USING SYNCHRONOUS COMPUTER-MEDIATED COMMUNICATION TO DEVELOP L2 LEARNERS' ORAL FLUENCY

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The current study investigated the effect of synchronous computer-mediated communication (SCMC) on developing L2 learner utterance fluency. Twenty-two native Japanese learners of English engaged in a series of task-based communicative activities in pairs for 12 weeks using the text-chat function of Microsoft Teams. Although their pre/post performances were not statistically different, the comparison of their oral performance recorded before and after the text-chat activities suggested a slight improvement in fluency, particularly in terms of the pause behavior with mid to large effect sizes. We argue that SCMC could be a promising alternative tool for L2 oral fluency development.

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INTRODUCTION

The current research investigated whether text-chat based communicative activities could enhance Japanese English-as-a-foreign-language (EFL) learners' speech production skills. The global pandemic has been challenging for language instructors tasked with developing students' communicative competence without meeting them face-to-face (Payne, 2020). Although simultaneous video-conferencing tools, such as Zoom and Microsoft Teams, were seen as favorable platforms to realize interactive, communicative foreign language classrooms, they imposed additional difficulties on language learners, including a unique turn-taking strategy which is challenging enough even if it is in the participants' L1 (Payne, 2020). Also, the participation of more than a handful of individuals (e.g., four to six) in web-based video chat very likely puts at risk the interactive and communicative nature of the language class (Payne, 2020).

In second language (L2) speech development, *fluency* is a key aspect for successful L2 communication (Suzuki & Kormos, 2019). Segalowitz (2010) proposed three types of fluency; *utterance fluency* (i.e., temporal features of speech), *cognitive fluency* (i.e., cognitive processes underlying speech), and *perceived fluency* (i.e., listeners' inferences about the speaker's cognitive fluency based on their utterance). Previous research has found that various dimensions in *utterance fluency* could characterize differences between L1 and L2 speech. For example, the number of pauses within a clause is one of the clear differences between L1 and L2 speech (Kahng, 2014). As proficiency grows, learners speak with fewer pauses within clauses, which suggests faster linguistic encoding (e.g., de Jong, 2016; Tavakoli, 2011). Unlike the mid-clause pause, pauses between clauses reflect a speaker's planning and conceptualization (Kahng, 2018; Saito, Ilkan, Magne, Tran, & Suzuki, 2018). On the other hand, the frequency of final-clause pauses in L1 and L2 speech may not significantly differ between L1 and L2 (de Jong, 2016; Tavakoli, 2011),

implying a relatively independent degree of automatization of language processing (Suzuki & Kormos, 2019). Finally, articulation rate may reflect the execution of articulatory motor gestures (Suzuki & Kormos, 2019).

In developing L2 learners' fluency, we see that text-based Synchronous Computer-Mediated Communication (SCMC) could be an alternative medium of communication and language practice among learners. Text-based SCMCs are known to have a positive impact on oracy skills, especially fluency (e.g., Blake, 2009). Referring to Levelt's (1989) speech production model, Payne and Whitney (2002) and Blake (2009) argued that language processing mechanisms involved in SCMC and face-to-face interactions are similar up to the conceptualization and formulation stages; the only difference between the two modalities would lie in the articulation stage, in which online chat involves activation of muscles in the fingers rather than articulators in the vocal tract. In Payne and Whitney (2002), participants engaged in a series of activities, including role-plays and discussions, in groups of four to six in 21 chat sessions over a period of a 15-week semester. The participants' oral proficiency was assessed by two examiners based on the assumption that the greater proficiency would entail "the ability to plan for an oral performance" (Payne & Whitney, 2002, p. 25), resulting in more fluent speech. The results demonstrated a larger gain by the participants in the chat room condition than those in a face-to-face condition. They argued that "language production, whether aural or textual, should develop the same set of underlying cognitive mechanisms" (Payne & Whitney, 2002, p. 20). Similar results were reported in Blake (2009), in which the participants worked on a 6-week English curriculum in three different conditions (face-to-face, online chat, and asynchronous computer-based self-learning). Those in face-to-face and online chat conditions were engaged in communicative activities whereas those in the asynchronous condition were not. Participants' utterance fluency was acoustically analyzed in the pre- and post-tests in terms of the following measures: *speech rate*, *mean length of run*, *phonation time ratio*, *articulation rate*, and *average length of pauses*. The results indicated that participants in the online chat condition developed greater oral fluency than those in the face-to-face and the self-learning conditions along the dimensions of *phonation time ratio* and *mean length of run*.

Research question

Previous research has shown an advantageous effect of SCMC compared to face-to-face interactions in L2 utterance fluency development. However, such comparisons do not necessarily tell us to what extent SCMC in itself has positive effects on developing oral fluency. Furthermore, participants in Blake (2009) were diverse in terms of their L1, which makes it unclear to what extent their findings could be applicable to EFL settings in which participants are relatively homogenous in their language background.

The current study investigates the extent to which SCMC facilitates development of L2 utterance fluency. In our experiment, we focus on a relatively homogeneous group of EFL learners who share the same L1. In addition, we include a wide range of fluency measures in our analysis of utterance fluency: *speed, breakdown* and *repair fluency* (Tavakoli & Skehan, 2005), enabling us to discuss the results in line of the previous research, particularly regarding the pause behavior (e.g., Saito et al., 2018; Hanzawa, 2021). These considerations enable us to suggest pedagogical implications regarding the use of SCMC in L2 classrooms as an alternative means of speaking

practice. Below, we report our practice of a semester-long English language syllabus in an EFL setting incorporating the use of text-based SCMC with the following research question:

Which of the fluency measures show development in EFL learners' speech as a result of text-chat based online English classes?

Methods

Participants

Twenty-two EFL learners in Japan participated in the study, all of whom were native Japanese college students enrolled in a general English course conducted by the first author. The English class took place twice a week and continued for 12 weeks (i.e., 24 classes in total). Almost all the participants did not take any other English language classes, but some may have had a greater motivation for independent English study for career purposes They had received formal education in English for at least 6 years in school. Based on the authors' observations, their English proficiency was estimated to be beginner to elementary (approximately between A1 to A2 levels in the Common European Framework of Reference for Language benchmarks).

Procedure

During the 12-week curriculum, the participants engaged in the communicative activities using the SCMC functionality for seven weeks (i.e., 14 classes), as some classes were saved for the introduction session and exams. The SCMC classes were conducted using the text chat function of Microsoft Teams. In each class, the first 10 minutes were used for checking new vocabulary items as the pre-task activity, where they listened to the pronunciations and checked the definitions of each vocabulary item. After that, they engaged in information gap activities in pairs for approximately 50 minutes, in which they were instructed to collaborate with each other to complete the task. The tasks were designed based on the task-based textbook by Kelly and Kelly (1995), which contained 12 different information-gap tasks. The participants were instructed to interact with each other as much as they could to complete the task successfully. It would have been ideal for us to be able to obtain the amount of participants' language production during the text-chat sessions, but we were not able to do so due to technical difficulties. Each person had the same partner throughout the semester.

To assess the participants' utterance fluency, participants recorded unscripted argumentative speech before and after the semester, in which they expressed their opinions to the following two questions: *1) Is it good for children to watch TV? 2) What is the best age to start learning English?* To avoid any undesired effects from the topic ordering, half of the participants did Topic 1 for the pre-test and Topic 2 for the post-test, whereas the other half did the opposite.

Data Coding

The speech data were processed using *Praat* (Boersma & Weenink, 2016). With the custom script developed by de Jong and Wempe (2009), the utterance and pause portions were automatically segmented and were then manually checked by a trained coder to identify filled and unfilled pauses. We adopted the pause threshold of 200 milliseconds based on practices in previous studies (e.g., Suzuki & Hanzawa, 2021). Also, the coder transcribed the utterances and identified the mid-

clause and final-clause pauses based on analysis of the speech unit (AS unit; Foster, Tonkin, & Wigglesworth, 2000).

Table 1 summarizes the fluency measures that we included in this study. Utterance fluency is generally analyzed in terms of *speed fluency*, *breakdown fluency*, and r*epair fluency* (e.g., Tavakoli & Skehan, 2005). We chose nine measures in line with previous studies (e.g., Kahng, 2014; Suzuki & Hanzawa, 2021). *Speed fluency* measures included *articulation rate, mean length of run* and *phonation time ratio*. *Breakdown fluency* was measured with *mid-clause pause ratio, final-clause pause ratio, mid-clause pause duration and final-clause pause duration.* Finally, we included *repetition frequency* and *repair frequency* as the measures of *repair fluency.*

We have included a wider range of fluency measures than those used in Blake (2009). This decision is motivated by our reasoning that Blake's (2009) findings regarding *mean length of run* and *phonation time ratio* could result from changes in the speakers' pause behavior and thus, as an anonymous reviewer pointed out, be considered to be composite measures. Changes in pause behavior have also been reported in previous research with native Japanese EFL learners (Saito et al., 2018; Hanzawa, 2021).

Table 1

Fluency measures and definitions utilized in the current study

Measure	Definition
Speed fluency	
Articulation rate	The number of syllables per minute of speech, excluding pauses
Mean Length of Run	The number of syllables between clauses
Phonation ratio	Utterance duration divided by the total duration
Breakdown fluency	
Mid-clause pause ratio	The total number of unfilled pauses within clauses was divided by the total number of words
Final-clause pause ratio	The total number of unfilled pauses between clauses was divided by the total number of wards
Mid-clause pause duration	Mean duration of pauses within clauses
Final clause pause duration	Mean duration of pauses between clauses
Repair fluency	
Repetition frequency	The number of repetitions per minute
Repair frequency	The number of repairs per minutes

Statistical Analysis

The fluency measures were submitted to a one-way multivariate analysis of variance (MANOVA) to investigate the utterance fluency development over the course. Since we did not have a control

group, we only conducted within-group comparisons with the test conditions (pre *vs.* post) as fixed factors and fluency measures as outcome variables.

We performed log-transformation on the data to obtain the normal distribution and used Pillai's trace. The significance threshold was set at 0.05. Follow-up univariate analyses of variance (ANOVAs) were also conducted to evaluate statistical significance of each of the fluency measures. The alpha level for the follow-up analyses was 0.006 after Bonferroni corrections by dividing the significance threshold of 0.05 by nine. Finally, the effect size was calculated using partial eta square (η_{p^2}), and we interpreted the effect size using the following threshold based on the previous research; small: η_{p^2} = 009, medium: η_{p^2} = .05, and large: η_{p^2} = .13 (Richardson, 2011).

Results and discussion

We first describe the descriptive information on the speech samples. The mean durations of the recordings were 61.25 seconds (*SD* = 26.18) for the pre-test and 61.32 seconds (*SD* = 15.59) for the post-test. The mean total numbers of words were 54.14 (SD = 12.04) for the pre-test and 71.42 (*SD* = 19.64) for the post-test. From these values, we could see that participants produced more words in the post-test than in the pre-test.

We have summarized the results of the ANOVAs in Table 2 and visualized them in Figure 1. Note that the values reported are raw values for ease of interpretation whereas the statistical values are the results of analysis based on the log-transformed values. As seen from the significance threshold values, none of the measures reached statistical significance. Nevertheless, we highlight the positive trend of fluency gains between the pre- and post-tests. For instance, *articulation rate* increased from the pre-test (*M* = 162.141, *SD* = 29.409) to the post-test (*M* = 167.487, *SD* = 29.662; $F(1, 42) = .36$, $p = .55$, $\eta_{p^2} = .009$), which indicates that their speech was faster in the post-test than in the pre-test. Slight increases were also manifested in the other speed fluency measures: *mean length of run* (Pre: *M* = 3.881, *SD* = 2.316, Post: *M* = 3.589, *SD* = 1.104; $F(1, 42) = .284$, $p = .60$, $\eta_{p^2} = .0004$) and *phonation ratio* (Pre: *M* = .511, *SD* = .083, Post: *M* = .572, *SD* = .092; $F(1, 42) = 5.31$, $p = .026$, $\eta_{p^2} = .109$).

Regarding pause behavior, the frequency and duration of pauses decreased from the pre-test to the post-test judging from *mid-clause pause ratio* (Pre: *M* = .360, *SD* =.112; Post: *M* = .304, *SD* = .115; $F(1, 42) = 2.886$, $p = .097$, $\eta_{p^2} = .064$), *final-clause pause ratio* (Pre: *M* = .112, *SD* =.040; Post: *M* = .090, *SD* = .028; $F(1, 42) = 4.425$, $p = .041$, $\eta_{p^2} = .095$), *mid-clause pause duration* (Pre: *M* = .904, *SD* =.370; Post: *M* = .757, *SD* = .238; $F(1, 42) = 2.502$, $p = .121$, $\eta_{p^2} = .056$) and *final-clause pause duration* (Pre: *M* = 1.613, *SD* = .846; Post: *M* = 1.470, *SD* = .668; $F(1, 42) = .296$, $p = .589$, $\eta_{p^2} = .007$). These are also indicative of a more fluid speech in the post-test compared with that in the pre-test.

Four of the fluency measures showed medium to large effect sizes, and this was evident in the pause measures: *mid-clause pause ratio* (η_{p^2} = .64), *final-clause pause ratio* (η_{p^2} = .95), and *mid-clause pause duration* (η_{p^2} = .56). In addition, *phonation ratio* yielded an effect size of η_{p^2} = .109. This could suggest that, while we did not find any statistical significance as far as the current population is concerned, SCMC could potentially improve L2 learners' oral fluency skills in these regards. We discuss this in line with the previous research later in this section.

Finally, we note the infrequency of repetition (Pre: M = .633, SD =1.478; Post: M = .500, SD = .240; $F(1, 42) = .240$, $p = .627$, $\eta_{p^2} = .006$) and repair (Pre: M = .1.392, SD =2.119; Post: M = .991, SD = 1.464; $F(1, 42) = .466$, $p = .499$, $\eta_{p^2} = .011$), and this could be due to the nature of the pre- and post-tests that were relatively short in length, leaving little room for participants to make repetitions or repairs to their utterance.

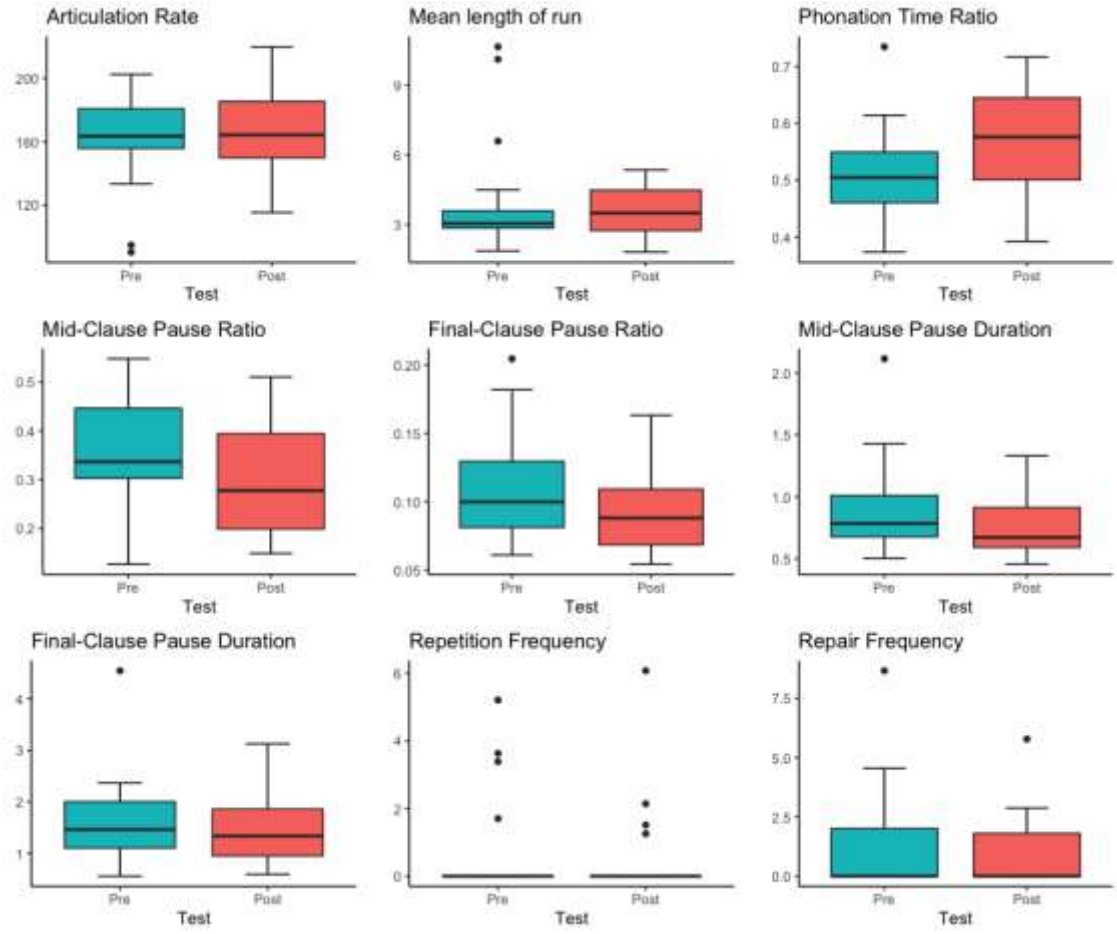
Table 2

Descriptive statistics and pre-test/post-test comparisons

	Pre-test		Post-test					
Fluency measures	*M*	*SD*	*M*	*SD*	*F*	*df*	*p*	η_{p^2}
Articulation rate	162.141	29.409	167.487	29.662	.377	1	.543	.009
Mean length of run	3.881	2.316	3.589	1.104	.017	1	.897	>.001
Phonation ratio	.511	.083	.572	.092	5.157	1	.028	.109
Mid-clause pause ratio	.360	.112	.304	.115	2.886	1	.097	.064
Final-clause pause ratio	.112	.040	.090	.028	4.425	1	.041	.095
Mid-clause pause duration	.904	.370	.757	.238	2.502	1	.121	.056
Final-clause pause duration	1.613	.846	1.470	.668	.296	1	.589	.007
Repetition frequency	.633	1.478	.500	1.379	.240	1	.627	.006
Repair frequency	1.392	2.119	0.991	1.464	.466	1	.499	.011

Figure 1

Pre-test/Post-test comparisons of the nine fluency measures created in R (R Core Team, 2021). Note that the raw values are reported, rather than the log-transformed values.



Despite lack of statistical significance, we argue that SCMC-based text interactions could serve as a means for fluency training. We have found that the participants improved their L2 oral fluency in terms of pause behavior, particularly with *mid-clause pause ratio* (related to grammatical/lexical encoding), *final-clause pause ratio*, and *final-clause duration* (related to planning), which suggests decrease in pause length and frequency. Similar changes in pause behavior have been reported in other previous studies. For example, Saito et al., (2018) found that changes in final-clause and mid-clause pauses occur at an early stage of L2 oral fluency development, with the former distinguishing learners with low-level fluent speakers from those with mid-level and the latter differentiating learners with low-, mid- and high-level fluent speakers. In a longitudinal study, Hanzawa (2021) examined L2 fluency development of Japanese EFL learners and showed that within- and between-clause pause length significantly decreased over an academic year. These studies suggested that development of pause behavior would occur at the initial stage of L2 fluency development, and our results are in line with this, given especially that our participants had

relatively low L2 proficiency. This could suggest that EFL leaners might enjoy advantages of SCMC in terms of L2 oral fluency development. Our results did not show statistical significance in any of the measures employed, but we speculate that this is due to the small number of participants given the medium to large effect size in measures of *mid-clause pause ratio* (η_p^2 = .64), *final-clause pause ratio* (η_p^2 = .95), and *mid-clause pause duration* (η_p^2 = .56). We argue that the relationships between SCMC and pause behavior in L2 speech might be worth pursuing in the future research.

Our results were similar to Blake (2009) in that the development of oral fluency was manifested in the measures of *phonation ratio* and *mean length of run*. Blake (2009) attributed these gains to the nature of message exchanges in the chat room, including frequent message exchanges, learners' reduced anxiety in expressing their opinions in the class, and the increased feedback through the visual information provided by typing. Blake's claim seems reasonable given that text chat allows learners to 'speak' simultaneously while not depriving others of their turns of speaking. However, the discussions regarding the amount of language production in Blake (2009) remained impressionistic, and we were also not able to obtain quantitative data of the amount of language production. It would then be beneficial if future research could investigate the relationships quantitatively between the amount of language production in the text-chat interactions and the extent of gains in their oral fluency measures.

Finally, we speculate that the quantity of the activities was not great enough for the participants to gain better skills. Saito and Hanzawa (2018) suggested that developing fluency takes time. The participants, therefore, might need extra opportunities to have contact with the target language (Hanzawa, 2021). Our participants, who did not have many language-related experiences outside the classroom (see participants section), appeared to successfully develop their speech proficiency, but their gains might not have reached statistical significance because of lack of language use. This could pave the way for future research to look into the effectiveness of using SCMC in ensuring the amount of language use outside language class.

CONCLUSION

The current research explored the possibilities that SCMC-based interactions have positive impacts on the development of Japanese EFL learners' utterance fluency. The results from the pre- and post-tests suggested that there was an overall tendency toward improvement. The current research could be improved by examining the relationships between written and spoken modalities of language production. As a result, language instructors could be informed as to what alternatives would be available under the challenging conditions in which they have to develop their students' communicative skills while 'face to face' oral interactions among learners have to be minimized.

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