to the comparison group (i.e., offline, asynchronous). In addition to the institutional placement criteria already in place, the Oxford Placement

Test (OPT; Allen, 2004) was administered (Table 1). After running an independent-samples *t*-test (Table 2), it became clear that the classes were homogeneous in terms of general proficiency (t (54) = .633, p = .530). Although the participants were notified that they were participating in a study, they did not know about the details. The participants fully agreed to take part in the research with the proviso that their identities remain anonymous for subsequent references.

Table 1: Relevant information for the two groups

Groups	N	Percent	Age Range	Gender	Course Level	OPT Mean	SD
Experimental	33	52.39 %	18-26	male	Pre-intermediate	47.55	3.26
Comparison	30	47.61 %	18-26	male	Pre-intermediate	46.93	4.29
Total	63	100 %	18-26	male	Pre-intermediate	47.25	3.76

Table 2: Independent samples test for the groups' OPT scores

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OPTscores	Equal variances assumed	4.746	.033	.641	61	.524	.612	.955	-1.297	2.522
	Equal variances not assumed			.633	53.9	.530	.612	.967	-1.327	2.552

Materials and Instruments

Skype

Skype is an online, synchronous communication platform enabling audio/video calls, messaging, and file sharing. Its educational utility lies in

virtual classrooms, interactive lessons, and real-time feedback. Features like screen sharing and video conferencing benefit L2 learning. This application can be operated on devices with internet access including computers and smartphones.

WhatsApp

WhatsApp is a popular messaging application that can be used for offline, asynchronous virtual learning, allowing educators to share prerecorded lectures, multimedia contents, and assignments with students. This application is compatible with devices that have internet connectivity, including computer operating systems and smartphones.

Grammatical target forms

This study focused on English present simple tense and present progressive aspect, areas of grammar that are problematic for L2 learners even at advanced levels (Housen, 2002; Kennedy, 2003). Indeed, some intermediate and advanced L2 learners may have internalized the forms but lack a deep comprehension of the "semantic implications of morphosyntactic choices at a conceptual level" (Gánem-Gutiérrez & Harun, 2011, p. 99).

Elicited Imitation Test (EIT)

In the present study, oral EIT was employed to assess L2 learners' automatized grammatical knowledge on the grounds that it has been shown to be the "best" measure of automatized (implicit) knowledge (Ellis, 2009, p. 59). In addition, it has been validated as a measure of implicit knowledge in several previous studies (e.g., Ellis, 2005; Erlam, 2006). According to Suzuki and DeKeyser (2015), due to the necessity of fast language processing and real-time speech production, employing EIT is suited to measuring automatized oral language ability and degree of automaticity of the L2 knowledge.

EIT presents target forms in isolated sentences, which remains effective for grammar testing (Ellis & Roever, 2018). Its methodology (Erlam, 2006)

includes: 1) mixed grammatical/ungrammatical stimuli to assess spontaneous correction, 2) comprehension questions (e.g., plausibility judgments) to shift focus toward meaning, and 3) timed production phases to limit explicit knowledge access.

The study employed a 24-sentence EIT (12 grammatical/12 ungrammatical) adapted from *Oxford Living Grammar* series (see Appendix). Employing a screen-based format, the test presented prerecorded sentences aurally via computer to individual learners. The participants first indicated agreement/disagreement with each statement's truth value (e.g., I'm believing in miracles*) to focus on meaning. Following a beep, they orally repeated sentences. Responses were audio-recorded and analyzed by identifying obligatory occasions for target structures. Failure to imitate or create obligatory contexts was coded as avoidance. Each imitation was scored 1 (correct target structure) or 0 (avoided/incorrect), yielding a maximum score of 24.

The content validity of the EIT was confirmed by two university professors. The representativeness of the sample of items in measurement devices is referred to as content validity (Martella, Nelson, & Marchand-Martella, 1999). Regarding the reliability of the test, by conducting a pilot testing, the EIT was administered to a comparable group of L2 learners from a different institute and the reliability of the test was obtained through Cronbach's alpha value of 0.85. Meanwhile, two raters scored students' responses and there was a high degree of inter-rater reliability, 0.92. Two different versions of the same EIT were utilized as pretests and posttests.

Semi-Structured Interviews

Following participant consent, interviews were conducted in Persian to explore attitudes toward virtual learning environments. Using learners' mother tongue facilitated authentic expression while maintaining uniformity in data collection procedure for thematic analysis. Guided by four open-ended questions (e.g., perceived strengths/weaknesses), each 10-minute session was recorded; then, translated into English for analysis.

Data Collection Procedure

This study employed a quasi-experimental, pretest-posttest design with a mixed-methods data collection approach, combining EIT to measure learners' automatized grammatical knowledge and semi-structured interviews to explore their perceptions on virtual leaning environments. The study lasted six weeks, with two weeks dedicated to administering pretests, posttests, and semi-structured interviews, and four weeks for the instructional phase (Table 3). Throughout the study, the first researcher was the instructor in both settings. The instructor dedicated comparable amounts of time to the instructional activities in both a/synchronous settings. This procedural arrangement is depicted in Figure 2 and is further elaborated upon below. Initially, two virtual classrooms were created: one on Skype for the online, synchronous group and the other on WhatsApp for the offline, asynchronous group.

The Synchronous Setting

In this online setting, the instructional treatment was conducted through Skype via live videoconferencing at a set time. Sessions were held twice weekly (Mondays and Wednesdays), with each session lasting one hour, over four weeks. Some Skype's synchronous features such as live screen sharing and digital whiteboard paved the ground to provide real-time guidance and to demonstrate complex target concepts in a more illustrative manner. Additionally, due to the live nature of these sessions, the instructor was able to monitor students' participation and provide real-time scaffolding to address areas of confusion or difficulty.

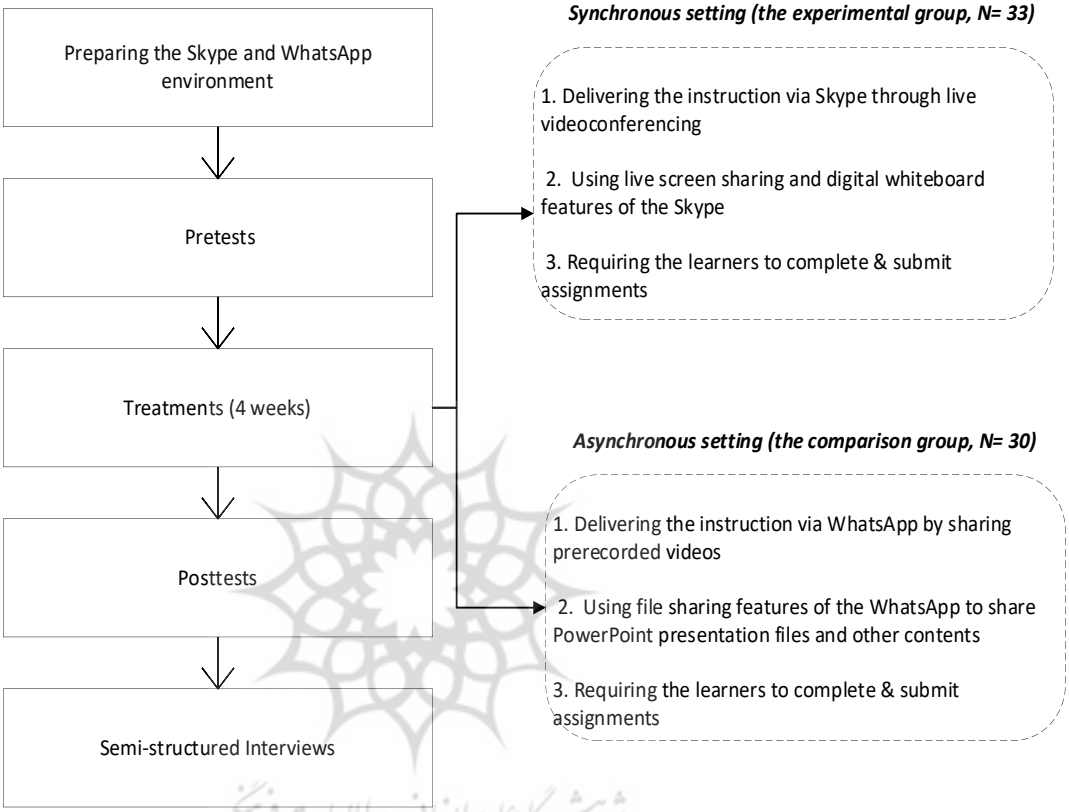
The Asynchronous Setting

The offline, asynchronous group received instruction via a locked WhatsApp group (instructor only posts), submitting assignments through private messages and emails. This private submission system allowed for personalized feedback while maintaining individual participation.

Prerecorded lectures, PowerPoint slides, and multimedia content were distributed through WhatsApp's file-sharing features. The participants in this virtual classroom did not undergo live sessions during instructional treatment. The study implemented structured asynchronous protocols through timed content releases, mandatory response windows, and triangulated engagement tracking (self-reports, polls, and timestamped submissions). These methods align with Salmon's (2013) e-learning framework and Andujar's (2020) mobile-assisted language learning (MALL) research, demonstrating true asynchronicity via flexible learner pacing. Over a four-week period, grammar content was delivered twice weekly (Sundays and Tuesdays) at 9 a.m. local time, with 48-hour response windows for tasks. The participants self-reported time spent per task via private messages. To verify participation, time-bound WhatsApp polls were deployed as digital check-ins. Additionally, the participants were required to verbalize their understanding of the target concepts, record their verbalizations, and submit to the teacher via private messages. The instructor then provided delayed feedback on each submission. Both instructional settings implemented the three core C-BLI stages (materialization, verbalization, and internalization) as detailed in the following section.

Table 3: The overview of research timetable

Week	Week1	Week 2-5	Week 6
Procedure	Pretest	Treatment: Twice a week; 60 minutes per session	Posttest Semi-structured interviews



The Instructional Treatment

The instructional content derived from CG (e.g., Bielak & Pawlak, 2013; Langacker, 1987, 2012). CG-related concepts such as expansibility/contractibility, homogeneity/heterogeneity, and temporal boundedness/unboundedness were introduced via PowerPoint slides. Synchronous group received live instruction via Skype, while asynchronous group had prerecorded lessons distributed through WhatsApp. Instruction focused on prototypical perfective/imperfective verb distinctions in tense-aspect pairings. The study implemented C-BLI through three progressive

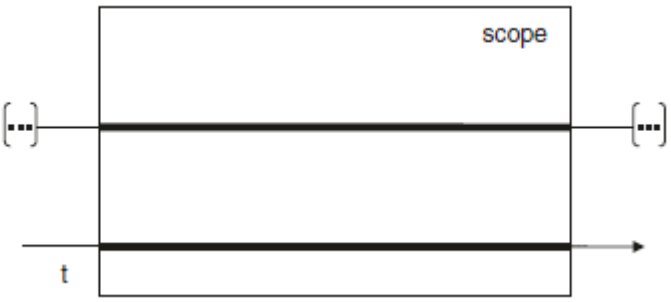
stages. In the materialization stage, the study first materialized tense-aspect concepts via SCOBAs (Figures 3-8). During verbalization, learners articulated their understanding through recorded explanations shared via Skype/WhatsApp. The internalization phase progressed from controlled practice (e.g., gap-filling, text reconstruction) to spontaneous production (e.g., oral narratives about current activities/holiday routines).

During the materialization stage, the participants were instructed that CG categorizes perfective verbs as heterogeneous and temporally bounded, represented via SCOBA (Figure 3) by zigzag lines for changeability and vertical bars for boundedness. In contrast, imperfective verbs are homogeneous and temporally unbounded, shown through SCOBA (Figure 4) by straight lines for homogeneity and dotted ends for expansibility. The participants learned these contrasts through SCOBA mediation.

Perfective verbs: changing through time and bounded in time

For example: cook, create, write, melt, clean, read

Imperfective verbs: stable and unbounded in time



For example: doubt, trust, believe, suspect, like, resemble

Figure 4: SCOBA for the features of imperfective verbs

Then, the participants learned that the nonprogressive present tense captures a brief (1-2 second) snapshot of actions, making endpoints irrelevant (Bielak & Pawlak, 2013). This aligns imperfective verbs (e.g., *trust*) with the present tense, as their unbounded nature allows viewing any action segment through the keyhole method SCOBA (Niemeier, 2005b, cited in Bielak & Pawlak, 2013) visualizing how imperfectives represent both whole situations and subparts. Through the present tense keyhole view, the imperfective *trust* demonstrates its expansibility by representing both holistic situations and subparts (Figure 5).

The instruction then indicated perfectives' temporal boundedness with clear endpoints (e.g., *build* in Figure 6, marked by vertical bars), making them incompatible with the nonprogressive present tense (Langacker, 2012). Unlike imperfectives, the participants saw that perfectives like *build* cannot fit the present tense keyhole view, as their bounded endpoints fall outside its scope (Bielak & Pawlak, 2013).

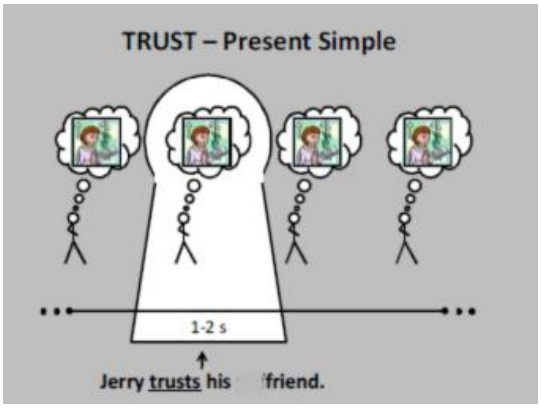


Figure 5: SCOBA for compatibility of the imperfectives with nonprogressive present

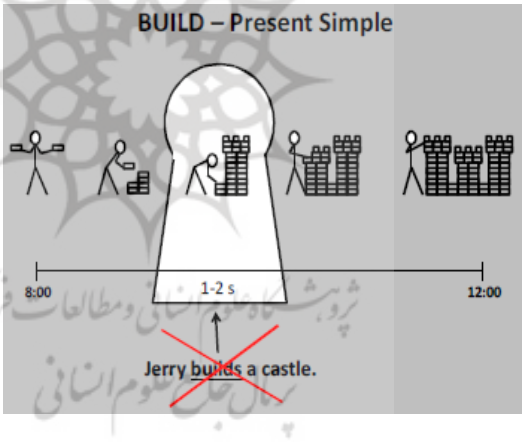


Figure 6: SCOBA for incompatibility of the perfectives with nonprogressive present

Subsequently, the participants learned that progressive forms typically pair with perfectives due to their bounded, changing nature (Niemeier, 2013). Following Langacker (2008), they understood that perfectives prototypically

resist simple present (e.g., *build*) but allow progressive (e.g., *building*), unlike imperfectives (e.g., *trust*). The participants learned that perfective verbs (e.g., *build*) can take progressive aspect when focusing on ongoing action rather than endpoints (Figure 7), visualized via the keyhole method (Figure 8). Then, the participants were asked to draw keyhole figures for given perfective/imperfective verbs to materialize conceptual knowledge via self-made SCOBAs.

During the verbalization stage, the participants verbally expressed their understanding of the key concepts, recorded their explanations, and submitted them through Skype or WhatsApp.

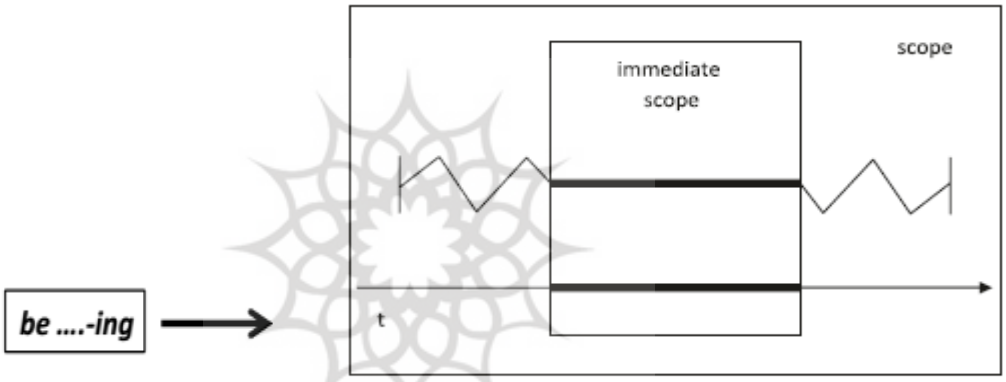


Figure7: SCOBA for the inherent quality of be…ing

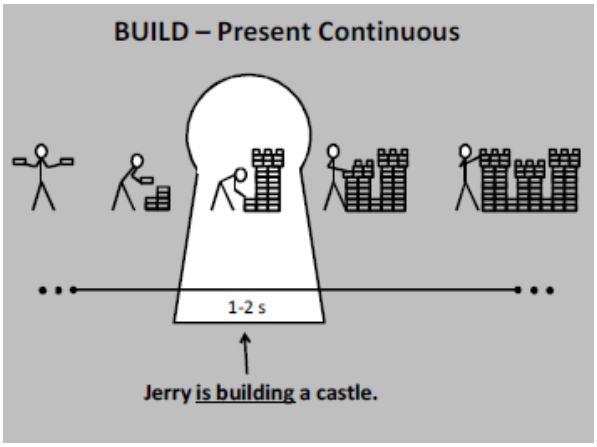


Figure 8: SCOBA for the perfectives in the present progressive

During the internalization stage, the participants engaged in a series of structured tasks and activities designed to reinforce their mastery of the target grammatical forms. Initially, they completed controlled exercises (e.g., gap-filling, error correction, and text reconstruction) adapted primarily from the *Oxford Living Grammar* series (Paterson, 2012). These tasks were selected because learners at this stage still depend on external mediation (e.g., SCOBAs) to perform accurately (Poehner & Lantolf, 2024). The participants were instructed to submit all completed assignments for evaluation.

As they gained more control over the target forms, they progressed to more spontaneous production tasks, including text translation and oral narratives. The narrative topics were designed to elicit specific target structures, such as the simple present and present progressive tenses. For instance, the participants described their typical New Year's holiday activities or reported their family members' current actions. All narratives were recorded and submitted to the instructor for assessment.

RESULTS

Effects of SCOBA-Based Instruction on Automatized Grammatical Knowledge

Descriptive statistical methods and relevant inferential tests were run to address the first research question and investigate the impact of the SCOBA-based mediation on L2 learners' automatized grammatical knowledge attainment regarding appropriate English tense-aspect application. The results of the analysis revealed that the mean scores increased quite differently from the pretest to the posttest for both groups (Table 4). Paired-samples *t*-tests were then computed to provide a more detailed examination of the pretest-posttest improvement with each a/synchronous setting (Table 5). Notably, both *t*-test results were significant, namely, for the synchronous ($t\,(32) = -15.26$, $p < .001$, $\eta^2 = .87$) and for the asynchronous ($t\,(29) = -12.07$, $p < .001$, $\eta^2 = .83$).

Table 4: Descriptive statistics for the EIT scores of the groups

	Groups	N	Min	Max	M	SD	Skewness	Kurtosis
Pretest	Synchronous	33	3	13	7.52	3.001	.176	-1.230
	Asynchronous	30	2	13	7.30	2.950	.134	-.832
Posttest	Synchronous	33	13	23	17.91	2.983	.041	-1.094
	Asynchronous	30	11	22	16.20	2.882	.166	-.582

Table 5: Paired-Samples t-tests for the groups' EIT scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Syncpretest Syncposttest	-10.39	3.913	.681	-11.78	-9.00	-15.26	32	.000
Pair	Asyncpretest	-8.90	4.037	.737	-10.40	-7.39	-	29	.000

Virtual-Learning Group Differences

To address the second research question, an Analysis of Covariance (ANCOVA) was conducted. Initially, a thorough examination of the descriptive statistics indicated that the normality assumptions were met (Table 4), with skewness-kurtosis values falling within the accepted range of ±1.5 (Tabachnick & Fidell, 2013). Similarly, the Kolmogorov-Smirnov test results (.15, .20, .19, and .20) yielded no significant departures from normality. In addition, the covariate revealed a high degree of reliability (0.87), meeting the ANCOVA assumption. The interaction between the covariate and the dependent variable was not significant, F (1, 59) = .164, p = .687, indicating no violation of the homogeneous-regression-slope assumption (Table 6).

Table 6: The interaction between the covariate and the dependent variable

Source	Sum of Squares	df	Mean Square	F	Sig.
Group * EITtime1	1.447	1	1.447	.164	.687
Error	519.127	59	8.799		
Total	18983.000	63			

a. R^2 = .092 (Adjusted R^2 = .045)

Subsequently, the ANCOVA was run to compare the effects of SCOBA-based instruction in the two virtual settings on the learners' posttests, while simultaneously accounting for any initial differences in pretests (covariate). The ANCOVA results revealed a statistically significant difference in EIT scores between groups, F (1, 60) = 5.15, p = .027, ηp^2 = .08, indicating that the synchronous group outperformed the asynchronous group on posttest EIT scores.

Learners' Perceptions

Semi-structured interviews explored participants' attitudes toward their virtual learning environments across both settings ((a)synchronous). Interviews were transcribed, translated into English, and analyzed using

MAXQDA 2018, a qualitative data analysis software, to facilitate systematic coding and thematic analysis of the qualitative data.

According to the framework proposed by Miles et al. (2013), an inductive approach to a composite process-emotion coding system was adopted. After summarizing the content, initial codes were identified and then further sub-coded to capture recurring patterns and meaningful segments within the data. A multilevel coding strategy was employed, involving word-based, sentence-based, and phrase-based coding.

The codes were then analyzed and judged by two university professors in the field. To enhance the trustworthiness of this phase, we utilized member checking, wherein the participants verified their responses against the assigned codes, and pair coding, wherein two coders independently coded the data and resolved any differences through discussion. Through calculating the kappa measure of agreement, the inter-rater reliability of the coding process was assessed, yielding a coefficient of 0.89, which represents a high degree of agreement between the two coders.

Thematic visualizations for each virtual group are illustrated in Figures 9 (asynchronous) and 10 (synchronous). For the asynchronous setting, three themes and six subthemes were extracted from 30 interviews (Table 8). The participants' retrospective views on this setting were categorized into two positive and one negative theme. In terms of the experienced flexibility, for example, one learner noted:

> When I am dealing with my assignments, it seems that I have much freedom to complete them in a way that suits me best. I can study at my own pace, so it allows me to balance my school plan with other personal activities.

Figure 9: Themes identified for the asynchronous group's perception data

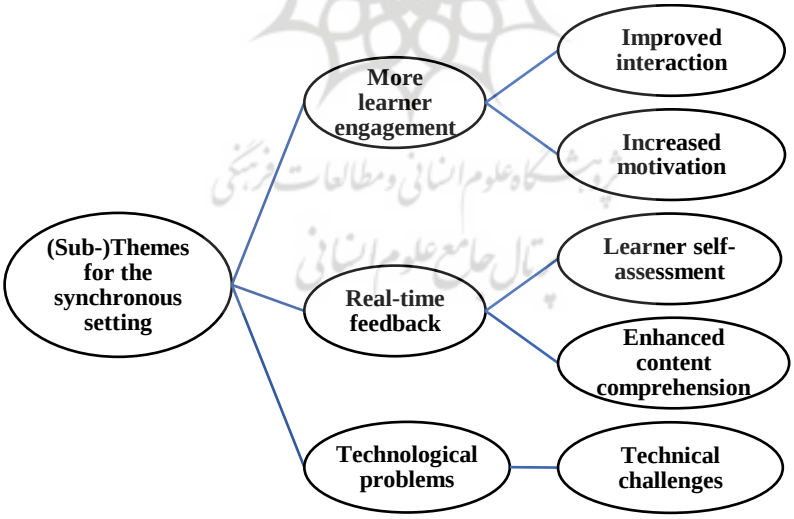


Figure 10: Themes identified for the synchronous group's perception data

Table 8: (Sub-)Themes for the asynchronous setting

Themes	Description	Sub-Themes	Description
Flexibility	Positive attitudes toward the flexible time of learning, thereby choosing when and where to engage with course materials: about 72%	Self-paced learning	Gaining the autonomy to control the speed and pace of their learning
		Suitable for personal learning style	Tailoring to their individual's unique way of learning
Less anxiety	Positive attitudes toward feeling less pressure and social anxiety: about 67%	No fear of public speaking	Not being judged by peers
		Reduced worry about making mistakes	Not being corrected in front of others
Lack of immediate feedback	Negative attitudes toward inability to correct mistakes in a timely manner: about 42%	Uncertainty and lack of self-assessment	Being uncertain about the quality of their work
		Reduced content comprehension	Not receiving timely clarification on complex concepts

Moreover, a good number of the participants commented on their reduced anxiety in the asynchronous setting, for example, one student reflected:

> It is good to be able to learn without having to worry about the pressure of a live class. I am not very nervous about making mistakes because I can correct them before sharing my assignments.

However, several participants showed negative attitudes toward the lack of immediate feedback during the instruction, for example, an interviewee noted:

> Sometimes, I wonder if I am on the right track or not. Without teacher's immediate feedback, it is difficult to realize whether I am improving or not.

On the other hand, the interviews with the participants in the synchronous setting yielded three themes (two positive and one negative) with five subthemes (Table 9). One participant commented on more learning engagement as follows:

> I feel more engaged in the class when we have live sessions. It seems we are all in the same room even though we're from different locations.

Similarly, the participants acknowledged the instructor's prompt and timely feedback. One participant, for instance, reflected as follows:

> I liked the way the instructor explained the errors and helped me whenever I got confused. What is more, as the teacher was really supportive, I felt more comfortable participating in class activities.

Regarding the participants' negative perceptions, they reported difficulties with connectivity and audio/video quality which hindered them from fully benefiting from the learning process. One participant noted:

> I experienced many times when I wanted to participate in the online discussion, but I faced some technical problems. The audio got disconnected and I could not hear the instructor clearly, which made it hard for me to follow the class. Additionally, I sometimes got into trouble accessing live sessions.

Table 9: (Sub-) Themes for the synchronous setting

Themes	Description	Sub-Themes	Description
More learner engagement	Positive perceptions toward being more connected to the learning process and their peers. about 76%	Improved interaction	Creating improved social interaction within the live class
		Increased motivation	Being more motivated during live sessions
Real-time feedback	Positive attitudes toward instructor's provision of prompt feedback: about 71%	Learner self-assessment	Developing a better understanding of their weaknesses and strengths
		Enhanced content comprehension	Receiving clarification and support on complex concepts
Technological problems	Negative views toward some recurring technical issues: about 34%	Technical challenges	Facing problems to access live sessions due to poor internet connection

DISCUSSION

This study compared the effects of SCOBA-based instruction in online, synchronous versus offline, asynchronous virtual settings on EFL learners' automatization of the English present simple tense and progressive aspect. The results revealed that while both groups demonstrated automatization gains, the online group achieved significantly greater post-intervention improvement.

The progress observed in both groups can essentially be attributed to the C-BLI framework, which provided learners with systematically organized explicit knowledge of the English tense-aspect system. As Lantolf (2011) has

emphasized, incomplete or oversimplified rule-of-thumb explanations impede effective language use, whereas C-BLI's focus on conceptual meaning fosters deeper cognitive restructuring. This SCT-oriented framework demonstrated practicality and utility when integrated with SAT notions, for instance, L2 learning initially begins with explicit declarative knowledge which gradually becomes automatized through extensive practice (DeKeyser, 2020). This view, as noted earlier, aligns with Suzuki's (2023, 2024) argument that explicit instruction plays a critical role in initiating and accelerating automatization. In other words, automatization depends on robust form-meaning mappings, where well-structured declarative knowledge serves as the foundation for accurate automatization (DeKeyser & Criado, 2012).

The findings thus provided further support for Vygotsky's (1978) SCT views, highlighting the role of mediation in cognitive development. In the present study, CG-informed SCOBAs served as physical mediational tools, materializing the abstract tense-aspect concept and reducing cognitive load. It was shown that by integrating visual schemas with linguistic explanations, SCOBAs can eliminate the need for rote memorization of isolated rules, instead promoting holistic understanding (Lantolf et al., 2021). This scaffolding likely enabled learners to process target structures more efficiently, accelerating the transition from controlled to automatic processing (Segalowitz, 2010). Moreover, learners' verbalization of their understanding (languaging) further mediated this process. As Swain (2006) argued, verbalization acts as a psychological tool that externalizes and refines conceptual knowledge, reinforcing metacognitive awareness and self-regulation.

However, as Criado (2016) cautioned, explicit knowledge alone is insufficient for automatization; therefore, sustained, meaningful practice is essential. The C-BLI approach in this study addressed this necessity by connecting abstract conceptual knowledge to tangible, goal-directed activities (e.g., text reconstruction and oral narratives). As Poehner and Lantolf (2024)

argued, "without linking conceptual knowledge to concrete goal-directed activity, education falls victim to intellectualism" (p. 27).

Overall, the synergistic integration of high-quality explicit input, SCOBA-mediated visualization, verbalization, and extensive meaningful practice established optimal automatization pathways and conditions. Through C-BLI's scaffolding stages, materialization (SCOBAs), verbalization (metalinguistic reflection), and internalization (gradual automatization), both groups demonstrated significant gains in automatized L2 grammatical knowledge. By the same token, it can be argued that even in line with SAT (DeKeyser, 2020), the results demonstrated that well-structured explicit knowledge instruction followed by scaffolded practice promoted automatization.

Regarding the second question of the study, the online, synchronous group's superior gains may reflect the added benefits of real-time interaction (e.g., immediate feedback and enhanced engagement), which reinforce procedural memory consolidation through socially mediated practice (Lantolf & Poehner, 2014). As participants' retrospections revealed, synchronous learners particularly valued live sessions for their enhanced engagement and immediate feedback, key features aligning with communicative language teaching principles (Perveen, 2016). For instance, one participant described feeling more engaged and receiving prompt feedback as follows:

> Live sessions made me feel truly present, like we were all learning together. Getting instant answers to my questions during classes kept me motivated and engaged. The instructor's error explanations made me feel comfortable participating in class activities.

The results thus pointed to the observation that synchronous real-time feedback promotes L2 automatization through two synergistic processes: (a) immediate error correction during working memory activation (Ellis, 2005), and (b) dialogic co-construction of knowledge that scaffolds form-meaning

connections more effectively than delayed feedback (Aljaafreh & Lantolf, 1994).

It can be argued that, through synchronous real-time instruction, L2 learners gained access to authentic input, aligned with VanPatten's (2004) input processing theory, and meaningful interaction opportunities with peers and instructors. The results in turn supported Swain's (2006) notion of collaborative dialogue and languaging which posits that when participants work together collaboratively and can communicate with one another simultaneously, they can easily offer modifications and task-focused feedback (Mirzaei & Eslami, 2015). This process helps L2 learners notice linguistic gaps (Schmidt, 1990) and, in accordance with SAT and SCOBA, facilitates cognitive restructuring through integrated semantic-visual scaffolding, ultimately optimizing L2 automatization pathways (DeKeyser, 2020; Poehner & Lantolf, 2024). Additionally, the effectiveness of collaborative, simultaneous learning environments is theoretically anchored in Vygotskian SCT (scaffolding via peer/teacher interaction) and interaction hypothesis tenets (negotiation of meaning) as affirmed by relevant meta-analytical research (e.g., Ziegler, 2016). Furthermore, Videoconferencing allows multi-layered communication through speech, visuals, and gestures that resemble face-to-face interaction (Keegan et al., 2005; Yu, 2022).

In spite of the collaborative, mediational affordances observed with the synchronous Skype-based setting, participants reported technical challenges, particularly due to unstable internet connections. This aligns with Perveen's (2016) observation that synchronous online learning can be problematic by its dependence on technological availability during scheduled sessions. One participant, for instance, noted:

> I faced frequent difficulties accessing live sessions, which disrupted my learning. Technical problems like audio disconnections often prevented me from participating in discussions or hearing the instructor clearly.

In that respect, participants in the offline, asynchronous setting reported greater flexibility, availability, and reduced anxiety in their learning experience. Asynchronous virtual classrooms are not time-constrained, enabling students to work at their preferred pace. The lack of real-time interaction also contributed to a more comfortable learning environment, as students could engage without the pressure of immediate responses (Perveen, 2016). For instance, one participant reported:

> I like how I can do assignments my own way and at my own pace. It helps me balance school with my personal life. Without live class pressure, I feel less stressed. I also appreciate being able to fix mistakes before submitting my work.

However, these participants expressed concerns about delayed feedback, which often left them unsure of their comprehension and progress. For example, one participant noted:

> I often wondered whether I was learning properly since I didn't get the teacher's instant responses to guide me.

These observations and perceptions revealed that without opportunities for live discussion or instant clarification, learners struggled to resolve misunderstandings or grasp complex concepts efficiently (Chen & Rodway, 2023). From a Vygotskian perspective, therefore, offline instruction cannot fully mediate learning within the ZPD, where scaffolding from peers or instructors is critical for cognitive growth (Dorrell, 2022; McLeod, 2024). To sum up this section, while asynchronous tools like discussion forums have attempted to bridge this gap, they often fail to provide the dynamic, adaptive support found in face-to-face or synchronous interactions (Dorrell, 2022). Thus, the findings of the study support Nami (2022) in favoring synchronous L2 instruction while challenging Cervatiuc's (2018) claim of asynchronous superiority.

CONCLUSION AND IMPLICATIONS

The study revealed empirical evidence that using SCOBAs as mediational tools significantly enhanced EFL learners' automatized grammatical knowledge of English tense-aspect system. The SCOBAs' pedagogical power stemmed from visually materializing abstract grammar concepts, scaffolding learners' mastery of English tense-aspect complexities. This mediation mechanism empirically validated Vygotsky's (1978) mediation theory, which posits that higher mental functions develop through material and symbolic mediation. The findings of the study particularly indicated how this material mediation facilitated deeper cognitive processing, allowing learners to move beyond rote memorization to conceptual understanding, which, in turn, supported more accurate and automatic use of tense-aspect forms. While participants in both instructional modalities demonstrated significant gains, synchronous instruction yielded superior outcomes. As L2 learners' retrospections revealed, the observed advantage was grounded in SCT principles of learning, manifesting through immediate feedback enabling ZPD scaffolding (Lantolf & Poehner, 2014), and socially-constructed engagement patterns mirroring face-to-face classroom interactivity (Keegan et al., 2005; Yu, 2022).

The findings of this study carry significant theoretical and pedagogical implications for L2 instruction. By demonstrating that SCOBA-based mediation effectively facilitated the acquisition of grammatical concepts, this research provided evidence for the application of Vygotskian principles (materialization, verbalization, and scaffolding) in technology-mediated contexts. Pedagogically, it is recommended to integrate SCOBAs into teacher education programs, equipping instructors with tools to transform abstract grammatical rules into visually mediated lessons. For optimal implementation, synchronous platforms should be prioritized to mediate learning within the learners' ZPD, though asynchronous modalities may supplement practice phases. The systematic implementation of C-BLI bridges

declarative knowledge and automatization, with technology serving as a valuable tool for guided mediation across instructional environments.

This study suffered from at least four main limitations. Firstly, the offline, asynchronous setting was limited to the widely-used educational social networking platform of WhatsApp, due to its affordability and ease of use by all students. Given the recent technological advances and widespread access, future similar studies are recommended to use more interactive, offline learning content, for instance on learning management systems, which enable teachers to more easily track learners' activities and learning progress. Secondly, the all-male participant pool due to institutional constraints may limit the generalizability of the findings. Additionally, the study's focus on present tenses restricted the applicable grammatical scope. Finally, the convenience sampling of intact pre-intermediate classes may add further caveats to the possible implications of the study although this limitation was partially addressed by randomly assigning the intact classes to the experimental and comparison groups. Future research should, therefore, incorporate mixed-gender samples, diverse proficiency levels, broader grammatical targets (e.g., perfect aspects), and blended learning designs to strengthen ecological validity. These methodological refinements would enhance understanding of SCOBAs' efficacy across varied instructional contexts.

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APPENDIX

Oral EIT Stimulus Sentences

1. I'm hating historical movies.
2. My father doesn't doubt my abilities.
3. My brother is building a sandcastle at the moment.
4. The new English lesson is consisting of 4 sections.
5. My uncle has a house in the country.
6. My teacher works with his mobile now.
7. I think pizza is delicious.
8. I'm sending an email right now.
9. My friends don't make snowman in the yard at the moment.
10. My grandfather owns a big garden.
11. I'm understanding the meanings of these sentences.
12. My cell phone costs 5 hundred dollars.
13. My father doesn't wash the car now.
14. More people are shopping online these days.
15. I take English test right now.
16. I'm believing in miracles.
17. My mother is cooking lunch in the kitchen now.
18. This computer is belonging to my teacher.
19. My classmates don't clean the whiteboard now.
20. Boiled potatoes are smelling awful.
21. I'm learning Italian at this class.
22. The teacher doesn't draw a picture at the moment.
23. I'm drinking water right now.
24. Most plants are needing plenty of water.

Answer sheet

1. True ◯	Not true ◯	I'm not sure ◯
2. True ◯	Not true ◯	I'm not sure ◯
3. True ◯	Not true ◯	I'm not sure ◯
4. True ◯	Not true ◯	I'm not sure ◯
5. True ◯	Not true ◯	I'm not sure ◯
6. True ◯	Not true ◯	I'm not sure ◯
7. True ◯	Not true ◯	I'm not sure ◯
8. True ◯	Not true ◯	I'm not sure ◯
9. True ◯	Not true ◯	I'm not sure ◯
10. True ◯	Not true ◯	I'm not sure ◯
11. True ◯	Not true ◯	I'm not sure ◯
12. True ◯	Not true ◯	I'm not sure ◯
13. True ◯	Not true ◯	I'm not sure ◯
14. True ◯	Not true ◯	I'm not sure ◯
15. True ◯	Not true ◯	I'm not sure ◯
16. True ◯	Not true ◯	I'm not sure ◯
17. True ◯	Not true ◯	I'm not sure ◯
18. True ◯	Not true ◯	I'm not sure ◯
19. True ◯	Not true ◯	I'm not sure ◯
20. True ◯	Not true ◯	I'm not sure ◯
21. True ◯	Not true ◯	I'm not sure ◯
22. True ◯	Not true ◯	I'm not sure ◯
23. True ◯	Not true ◯	I'm not sure ◯
24. True ◯	Not true ◯	I'm not sure ◯