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*Iranian Journal
of
Language Teaching Research*
ORIGINAL ARTICLE



Urmia University

Synchronous Computer-mediated Corrective Feedback and EFL Learners' Grammatical Knowledge Development: A Sociocultural Perspective

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ABSTRACT

Recent discussions in language communication indicate the effectiveness of technology and computer-mediated communication. Research also highlights the central role of synchronous and asynchronous modes of interaction in second and foreign language development. Gaining insights from Vygotskian sociocultural theory of mind, the present study employed a mixed methods approach to explore the effect of synchronous computer-mediated corrective feedback on EFL learners' grammatical knowledge development. The participants were 40 Iranian EFL learners selected through a grammar-based pretest. Employing Skype software, the experimental group (N = 20) was exposed to online text-based chatting. The purpose was to provide the participants with online technology-based corrective feedback on their grammatical errors. However, the control group (N = 20) did not receive technology-enhanced corrective feedback during the experiment. The results highlighted: (a) the technology-enhanced, experimental group outperformed their counterpart with regard to grammatical accuracy, (b) the online Skype-based text chatting context played a mediating role in reinforcing the experimental group's grammatical knowledge, and (c) the participants displayed a high level of motivation to initiate and engage in L2 communication. The participants' experience of the Skype-based classroom emphasized themes of overcoming emotional problems in communication and fostering interpersonal relationship and rapport with the teacher and peers. Pedagogical implications focus on the potential of synchronous computer-mediated communication-based contexts as useful spaces for active collaborative learning and task engagement.

Keywords: computer-mediated communication; corrective feedback; Skype-based text chatting; interpersonal communication

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ARTICLE HISTORY

Received: 30 May 2019

Revised version received: 6 Feb. 2020

Accepted: 7 June 2022

Available online: 1 July 2022

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10.30466/ijltr.2022.121186

Introduction

Applied Linguists now recognize the importance of the implementation of technology in second/foreign language development (Farr & Murray, 2016; González-Lloret, 2019). Recent research also demonstrates the active role of technology-based resources in language learners' self-regulation and skills development (e.g., Lai, Shum, & Tian, 2016). Foreign/second language pedagogy has recently undergone a host of transformations as the focus from mastery of structural elements turned into a focus on meaning and interaction. To foster interaction in the classroom, a number of factors should be taken into consideration, including teacher beliefs, teacher motivation, classroom context, learners' background and characteristics, technological tools, etc. Computer-assisted language learning (CALL), sometimes called computer-mediated communication (CMC), is "person-to-person communication that takes place via a range of computer-supported transmission technologies that enable both synchronous real-time and asynchronous interaction across different modalities" (Sauro, 2013, p. 1). Therefore, CMC/CALL includes such technological devices as "e-mail and text chat, blogs, vlogs (video blogs), bulletin boards and voice boards, and Web sites and wikis) a series of interconnected Web pages" (Sauro, 2013, p. 1). In language learning environments, CMC or, more simply, language learning through technology has become a well-known catchphrase as a number of references have been made to the term of 'technology' in various aspects of language communication (Chun, Kern, & Smith, 2016).

However, in foreign language learning contexts, insufficiency or inappropriateness of the interactional architecture of language classroom is a challenging issue (Li & Walsh, 2011; Seedhouse, 1998). The reason might be attributed to a number of factors such as lack of exposure to the foreign language outside the classroom (Szudarski & Carter, 2016), learning styles (Naserieh & Sarab, 2013), lack of teacher autonomy (Agheshteh & Mehrpur, 2021), prescriptive curricula and syllabus inflexibility (Atai & Mazlum, 2013), lack of intercultural awareness and cultural engagement (Soodmand Afshar, Ranjbar, Yousefi, & Afshar, 2018), and school organizational climate (Collins & Muñoz, 2016; Razavipour & Yousefi, 2017). In such contexts, if we provide adequate opportunities for the learners to communicate outside the classroom, particularly in virtual environments via technology, learners as well as teachers would be awarded additional time and opportunities to simultaneously negotiate their meaning resources. From the perspective of sociocultural theory (Vygotsky, 1978), technologies are viewed as objects/tools mediating the process of interaction and learning.

According to recent research, synchronous CMC helps teachers provide corrective feedback in a more interactive manner. It also assists learners in noticing grammatical errors, mostly in online text-based chatting (Shang, 2017). In a seminal study, Aljaafreh and Lantolf (1994) provided a detailed discussion of feedback given to learners' grammatical errors. Their taxonomy ranged from 'most implicit' to 'most explicit' – in accordance with the learners' self-grammatical knowledge. Accordingly, since previous research has explored various types of feedback (e.g., recast, metalinguistic) on oral and written interaction and a lack of mixed methods research into self-regulation in grammatical knowledge is felt in this regard, the purpose of the current study is to investigate Iranian intermediate EFL learners' self-regulation in grammatical knowledge through the use of Aljaafreh and Lantolf's (1994) framework of feedback. The study also draws on Nassaji and Swain's (2000) work on corrective feedback in L2 in order to examine the effect of negotiated help on grammatical accuracy.

Review of Literature

CMC and Grammatical Knowledge Development

Recent research in language learning and teaching now confirms the supporting role of technology in autonomous learning. CMC has vastly changed both process and product language learning in synchronous and asynchronous modalities (Kukulska-Hulme & Viberg, 2018). While the former refers to the type of interaction in virtual environment that is in the form of audio-visual and written real-time communication through chatting, the latter suggests a type of delayed interaction, for instance, sending and receiving emails (AbuSeileek & Qatawneh, 2013). Synchronous computer-mediated communication (SCMC) is in fact a suitable environment through which a learner is provided with contingent and step-by-step feedback in the form of negotiation with the teacher. Also, because of visual saliency and written form of interaction in learning contexts particularly in text-based online chatting which this study seeks to investigate, it seems necessary to examine how participants develop grammatical knowledge in virtual contexts of learning.

The text-based online chatting context can provide an opportunity for the teacher to interact with the learners outside the classroom in an individualized manner tailored to the learners' level of language and individual characteristics. The assumption is that text-based online chatting classrooms provide an appropriate condition for the improvement of speaking proficiency and the provision of CF since anxiety can be eliminated and internalization might take place (Yeh & Li, 2019). Since text-based online chatting context combines interaction and noticing, learners can focus on their errors owing to its visual saliency and extralinguistic features (Coyle, Reverte Prieto, & Martinez Rico, 2017; Michel & Cappellini, 2019; Sert & Balaman, 2018).

The present study has used insights from Vygotsky's (1978) sociocultural theory of mind in which the development of higher mental functions in a learner is seen as emerging in his/her interactions with peers, mediated by physical and psychological tools. A learner develops agency as he/she develops mental functions that allow for greater self-regulation. Using this approach, this study sees social classroom interactions and guidance by more capable others as a significant development in learners' self-regulation. As the learners develop greater ability to function autonomously, "the experts relinquish control to him/her at the appropriate time" (Lantolf & Thorne, 2006, p. 280).

Studies on CMC and Grammar (Online Text-based Corrective Feedback)

Some studies have been conducted in both international and local contexts to examine the effect of text-based chatting on learners' grammatical knowledge improvement. In a study on Chinese tertiary-level EFL learners, Zeng and Takatsuka (2009) investigated the extent of learners becoming engaged in text-based dialogues and how learners' language usage was influenced by mutual engagement. The results indicated that the learners had improved their language learning via collaborating with each other in shaping dialogues.

In another study, Chen and Eslami (2013) investigated the effectiveness of incidental focus on form in promoting second language development in text-based live chats. Decision-making and jigsaw tasks were designed specifically for the participants in the study. According to the results of the study, corrections from native speaker e-pals and text-based online chat lead to an increase in the learners' awareness of focus on form and language development. Learners recalled the linguistic concepts talked about in episodes, including appropriate use of grammar and vocabulary. The results suggested that successful uptake and the type of feedback (elicitations and

explicit responses) were two major factors for nonnative speakers' accurate recall. The results also indicated that the quality of uptake was more crucial than its presence.

In a study related to the effect of computer-mediated corrective feedback types (track changes and word processor), the researcher found that such approaches had positive effect on EFL learners' writing performances particularly over time (AbuSeileek, 2013).

Kim (2014) explored how SCMC and face-to-face (F2F) oral interaction inspired the learners to collaborate in language learning process and how they unraveled their communicative problems. Based on the findings, she concluded that the modality of output may inspire the learners to produce language, attend to linguistic forms, and resolve communicative problems. Moreover, she found out that collaborative processes to construct utterances were more dominant in F2F interaction compared to that of SCMC. Furthermore, the results showed that learners' engagement in activities and producing language in different forms depended on output modalities, with various types of physical, social, and interactional contexts that they generated and, also, the way in which they affected learners' communication strategies. According to the result, she suggested that SCMC context should be used selectively based on the pedagogical purpose.

Shintani (2016) investigated the characteristics of computer-mediated synchronous corrective feedback (SCF, while writing) and asynchronous corrective feedback (ACF, after writing). Also, by means of an interview involving stimulated recall, the researcher explored the two writers' perceptions about the feedback they had been provided. The findings were: (1) SCF could create an interactive writing process in some aspects similar to oral corrective feedback; (2) SCF and ACF encouraged noticing the gaps, at the same time, self-correction was more effective in the SCF context; (3) focus on meaning and focus on form occurred alongside the SCF condition while it took place separately in the ACF condition; and (4) both types of feedback assisted metalinguistic perception of the target feature, representing the unique characteristics of writing.

In the same vein, Shintani and Aubrey (2016) investigated the role of timing condition in how synchronous and asynchronous corrective feedback (SCF and ACF) effects on the accurate use of the hypothetical conditional structure affects grammatical acquisition. The results showed that both experimental groups (who received synchronous feedback on grammatical errors during writing tasks) and the ACF learners (who received feedback after the tasks) significantly developed from the pretest to the 2 posttests while the control group (who completed the writing tasks without feedback) did not. Overall, based on analyzing the effect sizes for the posttests, they concluded that SCF was more effective in improving learners' accuracy and grammatical structure compared to the ACF group.

Alibakhshi and Mohammadi (2016) investigated the effectiveness of using multimedia instruction tools with synchronous and asynchronous multimedia components of text on EFL learners' collocational knowledge. The participants were 150 male EFL learners at pre-intermediate proficiency level which were selected through convenience sampling. Based on the findings, computer-mediated instruction was more effective than non-computerized traditional face-to-face instruction. Moreover, synchronous computerized instruction was more effective than asynchronous computerized instruction. The results also showed that using text with added graphics for presentation was more effective than presentation through simple text.

Ebadi (2016) applied Dynamic Assessment (DA) and Web 2.0 technologies to explore their microgenetic development of L2 learners' grammatical knowledge. Applying microgenetic and thematic analysis, the researcher highlighted the fact that DA mediation and reciprocity patterns provided a more accurate picture of the learners' potential for future functioning in online DA.

Ziegler (2018) explored pre-task planning in a synchronous computer-mediated communication context. He investigated what learners do when they plan or how they use their plans when performing tasks. Results suggested that pre-task planning time resulted in increasing the lexical complexity (but not phrasal or syntactic) while no significant findings were identified for accuracy or fluency. Moreover, the results indicated that technology can provide the researchers with a lot of unique methodological repertoire, such as the ability to see and think about what and how learners produce language in tasks, so, providing evidence of L2 knowledge that would otherwise be unobservable.

Finally, Akiyama (2019) examined the effects of lexical categories on Focus on Form (FonF) and the use of multimodal features of Skype for preemptive and reactive Language-Related Episodes (LREs) in a task-based language exchange via Skype (i.e. telecollaboration). Twelve pairs of Japanese EFL learners and Japanese native speakers participated in two decision-making tasks. Each task comprised of target vocabulary of different lexical categories (nouns or onomatopoeia) that they had to negotiate for performing the task. The quantitative analysis of oral interaction showed a significant positive impact of lexical categories on the total number and linguistic focus (i.e. morphological, lexical, and phonological items) of preemptive LREs, also, the correction method, linguistic focus, and the uptake rate of reactive LREs. The qualitative analysis of multimodal interaction showed that participants often used text chat, images, and webcams to do telecollaborative interaction and the lexical categories influenced the type of these multimodal features of Skype for FonF.

Most of the studies done in the SCMC environment have attempted to put the principles of Long's Interaction Hypothesis into practice (e.g., McDonough, 2004) and a large part of these studies have emphasized the effective role of SCMC for negotiation of meaning (e.g., Rouhshad, Wigglesworth, & Storch, 2015) in international contexts. In the Iranian EFL context, however, a lack of mixed methods research in the area of SCMC is clearly felt. Considering the scarcity of research in this area, the present study was conducted to examine the errors committed by Iranian EFL learners in a chat-based context and the corrections they receive. The study also examined the attitudes of learners towards the use of technology in teaching grammar. Thus, as the literature review shows, although there is considerable SCMC research on the four skills development as well as phrasal-collocational families, there are few coherent robust studies on the effect of SCMC on EFL learners' grammatical knowledge using Aljaafreh and Lantolf's (1994) taxonomy of corrective feedback and Nassaji and Swain's (2000) work on negotiated help on the grammatical accuracy.

Significance of the Study and Research Questions

In the educational system of Iran, foreign language education is now using various digital resources as students start learning English at junior high school. Students now have access to social media and the Internet, interacting with their teachers, peers, and their pen pals across the world. In line with these changes in English language teaching context, students, however, require guidance and scaffolding in skills development, in particular in their grammatical knowledge, and the appropriate ways to receive CF from their teacher. Despite such positive observations along with enormous input from the world around, a lack of authentic, communicative context is largely felt in Iran (Mirzaei, Domakani, & Rahimi, 2016; Soodmand Afshar & Yousefi, 2019). Thus, previous researches have already examined various types of CF (e.g., recast, metalinguistic) on oral and written interaction (e.g., Rassaei, 2019; Wacha & Liu, 2017; Yang, 2016), but self-regulation within grammatical knowledge development has not been sufficiently investigated from a mixed methods research perspective (Ebadi, 2016; Ebadi & Rahimi, 2019). The present study deals with Iranian intermediate EFL learners' self-regulation in grammatical accuracy using Aljaafreh and Lantolf's (1994) conceptualization of feedback and Nassaji and Swain's (2000) work on corrective feedback in L2. It attempts to provide answers for the following questions:

1. Is there any statistically significant difference between the performance of technology-equipped group and traditional face-to-face group with regard to grammatical knowledge development?
2. To what extent, can online text-based chatting help learners improve their grammar knowledge development?
3. What are Iranian EFL learners' perceptions of language learning in an online text-based chatting context?

Method

Participants and Setting

The participants of the present study were 40 intermediate EFL learners of a private language institute in Tehran, Iran, who were recruited through selective sampling method. The learners' age ranged from 14 to 17, with the mean of 15.5. They were all male native Persian speakers. As mentioned in the procedure, the participants were divided into one experimental (N = 20) and one control (N = 20) group. The experimental group was chosen on the basis of their previous familiarity and experience with the Skype software. However, the control group had no experience of using Skype software in their language courses. As noted, the participants were all intermediate based on the proficiency level tested by the language institute. Concerning research ethics, all the participants' identity was kept anonymous.

Data Collection and Instruments

Following a technology-oriented treatment, in this study the researcher/teacher used four main research instruments defined below.

Skype

The Skype software was one of the instruments employed in the present study. Developed by Microsoft Skype Division, this software assists users to converse with people by voice calls, video chats, and instant messaging over the Internet. The reason for the selection of this software was the participants' experience and familiarity with the software and its applications. Based on the students' previous course terms in the institution, their hybrid courses were run using online platforms. It should be noted that Instant messaging technology (a type of online chat) was utilized in the present study.

Pretest and Posttest

A pretest was administered to determine the participants' level of grammatical knowledge. The test included 100 questions selected from their coursebook. The total score was 100. The test measured their grammatical accuracy in different question formats including 'fill-in-the-blanks', short-answer, negation, parts of speech, multiple choice questions, etc. A posttest was also administered at the end of the treatment to examine if there was any improvement in the participants' grammatical knowledge formation. The posttest comprised 100 questions with a total score of 100. The format of the questions in the posttest included fill-in-the-blanks, short answer type questions, part of speech questions, question making items, and choosing the correct alternative. It should be noted that the pretest was administered one semester before starting the treatment in the classes, therefore, the effect of practice if any, might be negligible. Concerning the method of scoring, for each question a score of 1 was allocated because the researchers

attempted to facilitate the scoring procedure. The scoring weights (point values) were the same for all the questions. The reliability indices for the pretest and posttest were .85 and .80, indicating accepted levels of reliability (Pallant, 2016).

Written Chat Logs

Written chat logs were used to investigate corrective feedback given to the learners. More specifically, these chat logs aimed at tracking changes leading to learners' self-regulation in their grammatical knowledge. One clear benefit of employing written chat logs in this study was to investigate the type of feedback offered to the learners and when learners themselves negotiated their linguistic resources during peer-to-peer feedback. Thus, these chat logs served as a reliable source to study the process of learners' self-regulation and to examine differences between the experimental and control group's grammatical accuracy following the treatment. It is important to note that statements such as 'excellent', 'very' good', 'you did very well', etc. were used to make them more motivated and collaborative.

Open-ended Interviews

In addition to pre- and posttest, as well as written chat logs, open-ended interviews were conducted with the learners to examine their perceptions of individual chat sessions and the mediating role of text-based chatting in removing grammatical errors (see Appendix). The researchers asked three questions from ten learners about their perceptions of language learning in an SMC environment. More specifically, questions included learners' experiences throughout the chat sessions and their analysis of practicing grammatical structures in a virtual dynamic setting. The interviewing sessions lasted around 20 minutes and the learners were required to type their responses on the Skype chat-room page. After each session, all the responses were transformed into the Microsoft Word and subjected to content analysis. The researchers content analyzed the data, noted down important points, and constantly moved back and forth to track the learners' orientation from other-regulation to self-regulation.

Research Design and Data Analysis

Quantitative-then-Qualitative design is the research method employed in this study. In other words, a mixed-method study was developed, an experimental research with between subjects approach, and a pretest, posttest control group design. In the quantitative part, the learners' posttest scores were compared and analyzed to explain the development of learners' grammatical knowledge in the experimental group. In addition, the differences between the pre-test and post-test performance of the experimental group were examined. For the qualitative part, the data were collected through open-ended interviews with learners. Independent samples t-test, paired-samples t-test, and Chi-square tests (using SPSS, version 24), - as well as content analysis were - employed to analyze the data.

The method of teaching via Skype was that learners were required to become online at specific time periods during the week and were required to ask several pre-selected questions from each other. If they produced any grammatically wrong structure while answering the questions, the learner had to first attend to the structure, then in the next step the partner was required to correct the error, and if the peer could not provide the correct answer in the third step, the teacher intervened to provide the correct form in accordance with the notion of scaffolding so that the learner could see and repeat the correct form. In this way, the teacher mediated the process of correction. Put it simply, based on the teachers' initial feedback on grammar production, they were notified of the structure of sentences at each session when producing grammatical structures.

Participants of the control group consisted of 20 learners divided into groups of 2 who received the same syllabus but in the classroom context and offline. The classroom context was the same except for the fact that the conversation was in face to face format. The topics chosen from the textbook were discussed in the classroom and the nature of these talks was teacher-fronted.

Following the performance of the 10 sessions (10 weeks) of treatment, a posttest similar to the pretest was administered and the scores were compared. To investigate the learning experience in the chat context, the correction of grammatical errors in the chat context, the extent of language learning, and their ease of using this software, the researchers asked the participants some questions. At the end of each chat session, the researchers asked the learners' ideas regarding that day's chat and the experience of that chat environment and their language learning experience. The majority (about 90% of the learners) identified this context as a natural interactional situation for language learning and considered it as a chance for the correction of their errors. In order to facilitate the process of coding the content of the chat logs, the researchers used the term 'episode' which is defined as a sequence of the utterances produced by the learners and the teacher in each session of chatting.

Results

Data Normality and Reliability

The one-sample Kolmogorov-Smirnov test was performed to check the normality of the data, the results of which indicated the data were normally distributed ($K-S Z = 1.14, p > 0.05$). Homogeneity of variances was also checked using Levene's test. Results showed that variances were homogenous. After ensuring the required assumptions, we conducted the necessary data analyses to answer the research questions.

The First Research Question

To answer the first research question which aims at finding whether there is any statistically significant difference between the performance of technology-equipped group and traditional face-to-face group with regard to grammatical knowledge development, an independent samples t-test was run, the results of which are presented in Tables 1 and 2.

Table 1
Descriptive Statistics for Error Types Committed by the Learners in Chat Groups

Error types		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Grammatical	53	37.9	37.9	37.9
	Syntactic	6	4.3	4.3	66.4
	Word order	6	4.3	4.3	70.7
	Incomprehensible syntax	17	12.1	12.1	82.9
	Noun adjective	8	5.7	5.7	88.6
	Agreement				
	Past participle	2	1.4	1.4	90.0
	Agreement				
	Subject verb	4	2.9	2.9	92.9
	Agreement				
	Form	3	2.1	2.1	95.0
	Incorrect plural	5	3.6	3.6	98.6
	Form				
	Incorrect word	2	1.4	1.4	100.0
	Formation				
	Article	20	14.3	14.3	52.1
	Ambiguity	6	4.3	4.3	56.4
Morphological	6	4.3	4.3	60.7	
Spelling	2	1.4	1.4	62.1	
Total	140	100.0	100.0		

Results of Table 1 show the total frequency and percent of error types committed by learners during the chat sessions and Table 2 displays the error types across episodes.

Table 2
Descriptive Statistics of Error Types across Episodes

		Episodes			
		1-30	31-50	51-72	
Error types	Grammatical	Count	24	16	13
		% within episodes	70.6%	64.0%	46.4%
	Article	Count	10	6	4
		% within episodes	35.7%	24%	11.8%
	Ambiguity	Count	4	2	0
		% within episodes	11.8%	7.1%	0.0%
	Morphological	Count	3	2	1
		% within episodes	12.0%	5.9%	3.6%
	Spelling	Count	2	2	0
		% within episodes	7.1%	0.0%	0.0%

As Table 2 indicates, five major types of errors were committed by learners during chat sessions, namely, grammatical, article, ambiguity, morphological, and spelling types. The results indicate that the grammatical category was the most commonly committed error type when compared to other categories. Examining the episodes divided into three categories (e.g., 1-30, 31-50, 51-72), it was found that errors in general, and grammatical errors in particular were considerably decreased during chat sessions. Table 2 shows that students were moving from other regulation to self-regulation especially in the final stages of online text chatting via Skype.

In order to investigate the different types of corrective feedback provided to the learners, descriptive statistics are shown in Table 3.

Table 3
Corrective Feedback Types during Online Text-based Chatting

		Episodes			Total	
		1-30	31-50	51-72		
correction types	Elicitation	Count	6	0	0	6
		% within episodes	17.6%	0.0%	0.0%	6.9%
	Metalinguistic	Count	1	0	0	1
		% within episodes	2.9%	0.0%	0.0%	1.1%
	Clarification	Count	3	4	5	12
		% within episodes	8.8%	14.3%	20.0%	13.8%
	Explicit	Count	2	3	2	7
		% within episodes	5.9%	10.7%	8.0%	8.0%
	Recast	Count	11	6	15	32
		% within episodes	32.4%	21.4%	60.0%	36.8%
	Repetition	Count	8	0	0	8
		% within episodes	23.5%	0.0%	0.0%	9.2%
	scaffolding/providing options	Count	3	14	2	19
		% within episodes	8.9%	50.0%	8.0%	21.8%
	Implicit	Count	0	1	1	2
		% within episodes	0.0%	3.6%	4.0%	2.4%
Total		Count	34	28	25	87
		% within episodes	100.0%	100.0%	100.0%	100.0%

In this study, eight types of corrective feedback were applied using Aljaafreh and Lantolf's (1994) taxonomy (Elicitation, Metalinguistic, Clarification, Explicit, Recast, Repetition, Scaffolding/providing options, and Implicit). Two conclusions can be reached from the data presented in Table 3. First, the types of corrective feedback in the first episodes were reduced in the second and final episodes, indicating that students became more aware of their errors and attempted to *self-regulate* themselves through chat sessions. Second, as indicated the teacher's explicit feedback in the initial stages of text chatting changed to mostly implicit corrective feedback, resulting in no single type of feedback being used in the last sessions.

An independent samples t-test was performed to detect possible differences between the experimental technology-equipped group and traditional face-to-face group with regard to grammatical knowledge development, the results of which are indicated in Table 4.

Table 4
T-test Results for Experimental and Control Groups' Grammatical Accuracy

		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
Post test	Equal variances assumed	.000	.92	12.18	38	.000	28.60	2.34	23.84	33.35
	Equal variances not assumed			12.18	37.99	.000	28.60	2.34	23.84	33.35

The results show that the significance level of Levene's test is ($p = 0.92$), which means that the variances for the two groups (experimental and control) are *the same*. The results of independent samples t-test show statistically significant differences ($t(38) = .00$, $p < 0.05$) between the experimental and control group in their grammatical accuracy.

The Second Research Question

The second research question was concerned with the extent to which an online text-based chatting can help learners improve their grammar knowledge. Paired samples t-tests of groups' performance and qualitative-microgenetic analysis of chat logs indicated that the experimental group made significant progress in grammatical knowledge development. Their grammatical errors were also reduced. In the final episodes, it was observed that this group did not require any type of explicit feedback, being able to self-correct their errors. In other words, students in the experimental group reached the accepted level of ZPD and self-regulated themselves during interactional dyads. Descriptive statistics and the results of paired t-test are tabulated in Tables 5 and 6.

Table 5
Descriptive Statistics for the Experimental Group's Grammatical Improvement

	Conditions	N	Mean	Std. Deviation	Std. Error Mean
Scores	Pretest	20	42.60	6.11	1.36
	Posttest	20	66.60	7.39	1.65

The results of descriptive statistics show that the mean scores of the experimental group in the pretest ($M = 42.60$, $SD = 6.11$) and the posttest ($M = 66.60$, $SD = 7.39$) were different from each other. The results of dependent samples t-test are indicated in Table 6.

Table 6
T-test Results for Experimental Group's Grammatical Improvement

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
Equal variances assumed	.48	.48			-11.18	19	.000	-24.00	2.14	-28.34	-19.65	
					-11.18	36.71	.000	-24.00	2.14	-28.34	-19.65	
Equal variances not assumed												

The results show that the significance level of Levene's test is $p = 0.48$, which means that the variances for the two scores (pretest and posttest) are the same. The results of dependent samples t-test show statistically significant differences ($t(19) = -11.18$, $p < 0.05$) between the pretest and posttest of experimental group learners regarding the employment of explicit grammatical knowledge.

Microgenetic techniques were adopted to explain how participants in the experimental group moved from other-regulation to self-regulation. The following episodes are samples of interactional moves which took place between peers in the classroom and the teacher guided the peers in their interaction. 'T' stands for the teacher.

Episode 1

1. Vahid: Hassan tell me that when you have managed an appointment, would you be an on time person or not?
2. Hassan: Of course,... I like to be an on time person as far as you know **everybody like** on time person.
3. Teacher (T): **Everybody (like/ likes)??!**
4. T: Hassan c'mon boy!
5. Hassan: yes, **everybody likes**to be on time.
6. T: aha, go ahead!
7. Vahid: Have you ever to be late?
8. Vahid: Have you ever tried to be late?
9. T: **NO, I haven't BEEN late Vahid. How about you, Hassan?**
10. Vahid: **No, I haven't been.**

In this episode, teacher provides hints and cues, enabling the learners to generate the accurate structures. The learners also react to the teacher and notice errors and retry to make the correct sentence.

Episode 2

11. Vahid: Then, what happened?
12. Hassan: After **I go to** English class.....my last teacher gave me a negative score.
13. Hassan: Uhhh.....
14. T: How did you react then?
15. Vahid: **You mean you went to the class?**
16. Hassan: Yeah, U hhh... I **went to** class.

In this episode, we see that Hassan commits an error (i.e., I go to) during the interaction. Although the teacher tends to let peers manage the interaction, Vahid provides an interrogative sentence to draw Hassan's attention to the committed error (you went to), resulting in Hassan's modification of the structure. Thus, this is a type of peer feedback through which peers were able to foster a type of autonomous learning.

Episode 3

17. T: What do you do when a friend forgets an appointment?
18. Hossain: We have to wait!
19. T: and how about you Ali?
20. Ali: Sure, **it bother** me
21. T: Hossain, what do you do in this case?
22. Hossain: **It BOTHERS us!** I can't do it....I can't do it at all.

Again, in this episode, we observe a type of peer feedback exchanged between Hossain and Ali. Hossain highlighted Ali's error and re-wrote and capitalized the correct form of the verb in focus. Since Ali's error was initially corrected by Hossain, in the ongoing exchanges Ali was able to correct himself and produced accurate structures leading to intake.

Episode 4 (Self-regulation in focus)

23. Ali: Have you made any recent changes in your life?
24. Javad: yes I have made a change in my studying recently. What about you?
25. Ali: how you changed your studying?
26. Javad: I studied a little before but I decided to study much more.
27. Ali: Very good
28. Ali: Recently I have made a change in my manner of behavior.
29. Javad: how you did that?
30. Ali: I decided to behave more politely in university.
31. Javad: That's good.
32. Javad: Do you think change is important?

33. Ali: Sure. I think without change we cannot continue in our life. What's your odia?
34. Ali: Sorry...idea.
35. Javad: I think so. I think everyone should have a change in his life.
36. Ali: did you have a change in your life that effect your way of life?
37. Javad: Not yet. But maybe studying more will change my way of life. What about you?
38. Ali: No...
39. Ali: Do you ever get the urge to refurnish your whole house?
40. Javad: Could you explain more, dear Ali?
41. Ali: Do you ever change your house furniture completely?
42. Javad: I didn't do it before but my parents did it and change all the furniture of our house.
43. Ali: what was your idea about that change was it good or bad?
44. Javad: I think changing furniture is good but I see our furniture that we had was good.
45. Ali: what do you mean? I didn't understand.
46. Javad: I mean I am happy that we changed the furniture. But I think last furniture that we sold it was good.
47. Ali: OK.
48. Javad: What is the most difficult change you have ever had to make?
49. Ali: I didn't have any special change what about you?
50. Javad: I had a special change that it was changing our house.
51. Ali: Did it take time to get used to your new house?
52. Javad: Yes, ...emm we bought a land 3 years ago and we finished building this summer.
53. Ali: No, I meant that is it difficult to move to new house?
54. Javad: Yes.... Yes... of course.

Finally, this episode which describes the final stages in moving towards self-regulation, Ali and Javad were able to get involved in long interactions and provided feedback to each other. As the episode shows, the teacher plays an observing role and lets students navigate the ongoing interaction.

The Third Research Question

Finally, the third research question examined Iranian EFL learners' perceptions of language learning in an online text-based chatting context. The interviews conducted with ten participants having experienced online language learning in the chatting context revealed several themes. The interviews were content analyzed carefully based on the principles of content analysis (Boyatzis, 1998; Given, 2008; Weber, 1990). According to Boyatzis (1990), in conducting content analysis, the researcher first goes through a multitude of initial themes to arrive at central emerging themes. Then, he compares and contrasts the emerging themes to identify the most important thematic categories. Finally, he develops the categories in line with explanatory concepts. Table 7 illustrates the patterns that emerged from the interviewees' responses.

Table 7
Common Patterns of the Interviewees' Responses

No.	Pattern	Frequency	Percentage
1	SCMC: empowering and motivating learners	10	100%
2	SCMC inclusion in language learning classes	9	90%
3	Online classes and skills development	9	90%
4	Online classes and voice sharing	8	80%
5	Online classes and anxiety reduction and autonomous learning	8	80%

As Table 7 shows, the themes highlight the key role of SCMC context in empowering and motivating learners, the inclusion of SCMC in language learning classes, the role of online classes in skills development, voice sharing, shyness reduction, and autonomy construction. These themes state that online classes act as an opportunity to remove barriers associated with emotional dimension of language education, something which is in accordance with the current literature on SCMC (see Angelova & Zhao, 2016; Dashtestani, 2016).

Discussion

The present study investigated the effect of synchronous computer-mediated corrective feedback on EFL learners' grammatical knowledge development. In this line, three research questions were formulated. The first question delved into any possible significant difference between the performance of technology-equipped group and traditional face-to-face group in relation to grammatical knowledge development. The results showed that the group exposed to technology-enhanced learning progressed in their grammatical knowledge formation. In other words, contrary to the control group who were confined to traditional face-to-face methods of grammar learning, the technology-equipped learners developed remarkable advancement in grammatical knowledge. This finding can be justified from several points. First, the social and friendly atmosphere of the classroom played a contributing role in fostering learners' grammatical knowledge. In fact, it was observed that in such an interesting and interactive climate, learners noticed grammatical errors in a focused way and this focused noticing was ascribed to the scaffolding role of technology. When learners used Skype to communicate messages, they monitored their grammatical output, checking the accuracy of produced sentences. Thus, the engaging nature of online class allowed learners to pay more *attention* to grammatical features and *notice* the structures actively. In fact, learners' focused attention to grammatical cues signaled by the teacher raised their awareness of accurate structures in oral exchanges. This finding can be justified by Robinson's (1995) model of the relationship between attention and memory and Schmidt's (1990) noticing hypothesis that found links between noticing, attention and awareness. As Schmidt asserted, noticing is "the necessary and sufficient condition for the conversion of input into intake" (1993, p. 209). Additionally, Robinson (1995) concluded that noticing involves awareness and that it played a central role in L2 learning. Considering the significance of output in this study, it is also worth referring to Swain's (1985) output hypothesis stating that comprehensible production by L2 learners is a necessary condition in second language acquisition. In fact, in this study it was observed that negotiated help *pushed* the learners to produce understandable structures.

Second, we can highlight the dynamic role of the teacher in co-shaping the grammatical knowledge. From the initial stages, the teacher played a mediating role in negotiating the desired grammatical cues and scaffolding the learners to move forward to reach self-regulation.

Emphasizing the collaborative role of teacher in producing joint activities in the classroom, Newman (2017) found that teachers should dialogically help learners in the processes of teaching. Since grammar teaching requires focused attention on the part of learners, teacher can deploy effective strategies to draw students' attention to grammatical features in general and contextualized meaning in particular. These results are overall in line with Sun (2018) who found that online language learning contexts help students in engaging tasks and processing the tasks more skillfully.

The second research question examined the extent to which online text-based chatting can help learners improve their grammar knowledge development. Results showed that online text-based chatting helped reduce grammatical errors. In other words, the dynamic and scaffolding role of technology in text messaging resulted in a metaphorical equation as follows: "Object-regulation + other-regulation = self-regulation". This metaphor indicates that technology (i.e., deployment of Skype) acted as a mediating tool in internalizing the grammatical structures. The term 'Other' represents the role the teacher and peers play in co-constructing learner's grammatical repertoire.

Confirming our finding in this regard, Shekary and Tahririan (2009) argue that technological use facilitates language learning socially, pedagogically as well as cognitively. In terms of the social aspect, technology use in the classroom fosters intimacy, closeness, and collaborative dialogue between and among the learners and teachers. Pedagogically, using technology provides enough room for students to negotiate meaning and participate in on-going group work activities. Also, in terms of cognitive facet, technologically-equipped classroom offers potential benefits to students as it can improve motivation (Mahmoodi & Yousefi, 2021), reduces cognitive loading of information and empowers mental functioning (Lee, 2016; Shekary & Tahririan, 2009).

We also found that there was a transformation in teacher's feedback submission. Put it simply, as learners negotiated text messages, teacher's explicit corrective feedback was substituted with mostly implicit and even no types of feedback. This finding indicates that learners reached self-independence in grammatical knowledge through the use of text-based online chatting. As Baser, Kopcha, and Ozden (2016) hold, CALL-based instruction provides opportunities for constructing knowledge in a variety of topics raised in the classroom.

These findings also seem to be supported by Nami, Marandi, and Sotoudehnama (2018) and Lee (2019) who asserted that online learning contexts help foster willingness to communicate, resulting in L2 self-confidence and anxiety. Thus, technology-enhanced classroom provides a learning community through which its participants are able to express their personal thoughts and co-promote social presence (Nel, 2017). Supporting the findings in this regard, Jianling (2018) noted that online text-based chatting helped L2 Chinese college learners compose their writings in an interactive manner, leading to improved performance in writing tasks.

To cement the finding that synchronous text-based online chat helped students reduce grammatical errors and self-correct themselves, we used microgenetic techniques illustrating the metaphorical equation. The episodes, particularly episode 4 showed that learners had a notable progress in their grammatical knowledge and were able to self-correct and peer-correct errors committed during chats. As shown, learners' ZPD was activated and they were capable of managing long pieces of discourse. The results are also in line with Cho (2017) who acknowledged the empowering role of synchronous interaction in improving learners' advancement in generating extended discourse, in particular, in writing skill.

Finally, the third research question examined Iranian EFL learners' perceptions of language learning in an online text-based chatting context. The qualitative analysis of the interview data

vividly showed that the participants displayed positive perceptions towards language learning in text-based online environment. Reza, one of the active students, expressed that:

I feel that I learn language more effectively in the online class and I never feel tired.....in this class, I enjoy participating in group work activities and discussions about real-life topics. (Participant # 4)

Hossain who was a shy student and avoided taking part in group discussions, explained his experience in the SCMC context as follows:

I was always shy in my previous class.....unable to express my voice. Actually, I was able to get involved in a piece of conversation but the classroom mismatched with my learning styles....Really, I love online classes since I feel motivated to participate in interactions. (Participant # 7)

Referring to Reza and Hossain's responses, it becomes clear that technology-enhanced classes provide not only a sense of empowerment in students but also foster learners' motivations and autonomy. Some learners labeled a range of roles to their teachers. The following quotes clarify the situation vividly:

The teacher provides enough space for all learners to participate in the discussion. Here, the teacher is like a friend and helps us to notice errors using virtual cues and emoticons.....in fact, the use of cues and emoticons helped me to remove the grammatical errors in the next sessions. (Participant # 9)

According to this participant, online classes develop a sense of closeness and intimacy among learners and the teacher. He means that the SCMC context considers the emotional dimension of language education as it improves motivation and helps overcome psychological barriers to learning such as anxiety and shyness. Overall, these results are in line with previous research indicating text-based and video-based SCMC classes to enhance learners' fluency development, pronunciation improvement, and ultimately language development (Hung & Higgins, 2016; Rassaei, 2017, 2019).

Conclusion and Implications

Informed by Vygotskian concepts such as regulation, scaffolding, and the ZPD, the current study was conducted to examine the effect of synchronous computer-mediated corrective feedback on EFL learners' grammatical knowledge development. The results showed that learners in the SCMC context made significant progress in their grammatical knowledge development compared to their counterparts in the control, traditional face-to-face group. It was found that the SCMC context helped reduce grammatical errors and played a scaffolding role in constructing grammatical knowledge. In the online class, it was observed that the teacher co-shaped learners' skills development, accuracy as well as fluency. The results also indicated that text-based online chatting contributed to learners' mastery of grammatical structures, leading to self-regulation and self-management. By analyzing the episodes, it was found that gradually explicit feedback was reduced, and the teacher used more recast and implicit types of feedback. Finally, as the interview data revealed, learners considered the SCMC-context as a helping, mediating and empowering means to potentially internalize grammar knowledge and reinforce long-term restoration of structures, usage, and negotiation of concepts. Learners pointed out that implementation of SCMC engages them in extended discourse, enhances their motivation, and leads to autonomous learning.

The study has several contributions to our understanding of language learning. First, technology in general and the SCMC-based contexts foster learners' collaborative active engagement in

classroom tasks and activities. Such contexts help learners pay more attention to their linguistic errors and notice cues and written feedbacks signaled by the teacher and peers. Second, current professional development programs are required to improve teachers' knowledge of SCMC and virtual classes targeting learners' personal and social transformation (O'Dowd & Dooly, 2022). Teacher development programs, for example, can equip teachers with various pedagogical toolkits (e.g., Scaffolding 2.0) to teach more skillfully in digital language learning contexts (Jiang, Yu, & Zhao, 2021). Third, since learners' ZPD is achieved incrementally, teachers must be sensitive to learners' individual differences, learning preferences, and emotional characteristics (Shabani, 2018). Finally, teachers have important roles in the task-based CMC instruction such as the selection and sequencing of tasks, familiarizing learners with the tasks, and making learners aware of the dynamicity of interaction set by tasks.

Limitations and Suggestions for Further Research

This study has four limitations, thus providing avenues for future research. First, the study was mainly concerned with male EFL learners failing to consider gender as a moderator variable. Second, since the study dealt with grammatical knowledge, it was not concerned with studying learners' L2 abilities in spelling, pronunciation and collocation. Third, the integration of asynchronous and synchronized modes of communication can be used together to foster the development of language ability in learners. Finally, the learning context was limited to Tehran language institutes due to feasibility issues, whereas future research can address these gaps and provide more details regarding the potentiality of CMC in second/foreign language development.

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Acknowledgement

We thank the reviewers and the journal's editor for their constructive comments.

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Appendix

Open-ended interview Questions

1. What is your feeling and experience in online language learning classes?
2. What is your perception of the role of text-based chatting in removing grammatical errors?
3. Based on your experience, do you think that text-based corrective feedback helped facilitate your grammatical knowledge? In other words, do you think this type of feedback has an impact on your grammatical knowledge compared to face-to-face corrective feedback?