

Research Article

Effect of Synchronous and Asynchronous Computer-Mediated Communication on Reading Comprehension and Reading Self-efficacy of Iranian EFL Learners

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Abstract

The current study aimed to investigate the effect of synchronous and asynchronous computer-mediated communication (CMC) on Iranian EFL learners' reading comprehension and self-efficacy. To this end, 56 elementary EFL learners were assigned to one of the two experimental groups. Those trained in online video and audio instruction were assigned to the synchronous CMC group (N=27) while the participants who were taught through offline and recorded instruction were assigned to the asynchronous CMC group (N=29). Before and after the treatment, a validated reading self-efficacy questionnaire and a researcher-made reading comprehension test were administered. Independent samples t-test and Mann-Whitney U test were used to compare the students' reading comprehension and self-efficacy scores in the two groups. Meanwhile, paired samples t-test and Wilcoxon test were used to do a within-group comparison of the pretest and the posttest scores. The findings showed that although both synchronous and asynchronous CMC significantly affected EFL learners' reading comprehension and self-efficacy, the synchronous instruction was more effective than the asynchronous one. This study has important implications for EFL teachers, EFL students, and syllabus designers.

Keywords: asynchronous CMC, computer-mediated communication, reading comprehension, self-efficacy, synchronous CMC

Introduction

Educational institutions are making use of the accessibility and flexibility that computer-mediated communication (CMC) presents for learners and teachers (Goertler, 2009). CMC is defined as the communication between groups or individuals separated in time or space by using interconnected computers. Common features of CMC include having high interactivity, owning a synchronous and asynchronous communication capacity, and multi-way communication (Kleinke, 2010). CMC has been a main component in the language learning process during the last decades and many language teachers have used it to develop collaborative language learning activities (Hsieh & Ji, 2013; Lazou & Tsinakos, 2022). The processes of CMC create some cognitive activities that enhance language acquisition through scaffolding and interactive communication (Hung & Higgins, 2016; Zhao & Lai, 2008). Hence, CMC possibly provides some effective tools for promoting the quality and quantity of interactions and it enables L2 learners to use several practices in different discourse functions (AbuSeileek & Qatawneh, 2013). Meanwhile, it can facilitate the processes of reading comprehension development in EFL students (Hsieh & Ji, 2013; Shang, 2023) and can be effective in improving the self-efficacy behaviors of the students (Carrington-Shipley, 2001).

The CMC includes two main methods, that is, synchronous and asynchronous. These CMC methods can serve as tools to assist English as a Foreign Language (EFL) learners in making social interactions both inside and outside the classroom (AbuSeileek & Qatawneh, 2013). Recent developments in CMC show that the utilization of synchronous tools offering more similarity to face-to-face communication has been increased. The use of web conferencing tools like ooVoo and Skype allows for real-time communication through chat, audio, and video (Giesbers et al., 2013). These synchronous tools have been used along with text-based asynchronous means in online and blended instruction (Nami, 2022). The studies on CMC show that both synchronous and asynchronous CMC are effective in helping students achieve their educational goals (Giesbers et al., 2013; Shang, 2023).

The application of CMC in teaching English relies on the idea that the use of technology-enhanced language learning approaches can encourage active communication and interaction among EFL learners and can help them to produce more linguistic output (AbuSeileek & Qatawneh, 2013). Meanwhile, studies have shown that students with low levels of CMC apprehension are potentially more inclined to engage in online technology and develop high levels of internet self-efficacy (Wrench & Punyanunt-Carter,

2007). According to Wrench and Puuayanunt-Carter (2007), there are two different categories of self-efficacy including internet self-efficacy and computer self-efficacy. Internet self-efficacy refers to the degree to which an individual believes he can use the internet more effectively while computer self-efficacy refers to a person's confidence in their ability to utilize a particular kind of computer technology. Thus, the present study aimed to investigate the effect of synchronous and asynchronous CMC on improving the reading comprehension and self-efficacy of Iranian EFL learners.

Synchronous and Asynchronous CMC

In recent years, many language instructors have been more inclined toward creating collaborative language learning activities through the use of CMC (Mirzaei & Taheri, 2016). CMC is one specific area of computer-assisted language learning (CALL) which is supposed to offer a great deal of instruction on language use (Herring, 2007). It is a kind of communication that happens on the internet (Herring et al., 2013) and has become the main process and component in language learning (Lin, 2014).

Synchronous CMC is considered as an opportunity to enhance the communicative competence of students because it closely resembles face-to-face communication. This allows students to authentically practice real-life skills, improving their practice inside and outside the school (Bueno-Alastuey, 2012; Young & Son, 2023). It includes instant communication between students and teachers, especially through text chat (Sanchooli & Okati, 2021). It shares communication in real time (Abrams, 2008) and it is an immediate online interaction (Hsieh & Ji, 2013). Synchronous communication on students' learning is a good way to decrease gaps in remote education (Lee et al., 2023; Sun & Chen, 2016). Some research suggests that there is a high capacity for conveying social presence in synchronous chat compared to asynchronous communication (e.g., Zeinali Nejad et al., 2021). Moreover, it requires students to be online simultaneously and need enough audio and visual equipment (Hsieh & Ji, 2013). Thus, learners tend to build stronger relationships with their teachers and peers in a synchronous session (Yamagata-Lynch, 2014).

Synchronous and asynchronous CMC methods differ in that the asynchronous method might provide students more opportunities to reflect and respond than the synchronous method (Abrams, 2008). Asynchronous communication is the most common type of CMC in education (Johnson & Aragon, 2003). It is a delayed form of communication where messages might not be transmitted from senders to receivers instantly (Hsieh & Ji, 2013; Ogwu

et al., 2020). Asynchronous environments have time flexibility, allowing learners to utilize their leisure and their own speed to do their assignments. The chances for delayed responses help them to apply their critical thinking abilities when they ponder over a topic for a long time. Meanwhile, asynchronous learning can enhance students' learning experiences and create new ideas and deep reflection (Fabriz et al., 2021; Tusino et al., 2021). Asynchronous CMC is an educational approach that is based on constructivism. In this approach, the teacher acts as a collaborator, working together with the students to promote their learning (Cavana, 2009; Oztok et al., 2013). Hence, asynchronous CMC is generally desirable because it provides extra time for reflection and developing ideas (An and Frick, 2006). Ordinary students may find asynchronous CMC activities more comfortable whereas the synchronous CMC method with its synchronous nature might intimidate some of the students (AbuSeileek & Qatawneh 2013). Baron (2000) suggests that synchronous CMC enables a process-oriented discussion for sharing ideas and monitoring students' responses. By using this method, teachers can find the best solution to the given situation. Meanwhile, asynchronous CMC creates a product-oriented approach where students think about messages before putting them into practice (Bailey et al., 2021; Baron, 2000).

Self-efficacy

Self-efficacy is one of the main factors influencing EFL learners' foreign language learning. It is defined as individuals' assessments of their abilities to organize and perform the necessary actions to achieve specific types of performance (Bandura, 1997). Bandura (1977) introduced a theoretical model of behavioral change, emphasizing the mediating influence of self-efficacy as a main element in individuals' decision-making and the execution of actions. Hence, he presented social cognitive theory as a comprehensive framework for understanding self-efficacy. According to the social cognitive perspective, individuals who effectively self-regulate their learning show higher levels of motivation (personal variables), use more efficient learning strategies (behavioral variables), and respond accurately to contextual demands (environmental variables) (Pintrich & Schunk, 2002). Meanwhile, general self-efficacy is considered as an enduring personality characteristic that exerts a consistent influence on an individual's performance, particularly in novel situations (Sherer et al., 1982). Studies show that people having greater general self-efficacy levels demonstrate an improved level of computer self-efficacy and attribute higher technological competencies to themselves (McCoy, 2010;

Meier et al., 2021). Thus, the option to select between synchronous and asynchronous communication modes appears to impact the self-efficacy levels of learners, and subsequently, this can influence their motivation for learning (Lin & Overbaugh, 2009).

Studies have shown that higher self-efficacy is associated with improved attitudes about social media and the intention to utilize it (Niu et al., 2021). Hence, CMC could enhance students' self-efficacy behaviors and cause them to have persistence in learning by interacting more with other students (Carrington-Shipley, 2001). Meanwhile, self-efficacy is significantly and positively associated with reading comprehension (McGirt, 2017; Niemiec & Lachowicz-Tabaczek, 2015). According to Anam and Stracke (2020), the beliefs learners have about their skill in using metacognitive strategies affect their language learning and improve their reading comprehension.

This study borrows its theoretical foundation from sociocultural theory (Vygotsky, 1978) and social-cognitive theory (Bandura, 1986). The sociocultural theory assumes that human mental activity is facilitated by tools (e.g., computers and language), artifacts, and interaction with other human beings (Jones et al., 2010). Hence, the unification of social interaction and mind is a key characteristic of human cognitive development in Vygotsky's theory (Shabani, 2016). According to Abrams (2008), CMC assists students to actively negotiate and interact with their peers and promote their communicative competence. According to Abrams (2008), computer-mediated learner-to-learner interaction provides EFL learners with distinctive chances to control topic selection and management actively. Meanwhile, CMC offers good opportunities for students to identify and adapt to different forms of interaction through collaborative engagement among the interactants. Frawley and Lantolf (1985) argue that the process of learning can be influenced by a person's interaction with others or with mediational means or tools. Thereby, several tools function as a buffer between the social environment and the learner, mediating the relationship between these two (Lantolf, 2000). Thus, computer-mediated platforms can be seen as an effective tool for improving EFL learners' language proficiency, especially in reading comprehension (Fakher Ajabshir & Sadeghi, 2019).

Social cognitive theory assumes that self-efficacy greatly influences an individual decision to complete a task. The stronger a person's belief that he can accomplish a task, the more possibly he is to spend an extra effort to overcome any possible difficulties and complete the task (Bandura, 1986). Hence, students who enhance self-monitoring, self-efficacy, and self-

regulation in CMC are more successful than students who do not promote these characteristics (Means et al., 2010; Tran & McCollum, 2016).

A growing body of research is investigating the integration of CMC technology in educational interventions, especially in EFL contexts. Hence, computer technology has extended the procedures and designs of cooperative work, moving education performances through technological affordances (Yim & Warschauer, 2017). In a study, Lin and Overbaugh (2009) investigated the effect of gender on learners' preferences to choose between synchronous and asynchronous modes of CMC, and whether this choice influenced learners' self-efficacy about knowledge acquisition. The participants included 180 teacher-education students (29 males and 151 females) enrolled in a hybrid (a blend of online learning and traditional instruction) foundations course at a United States research university. The results demonstrated that two-thirds of the participants, irrespective of gender, favored asynchronous over synchronous approaches. On the other hand, compared to the asynchronous mode, the participants in the synchronous mode felt higher levels of self-efficacy. In another pretest-posttest quasi-experimental study, Hsieh and Ji (2013) investigated the effects of synchronous CMC, asynchronous CMC, and traditional grammar-translation on the reading comprehension ability of 138 Taiwanese EFL students. The findings demonstrated that both synchronous and asynchronous CMC methods performed better than the traditional method. Meanwhile, synchronous and asynchronous methods were not significantly different in terms of reading comprehension scores.

In an Iranian context, Zeinali Nejad et al., (2021) investigated the effect of pronunciation instruction through synchronous CMC, asynchronous CMC, and face-to-face methods on 45 Iranian EFL learners' pronunciation ability. The data was gathered through two instruments of phonemic discrimination test and the lexical stress test. The results showed the effectiveness of CMC instruction in enhancing the pronunciation ability of EFL learners. Despite not having significant differences between the two CMC groups in enhancing EFL learners' pronunciation ability, the pronunciation achievement in the synchronous group tended to vary more than the other groups.

Happenings caused by the COVID-19 pandemic have required English language teachers to transition from face-to-face teaching to online teaching. As a result, students were required to use technology tools, including tablets, mobile and computers. Therefore, teachers need to develop different activities to involve students in online synchronous and asynchronous learning (Yuyun, 2023). Different studies have investigated the impact of both synchronous and

asynchronous CMC instructions on various aspects of EFL learning (e.g. Ajabshir, 2019; Ajabshir & Sadeghi, 2019). However, as to the best knowledge of the researchers, few studies have been conducted on the effect of synchronous and asynchronous CMC instruction on reading comprehension and the self-efficacy of Iranian EFL learners. Thus, this study aimed to investigate the effectiveness of synchronous and asynchronous CMC modes on improving Iranian EFL learners' reading comprehension and self-efficacy.

To accomplish the goals of this study, the following research questions were proposed:

1. How do synchronous and asynchronous CMC instructions affect the reading comprehension ability of Iranian EFL learners?
2. How do synchronous and asynchronous CMC instructions affect the self-efficacy of Iranian EFL learners?
3. Which method, synchronous or asynchronous CMC, is more effective in improving the reading comprehension ability of Iranian EFL learners?
4. Which method, synchronous or asynchronous CMC, is more effective in improving the self-efficacy of Iranian EFL learners?

Method

Participants

The participants of this study included 56 female students selected from two high schools of Bonab located in East Azarbaijan province, Iran. They were from two intact groups of classes. It should be mentioned that the participants were chosen out of the total number of 67 EFL learners whose level of English proficiency was elementary based on Key English Test. Their age ranged from 16 to 18 years, with an average age of 17 years old and they were selected based on convenience sampling. The participants, who had studied English for 4 to 5 years at school, had not visited any English-speaking countries. Their native language was Turkish and they were speaking Persian as their second language and English as a foreign language. The participants were randomly assigned to two synchronous group (27 students) and asynchronous group (29 students).

Data Collection Instruments

The following three instruments were utilized in this study:

Key English Test (KET): KET was used to ensure the homogeneity of the participants in two groups regarding their English proficiency. KET is the first-level Cambridge English exam designed for speakers of other languages (ESOL). The purpose of this exam is to assess the ability to deal with everyday

spoken and written communications at an elementary level. KET tests three different sections including reading, writing, speaking and listening. In this study, the focus was on the writing and reading sections of KET to provide a clear and relevant measure of the participants' initial proficiency levels in these specific areas. These sections were chosen because they directly related to the skills being measured in this study. There were 56 questions (55 questions in reading comprehension and 1 question in writing) which students answered in 70 minutes. The reliability of this test, as measured in this study, equaled 0.83 and its validity was proved by three EFL teachers.

Reading Comprehension Test

This test was conducted as a pretest to evaluate the participants' reading comprehension skill and as a posttest to study how synchronous and asynchronous CMC affected their reading comprehension and self-efficacy. The text for this test was chosen from the book of Thoughts and Notions (Ackert & Lee, 2005) helping students develop their active vocabulary and reading skills. The text selection was based on several criteria including its relevance to the participants' proficiency level, and the length suitable for the allotted test time. The test included a reading text followed by 30 fill-in-the-blank, true-false, and multiple-choice questions. Furthermore, a pilot test with 20 students was conducted to ensure the suitability of this test for elementary EFL learners. Feedback was gathered from the learners, and necessary adjustments were made based on this feedback. It should be mentioned that this reading comprehension test included continuous data at [0, 30] intervals.

Reading Self-Efficacy Questionnaire

Self-efficacy was measured using the reading self-efficacy questionnaire, developed by Wang et al. (2007) where students rated their confidence in their reading skills and ability to understand and analyze the texts. Originally, there were 32 items in Wang's questionnaire, eight of which measured reading self-efficacy. A seven-point Likert-type scale, ranging from 1 (I can't do it at all) to 7 (I can do it well), was used by participants to answer the questionnaire items. Hence, the range of the scores possible was between 10 and 70. The questionnaire was administered in Persian to make sure that the participants understood the content. The content validity of this questionnaire in an Iranian context was approved by five EFL teachers at the school and university levels and their insightful comments were taken into consideration in organizing and modifying the items (Zare and Mobarakeh, 2011). Meanwhile, the reliability of this questionnaire as measured by α Chronbach equaled 0.74 which was an acceptable level.

Procedure

The data gathering procedure in this quasi-experimental study was done in two phases. First, the KET proficiency test was administered online at the outset of the study to check the participants' homogeneity concerning their language proficiency. Conducting the KET online provided greater flexibility and accessibility for the participants. In order to lower the incentive for cheating, the teacher used randomized questions and also explained to the students that their scores on the online exams would not affect their final exam grades. Hence, the teacher of each class asked the students to answer the questions in one hour and ten minutes and send their answers through Shad application. From 67 participants, 56 elementary EFL students were chosen who scored one standard deviation ($S=8.02$) below and above the mean ($\bar{X}=32.1$). They were randomly assigned to a synchronous CMC group ($N=27$) and an asynchronous CMC group ($N=29$). For the first week, the participants in both groups took the pretests of the reading self-efficacy questionnaire and reading comprehension test.

Before the treatment, the students were familiarized with the type of instruction they were expected to receive. In the synchronous group, the students were involved in simultaneous two-way communication using Skyroom. Skyroom is a web conferencing system that provides real-time voice and video conversations and it is the perfect tool for holding meetings, events, and education online. The teacher created a room and sent the room link to the students. The rationale for using Skyroom with students was based on the school administrator's decision to teach the students through this software. First, the teacher asked the students to speak about their goals of reading and learning English. Each of the students answered the teacher's questions in a face-to-face discussion. Then, she asked some other questions to activate the students' background knowledge and she taught some reading strategies like skimming and scanning before the actual reading of the text. Next, she asked the students to read the first paragraph silently and taught them the different reading strategies such as lexical inferencing and rereading. Then, the students were required to answer the reading comprehension questions. Hence, in the synchronous groups, the course book was taught online via the audio and video medium. In other words, the students listened and repeated the new text and words and the teacher presented the meaning of the new words similar to face-to-face class. At the end of each class, the video clip was presented to the students depicting the different kinds of information about the topic and the different reading strategies students can use while reading. The teacher

interrupted some parts of the video and explained it to the students in a face-to-face discussion.

In the asynchronous groups, the students were taught through asynchronous exchanges. They were taught through SHAD which is primarily a messaging application that was used following the spread of Covid 19 due to the absence of students in schools in Iran. The software is published by the Ministry of Education of Iran, and teachers, students, and administrators are the people who use this software. In the asynchronous group, the teacher asked the students about the goals of reading, and the students were required to write their answers or to record their voices while answering. Meanwhile, she activated the students' background knowledge by asking some questions. Then she read the text while recording her voice and she taught students the reading strategies. Also, she asked the students to read the text and to record their voices. However, the method of this kind of teaching was not a face-to-face discussion. Here, the teaching materials were posted online through the SHAD application and the students worked through them by themselves and the communication was through the recording of the voice or through text chat. Then, the teacher assessed the students' recordings or text chats and provided individualized feedback to ensure their engagement and comprehension by meticulously reviewing them and conducting follow-up activities. It should be mentioned that both synchronous and asynchronous groups received the same instructional content to ensure comparability. The difference between these two groups was that in the synchronous group, real time for interaction through skyroom allowed for immediate feedback and richer interaction while in the asynchronous group, the same material was provided through offline and recorded interaction, and the feedback was given after the students had completed their tasks.

Since the time interval between the pretest and the posttest was 12 weeks which was long enough to minimize the likelihood of the participants remembering specific answers, the same tests were utilized as both the pretest and the posttest and the scores obtained from these tests were interpreted and statistically analyzed. To validate the findings, an independent samples t-test was used to compare the reading comprehension scores of the students in the two groups because the data was continuous and normally distributed, and the Mann-Whitney U test was used to compare their self-efficacy scores due to the data being ordinal and not meeting the assumption of normality.

Results

Homogeneity Test

An independent samples t-test was utilized to ensure the homogeneity of the two groups in the reading comprehension test before the treatment. The descriptive statistics and the numerical results of the independent samples t-test for the two groups are provided in Tables 1 and 2, respectively.

Table 1
Descriptive Statistics of the Pretest Scores

	N	Mini mum	Maxim um	Mean	Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
RC_Syn_pretest	27	9.00	16.00	12.6296	.40350	2.09667
RC_Asyn_pretest	29	9.00	15.00	11.7586	.25138	1.35370
Valid N (listwise)	27					

Note. RC Syn, reading comprehension in the synchronous group; RC Asyn, reading comprehension in the asynchronous group

Table 2
Independent Samples T-Test Results for Reading Comprehension Pretest Scores

		Levene's Test		t-test		
		F	Sig.	t	Df	Sig. (2-tailed)
RC	Equal variances assumed	9.974	.003	1.860	54	.068
	Equal variances not assumed			1.832	43.951	.074

The p-value in Levene's test (Table 2) equals 0.003, which shows that the assumption of the equality of variance in the two groups is rejected. Hence, the second p-value (0.074), as indicated in Table 2, is used for the comparison of the two groups' means. Since this p-value is more than the significance level (0.05), the assumption of the equality of the means at a 95% confidence level is accepted. This shows that the reading comprehension ability of the two groups was at the same level with a 95% confidence level.

Because of having categorical data and two separate groups, the Mann-Whitney U test which is a non-parametric alternative test was utilized for comparing the self-efficacy scores of the EFL learners in the two groups. The results of this test are shown in Table 3.

Table 3
Mann-Whitney U Test to Compare the Medians in the Two Groups

	SE
Wilcoxon W	774.50
	1
Mann-Whitney U	339.50
	1
Z	-.882
Asymp. Sig. (2-tailed)	.378

As illustrated in Table 3, the p-value for the Mann-Whitney U test equals 0.378, which is higher than the significance level of 0.05. The results of self-efficacy tests in the two groups show that the medians of this test are equal at 95% confidence levels in synchronous and asynchronous CMC groups. Thus, the self-efficacy of the students was at the same level in the two groups at a 95% confidence level. The measure of the effect size (r) for this test equaled $r = -0.118$ that shows a small difference between the two groups.

The efficiency of synchronous and asynchronous CMC in improving the reading comprehension and self-efficacy of EFL students

Paired samples t-test and Wilcoxon test were run to examine the efficiency of the synchronous and asynchronous methods in improving the reading comprehension and self-efficacy of EFL students after the treatment, respectively. The descriptive statistics and the results of the paired samples t-test of reading comprehension for both groups are presented in Tables 4 and 5, respectively.

Table 4
Descriptive Statistics of the Reading Comprehension Test in the Posttest

	N	Range	Minimum	Maximum	Std. Deviation	Variance
RC_Syn_posttest	27	18.00	11.00	29.00	3.96495	15.721
RC_Asyn_posttest	29	8.00	14.00	22.00	2.28456	5.219

Table 5
Paired Sample T-Test of the Reading Comprehension Scores in Both Groups

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
Pair1	RC_Syn_pretest -	-	4.388	.8445	Lower -10.624	Upper -7.152	-10.525	26	.000
	RC_Syn_posttest	8.88		1					
Pair2	RC_Asyn_pretest -	-	2.625	.4875	-7.412	-5.415	-13.155	28	.000
	RC_Asyn_posttest	6.41		7					

As illustrated in Table 5, the p-values of both groups in the reading comprehension test are less than 0.05. Hence, the mean of the reading comprehension test in the posttest is significantly higher than the mean of the reading comprehension scores in the pretest. This shows that both synchronous and asynchronous methods have significantly improved the reading comprehension ability of EFL learners.

Wilcoxon test was run to investigate the efficiency of synchronous and asynchronous methods in increasing the self-efficacy of EFL learners. The results of the Wilcoxon test are depicted in Table 6.

Table 6
Wilcoxon Test for Calculating the Medians of Self-Efficacy Questionnaire in the Pretest and Posttest

	$\frac{SE_Syn_posttest - SE_Syn_pretest}{SE_Syn_pretest}$	$\frac{SE_Asyn_posttest - SE_Asyn_pretest}{SE_Asyn_pretest}$
Z	-3.089	-2.995
Asymp. Sig. (2-tailed)	.002	.003

As shown in Table 6, the p-values of synchronous and asynchronous groups are less than 0.05, that is, 0.03 and 0.02 for synchronous and asynchronous groups, respectively. Hence, the median of the self-efficacy test in the post-test has been significantly increased at a 95% confidence level for both groups. Thus, it can be said that the synchronous and asynchronous

methods have significantly increased the reading comprehension ability and the self-efficacy of the participant EFL learners.

Comparison of the efficiency of synchronous and asynchronous methods

Since the students in the synchronous and asynchronous groups were homogeneous in terms of their reading comprehension ability and their self-efficacy before the treatment, the efficiency of the synchronous and asynchronous methods was evaluated in order to see the degree of effectiveness of each method in improving the participants’ reading comprehension ability and self-efficacy. As the continuous data of the reading comprehension test are situated at [0, 30] intervals, an independent samples t-test was employed to compare the means of this test in the two groups. Meanwhile, because the data in the self-efficacy test are categorical, the Mann-Whitney U test was utilized for comparing the medians of both groups. The results of the independent samples t-test are presented in Table 7.

Table 7
Independent Samples T-Test to Compare the Means in Both Groups

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	Df	Sig. (2- tailed)
RC	Equal variances assumed	4.034	.050	3.90 3	54	.000
	Equal variances not assumed			3.83 3	41	.000

Note: RC=reading comprehension

In Table 7, it becomes clear that the p-value of Leven’s test equals 0.05. Because this p-value is not higher than 0.05, the second p-value is used for comparing the means. The second p value was 0.000 which is below the 0.05 threshold. Hence, the means of the two groups are significantly different at a 95% confidence level. Because the means of the synchronous group in the posttest is higher than the means in the asynchronous group, the synchronous method seems to be more effective than the asynchronous one in improving the reading comprehension and the self-efficacy of EFL learners. Table 8 shows the results of the Mann-Whitney U test for the self-efficacy scores.

Table 8

Mann-Whitney U Test Results for Comparing the Medians of Self-Efficacy Questionnaire in the Posttest; SE=Self-Efficacy

	SE
Mann-Whitney U	250.501
Wilcoxon W	685.501
Z	-2.382
Asymp. Sig. (2-tailed)	.017

As indicated in Table 8, because the p-value of the Mann-Whitney U test equals 0.017, the median of the synchronous group in the self-efficacy test is significantly higher than the median in the asynchronous group. In other words, the synchronous method is more efficient than the asynchronous one in increasing the self-efficacy ability of EFL learners.

It is worth mentioning that as the number of the participants in the synchronous group and asynchronous group was 27 and 29, respectively, the normal distribution of numerical results of the reading comprehension test in the pretest and the posttest should be investigated. Identifying this normal distribution is a required condition for doing paired t-tests and independent t-tests. The results of the normality tests (Shapiro Wilk test & Kolmogorov-Smirnov test) are shown in Table 9.

Table 9

Results of Normality Test for Reading Comprehension Pretest and Posttest across Both Groups

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
RC_Syn_pretest	.188	27	.016	.935	27	.093
RC_Syn_posttest	.115	27	.200	.955	27	.278
RC_Asyn_pretest	.210	27	.003	.943	27	.143
RC_Asyn_posttest	.146	27	.145	.946	27	.174

Since the p values in the Shapiro Wilk test (Table 9) are higher than 0.05, the scores of the reading comprehension test in the synchronous and asynchronous groups in the pretest and the posttest have the normal distribution.

Discussion

The aim of this study was to investigate the relative effectiveness of synchronous and asynchronous CMC on the self-efficacy and reading

comprehension ability of Iranian EFL learners. The findings demonstrated that both synchronous and asynchronous CMC significantly and positively affected the learners' reading comprehension and self-efficacy. Hence, CMC can support students' learning process and can become an effective tool in facilitating EFL learners' reading comprehension ability (Hsieh & Ji, 2013). Meanwhile, CMC can significantly increase the self-efficacy behaviors of students, as mentioned in a study by Carrington-Shipley (2001). Hence, students having high ability of CMC are more possibly to promote a sense of self-efficacy (Wrench & Punyanunt-Carter, 2007). According to Dumanig et al., (2011), computer-mediated reading significantly affects students' reading comprehension ability especially in finding the main idea, making inferences, sequencing events, understanding details, and making generalizations. The findings of this study align with those of the previous research reporting the outperformance of CMC-oriented methods in different aspects of EFL learning (e.g., Ajabshir, 2019; Hsieh and Ji, 2013; Zeinali Nejad et al., 2021; Zhong & Zhang, 2023). Moreover, CMC potentially offers robust tools for promoting the quality and quantity of social interactions, causing L2 learners to engage in several practices and roles in different aspects of EFL learning (AbuSeileek, 2013). Thus, CMC provides desirable conditions for the formation of the different features of the target language (Zeng, 2017).

The study showed that both synchronous and asynchronous methods significantly affected the reading comprehension and the self-efficacy of EFL learners. However, the synchronous method showed greater effectiveness than the asynchronous one because the means of the synchronous group in the reading comprehension and self-efficacy posttests were higher than the means in the asynchronous group. According to the results of the study carried out by Yu and Hu (2023) on the effects of extracurricular synchronous and asynchronous CMC on students' digital reading comprehension achievement, synchronous CMC significantly and positively affected the digital reading achievement of students, while asynchronous CMC negatively affected it. Through synchronous CMC, EFL learners gain more access to online learning resources, which can improve their self-efficacy and motivation (Khodaparast & Ghafournia, 2015). Meanwhile, it allows learners to interact in a real-time setting, encouraging communication in the second language (Young & Son, 2023). In many previous studies, the positive effect of the synchronous method was confirmed (Mirzaei & Taheri, 2016; Shintani, 2015; Lenkaitis, 2020). Zeinali Nejad et al., (2021) investigated the effect of synchronous and asynchronous CMC on the pronunciation achievement of Iranian EFL learners.

The results showed that although the synchronous and asynchronous CMC significantly improved language learners' pronunciation, the students in the synchronous group paid more attention to their pronunciation than the asynchronous and face-to-face group.

The integration of digital technology in educational practices is supported by theoretical foundations as well. The emphasis on social interactions and social presence in CMC is aligned with Vygotsky's (1978) sociocultural theory in which learning occurs in society through meaningful interactions with others. According to Vygotsky's sociocultural theory, knowledge is mostly generated through social interactions and particular sociocultural contexts (Vygotsky, 1978). Hence, learning occurs through individuals' communication in the social situation (Ajabshir, 2019). Furthermore, Vygotsky (1978) introduced the concept of tool mediation (e.g., computer) in human learning to emphasize the uniqueness of the human mind. Thus, this theory is of great importance for learning in digital environments (Schneider et al., 2022). Meanwhile, based on Bandura's (1986) social cognitive theory, efficient learning occurs not only through social communication but also through observation and modeling characterized in contexts where students learn through digital resources (Schneider et al., 2022). Hence, CMC environments can act as an effective environmental factor affecting students' learning process by improving their self-efficacy and self-regulation and developing collaborative language learning activities (Lazou & Tsinakos, 2022; Schneider et al., 2022; Tran & McCollum, 2016).

This study identified the positive effects of both synchronous and asynchronous CMC on reading comprehension and the self-efficacy behavior of Iranian EFL learners. However, the synchronous method tended to vary more than the asynchronous group. These findings indicate that it is advisable to include synchronous CMC in EFL reading comprehension classes. The results of this study indicated that there is growing attention to the use of CMC in education because it has some benefits in supporting socialization, interaction, and connection (Abuseileek & Qatawne, 2012).

This study might have significant implications for teachers, students, and syllabus designers. The findings of this study suggest that teachers use the CMC to improve EFL learners' self-efficacy and reading comprehension. The decision on the use of synchronous or asynchronous CMC mode is dependent on contextual factors (Zeinali et al., 2021). In choosing each one of these modes for EFL classes, issues such as expectations, desire, human needs, and pedagogical objectives should be considered (Fitzpatrick & Donnelly, 2010).

Teachers should be aware that self-efficacy has an important role in improving students' reading comprehension. Teachers can enhance students' self-efficacy by providing feedback and using effective communication to guide them through the online task or motivate them. The findings will encourage the students to improve their self-efficacy because, according to Bandura, students who have high self-efficacy are better at reading comprehension. This study suggests that students need to be familiar with new technologies and must be aware of the use of audio-visual CMC. Syllabus designers can also use the results of this study to improve the curriculum. They should also consider the design of computer-taught courses. Because the needs and learning media have been progressed, the syllabus designer plays a crucial role in the curriculum design and the transfer of learning experiences. These results can help syllabus designers decide what aspects of CMC are important or unimportant to include or exclude in their syllabuses (Rahimi & Tafazoli, 2013).

Some limitations are imposed in this study. First, the kind of survey used for measuring students' self-efficacy was a Likert scale questionnaire. Therefore, not being honest about the responses may be an issue. Other studies can use other instruments such as interviews for measuring students' self-efficacy. Second, this study only compared the effects of synchronous and asynchronous CMC on EFL learners' reading comprehension ability and their self-efficacy behavior. Similar studies can be conducted by adding face-to-face instruction and comparing the results of the three methods of instruction. Meanwhile, the students' individual differences and their degree of involvement in the class may limit the generalizability of the findings.

Declaration of interest: None

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