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Text-Based SCMC for SLA: A Narrative Review



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Abstract

This review discusses and compares the findings of 38 peer-reviewed studies on text-based synchronous computer-mediated communication for second or foreign language learning from over the past twelve years. Research themes that emerged include: modality, corrective feedback, noticing, alignment and uptake, as well as task design/conditions and grouping. The comparison of findings revealed that the medium may enhance or hinder language learning depending on the context, method of implementation, and pedagogical aims. It also uncovers implications for language learning theory and practice that are less evident when examining each study in isolation, including findings on face-preservation and learner engagement, features of communication besides negotiation of meaning that lead to language acquisition, as well as a possible interaction between cognitive complexity and modality in the effectiveness of language learning tasks.

Keywords: Text-based synchronous computer-mediated communication (SCMC); second language acquisition (SLA); interaction; modality; affordances

Introduction

With the onset of the COVID-19 pandemic, computer-mediated communication (CMC) and particularly synchronous CMC (SCMC) has at times become the primary medium of education in many regions around the world, with video-based SCMC platforms such as Zoom and Google Meet taking center stage. While video-based SCMC has a strong corollary in traditional face-to-face communication (FTFC), text-based SCMC (TSCMC) is unique in that it transforms writing, a traditionally asynchronous form of communication, into a synchronous medium. It thus combines the real-time interactivity of spoken language with the permanent and textual nature of writing. Due to this unique combination of

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properties TSCMC offers novel affordances for language learning and research, and the body of studies exploring the potential of TSCMC for second language acquisition (SLA) continues to grow.

Prior reviews of TSCMC research

Several research reviews have already been conducted that investigate CMC for SLA (Lin, 2014; Lin, 2015; Lin, Huang, & Liou, 2013; Sauro, 2011; Zeigler, 2016). Of these, only two (Sauro, 2011; Lin *et al.*, 2013) allow the reader to distinguish the findings for TSCMC from other forms of CMC.

Sauro's research synthesis

Sauro (2011) reviewed 97 CMC studies from peer-reviewed journals. Notable findings for TSCMC include the observation that learners used more discourse functions in TSCMC compared to other modalities and that interaction via TSCMC led to greater gains in learners' ability to perform the refusal speech act compared to spoken modalities. In addition to these were results that showed learners who engaged in TSCMC achieved greater gains in fluency than those in a control or FTFC group and that negotiation in TSCMC decreased as scrolling and cursor movement increased, as well as the observation that learners produced more complex output in TSCMC after self-initiated deletions compared to those that were partner-initiated through interruption. Sauro concludes by pointing out future avenues of research into SCMC, recommending studies involving younger participants, learners of non-alphabetic languages, and pedagogic tools that are unique to SCMC contexts.

Sauro (2011) provides interesting details from TSCMC studies and attempts to respond to seminal questions for CALL research posed by Chappelle (1997) including, "How good is the language experience in CALL for L2 learning?" (p. 28). However, no overall findings with regard to TSCMC or SCMC in general are provided in response to this question. The review concludes by giving counts of studies investigating each of the four components of Canale and Swain's (1980; Canale, 1983) communicative competence without indicating how effective SCMC might be for acquiring them. The review's inability to provide a satisfactory answer to Chappelle's question may have been due in part to the sheer breadth of studies included, making it difficult to investigate each study in enough depth to form conclusions about the effectiveness of the technology.

Lin and colleagues' meta-analysis

Lin *et al.* (2013) conducted the only meta-analysis to date exclusively on the effect of TSCMC on SLA. It included 13 studies and found a modest overall effect size ($m = .33$) for conditions or interventions employing TSCMC. It also indicated two factors that appeared to moderate the effectiveness of TSCMC. First, only interventions that lasted a week or longer produced any effect. Second, TSCMC was more effective when done in pairs as opposed to larger groups. However, the researchers caution that these findings should be considered tentative, due to the small sample size of studies included in the meta-analysis. Despite this weakness, Lin and colleagues do manage to provide an answer to Chappelle's question regarding the use of the technology for L2 learning: TSCMC has a significant, yet weak effect on SLA.

This conclusion, however, oversimplifies the case for TSCMC. An inspection of the effect sizes from each individual study included reveals that they range from strongly positive to strongly negative indicating that TSCMC can be very effective in some cases while ineffective or even harmful in others. Beyond the tentative support for pair work and longer interventions, we are left wondering what contextual factors may account for the enhancing or hindering effects of TSCMC.

The Present Study

Nearly a decade has passed since the meta-analysis by Lin *et al.* (2013) and while many more studies on TSCMC have emerged, no review has since attempted to investigate for overall patterns or trends between studies in order to answer the question of how TSCMC may enhance or hinder language learning. Furthermore, despite the mode's uniqueness, not only as a means of interaction, but also as a tool for testing language learning hypotheses, no review has yet investigated the contribution of TSCMC studies to SLA theory.

This study therefore reviews and compares the findings of research on TSCMC from over the past twelve years in order to answer the following questions.

1. What aspects of SLA appear to be enhanced or hindered by TSCMC?
2. What are the insights provided and questions raised with regard to SLA theory and practice?

Method

While the rigor of the reviews by Sauro (2011) and Lin *et al.* (2013) is admirable, their adherence to synthetic approaches may have inadvertently limited the meaningfulness of their findings. Norris and Ortega (2007) present a generally favorable account of research synthesis, but warn of its pitfalls which may produce “technically sound but theoretically impoverished research” (p. 810). In order to tease out hitherto unseen patterns or connections, the current review prioritizes flexibility and interpretation over systematicity and rigor. It therefore takes a narrative, rather than synthetic approach. Even so, this review does employ a number of techniques common to research syntheses, including a systematic retrieval method and inclusion criteria. These are all utilized in the service of the narrative however, and as such, are applied more flexibly than they would be in a research synthesis.

Retrieval of studies

Following Sauro's (2011) approach, 16 peer-reviewed journals which Smith and Lafford (2009) and their informants had identified as the highest ranked journals featuring CALL and CALL related content were chosen as the primary sources for this review.

These journals were searched for the keywords: *synchronous*, *computer*, *mediated*, *communication*, *text*, and *chat* with “computer-mediated communication” quoted exactly when possible. The year 2010 was chosen as the starting point for articles to include and studies that were covered in the reviews by Sauro (2011) or Lin *et al.* (2013) were excluded from this one to avoid overlap.

In addition to the above journal searches, *Google Scholar* was searched using the same terms and the first 100 results examined for further publications to include, with an additional criterium that publications from this search had to have been cited by at least 20 other papers to qualify. This search produced three further publications, each from a journal that had not been included in Sauro's (2011) review.

Inclusion criteria

Due to the focus on studies with direct implications for SLA, this review adopts three selection criteria from Smith's (2017) outline of CALL studies that are exemplary in their attempt to develop and extend

both theory and practice in the field. Specifically, Criteria 6 through 8 are drawn from Smith's paper, with Criterion 7 undergoing some modification for clarity. The inclusion criteria for this review are thus that each study had to:

[Stage 1]

1. have been published in one of the 16 peer-reviewed journals included in Sauro's (2011) review or be one of the three additional papers discovered through the Google Scholar search explained above.
2. have been published in 2010 or later and have not been included in the previous reviews by Sauro (2011) and Lin *et al.* (2013).

[Stage 2]

3. be a primary study, not a research review or theoretical position paper.
4. involve at least one language learning condition during which the sole mode of communication was TSCMC and include an analysis of the results of that condition as distinct from those of any other condition
5. have collected data directly from the TSCMC and/or pre-post measures.

[Stage 3]

6. be "firmly grounded in an identifiable SLA theoretical framework"
(Smith, 2017, p. 447).
7. "examine key assumptions, constructs, hypotheses, and so on which are relevant to this theory of SLA" in that they are argued based on that theory to either lead to or moderate the learning of language
(Smith, 2017, p. 447).
8. "investigate some aspect of the argued affordances of CALL environments"
(Smith, 2017, p. 447).

In Stage 1 of the selection process, the initial search described above produced over 327 titles which satisfied Criteria 1 and 2. In Stage 2, a reading of the abstracts and papers revealed that 53 satisfied Criteria 3 through 5. In Stage 3, these papers were read in detail. Thirty-eight of them satisfied Criteria 6 through 8 and were thus included for review (see Appendix).

It is important to note that, although this method of selection parallels that used by Sauro's (2011) research synthesis, it was not meant to produce an exhaustive body of research on TSCMC but only a substantial slice. Providing enough detail about each study to elucidate common or contrasting findings was a priority of this narrative review and would not be possible if the number of studies included became too large.

Categorization

Papers were grouped based on similarities between their research questions, foci, and aims into five thematic categories:

Modality ($k = 4$)

Corrective Feedback ($k = 3$)

Uptake, Noticing, and Alignment ($k = 9$)

Task Design and Conditions ($k = 14$)

Grouping ($k = 9$)

These themes do not cleanly divide the papers, however. For example, there were two studies that investigated both the effects of modality and corrective feedback. These were assigned to the lower *Corrective Feedback* section. Thus, categories lower on the list may contain studies that partly involve categories higher on the list. The reverse however is not the case, with one exception: the study by Dao, Duong, and Nguyen (2021) which is included in two different sections, because it was deemed essential to the conclusions of both.

Results

Below is a review of the research within each of the five themes that emerged. Note that because 30 studies involved university learners working in pairs, ages and interactive group sizes will not be given unless other ages, backgrounds, or group sizes were involved.

Modality ($k = 4$)

Four studies investigated the effect of modality as their primary focus. Kim (2012) found that more communication strategies (CSs) were used during communicative tasks in FTFC than in TSCMC except for avoidance strategies which were more frequent in TSCMC. TSCMC was thought to elicit more avoidance strategies because further negotiation of meaning (NoM) might have disrupted the flow of conversation which, due to the nature of TSCMC, was already subject to time-delays and split turns. Similarly, Hung and Higgins (2015) found that open conversation through video-based SCMC led to a significantly higher number of CSs compared to TSCMC. They note, however, that communication problems in TSCMC were often resolved through self-repair rather than CSs.

Ajabshir (2019) conducted a study wherein learners watched video clips on the request speech act and then collaboratively answered questions about and composed dialogues based on the clips through TSCMC, asynchronous CMC (email) or FTFC. The two CMC groups both achieved significant pre-post gains in the ability to perform the speech act over the FTFC group. The researcher posits that CMC enhanced learning by reducing learners' dependence on the teacher, but acknowledges that the novelty of learning through CMC may have also played a role. Also, group assignment was based on learner preference, which may have confounded the results.

Finally, Kessler, Polio, Xu, and Hao (2020) heeded Sauro's (2011) call for studies involving learners of non-alphabetic languages. Learners of Chinese discussed topics for 20 minutes in preparation to write about them through TSCMC and FTFC. FTFC produced over three times more output than TSCMC, while post-FTFC writing featured significantly higher complexity. The disadvantage of TSCMC stemmed primarily from the delay caused by typing non-alphabetic characters.

To summarize, Kim (2012) and Hung and Higgins (2015) suggest that CS use in TSCMC is less prevalent than in other modalities, while Ajabshir (2019) found that TSCMC may enhance language development when used to collaboratively synthesize and apply previously studied content. Finally, Kessler *et al.* (2020) indicate that increased typing delays during TSCMC in non-alphabetic languages may dramatically decrease its efficacy.

Corrective feedback ($k = 3$)

Three studies involving TSCMC focused primarily on corrective feedback (CF). Darhower (2014) provided CF in the form of dynamic assessment (DA) to learners of Spanish collaborating via TSCMC to retell clips from a film. Learner's ability to narrate past events appeared to improve as the amount of DA mediation required to resolve linguistic problems decreased over the six-week study period.

Bower and Kawaguchi (2011) conducted a tandem study involving learners of English and Japanese conversing through TSCMC. Chat scripts revealed that, whereas 7.2% to 20% of the turns were for the negotiation of meaning (NoM), less than 5% of the linguistic errors made received CF. After the chat sessions, learners corrected their partner's chat script resulting in over 60% of the errors receiving CF. The researchers conclude that such post-chat correction might be considered to add focus on form (FoF).

Arroyo and Yilmaz (2018) investigated immediate versus delayed CF during an information gap task through TSCMC. Their immediate CF group achieved significantly higher pre-post gains than the delayed CF group whose gains were in turn significantly higher than a no-CF control group.

These studies suggest that the interactive, yet textual and permanent nature of TSCMC may enhance CF. While CF occurs rarely in learner-learner communication, TSCMC lends itself well to the provision of CF by an instructor or knowledgeable peer. While immediate CF was superior, delayed CF still resulted in significant gains, and thus might be considered when immediate CF is infeasible.

Uptake, noticing, and alignment ($k = 9$)

Ten studies featured a prominent focus on uptake, noticing, or alignment. Giguère and Parks (2018) focused on younger learners as per Sauro's (2011) recommendation. Their study involved Grade 6 elementary school learners who engaged in a tandem information exchange via TSCMC one hour per week for six weeks. Despite the researchers actively encouraging learners to provide and respond to CF, it occurred only rarely during chat sessions, and was seldom followed by an uptake in the form of repair.

Rouhshad, Wigglesworth, and Storch (2016) compared interaction in TSCMC to FTFC during an information gap and decision-making task. TSCMC produced approximately half the number of words as FTFC in over twice the time. Even after controlling for output amount, FTFC resulted in significantly more NoM and a higher percentage of uptake. However, uptake seldom occurred in either condition, possibly due to the type of task used which emphasized meaning over form. To encourage more focus on form (FoF), the researchers recommend collaborative writing tasks.

Following that recommendation, Dao, Duong *et al.* (2021) had 100 EFL learners aged 15 to 33 undertake a picture sequencing and collaborative story writing task in TSCMC versus video-based SCMC. Significant differences emerged in favor of FTFC for both CF and uptake. Video interaction produced between two and three times the instances of CF found in TSCMC during the 30-minute timeframe. Unlike Rouhshad *et al.* (2016) however, the percentage of CF instances followed by an accurate repair was nearly equal for the two modalities.

Yuksel and Inan (2014) had 64 learners engage in a similar task and investigated whether TSCMC enhanced noticing compared to FTFC. Although participants took more time in TSCMC and produced fewer NoMs, they were able to accurately identify significantly more instances of NoM in their communication afterward during a stimulated recall.

Smith (2012), investigated the relationship between noticing CF during TSCMC and language learning. Beforehand, Smith trained participants to recognize and learn from recasts. Learners then retold a story for the researcher who provided frequent CF (recasts). Both eye-tracking and stimulated recall data predicted immediate and delayed post-test scores, evidencing the relationship between CF, noticing, and language acquisition.

Kim, Jung, and Skalicky (2019) and Kim, Skalicky, and Jung (2020) paired with learners and attempted to induce alignment to grammatical structures during information gap tasks through TSCMC versus FTFC. Alignment occurs when learners adjust their language to match their interlocutor's due, ostensibly, to linguistic priming by a prior message. Kim *et al.* (2019) found that alignment for stranded prepositions in relative clauses was significantly more likely to occur during TSCMC compared to FTFC. A marginally significant difference also emerged on an immediate post-test in favor of the TSCMC group. A similar study by Kim *et al.* (2020) targeted direct and indirect questions, and found a significant difference in alignment between groups in favor of TSCMC, but only for direct questions. While the amount of alignment significantly predicted immediate and delayed post-test scores for both question types, modality itself did not significantly predict scores for either type of question. The results of Kim *et al.* (2019) and Kim *et al.* (2020) suggest that alignment does indeed lead to language acquisition and that TSCMC can foster more alignment than spoken interaction, but that this effect varies depending on the linguistic items targeted.

Uzum (2010) investigated alignment during TSCMC tasks between nine intermediate ESL learners and advanced or native English-speaking students. The researcher indicated that alignment occurred frequently, but the construct was operationalized very broadly including, for example, alignment in tone.

Kourtali (2022) investigated the effect of TSCMC on uptake during two information gap tasks done with the researcher and subsequent language gains. The study is one of the few that involves younger learners (aged 10 to 13). Despite the researcher providing more recasts during TSCMC, FTFC produced significantly more uptake and higher written and oral pre-post gains. Note though that the learners in this study had never used TSCMC for language learning purposes before the experiment and received no prior instruction or training regarding recognizing and responding to recasts in that medium.

In summary, Giguère and Parks (2018), Rouhshad *et al.* (2016), and Yuksel and Inan (2014) indicate that FTFC elicits more NoM, CF, and uptake than TSCMC. However, this difference may disappear when output amount is controlled for (Dao, Duong *et al.*, 2021), suggesting that it is likely caused by the delay necessitated by reading and typing in TSCMC. Furthermore, Yuksel and Inan (2014) indicate that TSCMC may be more effective for promoting noticing than FTFC. Noticing during TSCMC was, in turn, shown by Smith (2012) to lead to language acquisition, as was alignment by Kim and colleagues (2019, 2020) who also found that TSCMC leads to more alignment and, depending on the target form, more acquisition than FTFC. Finally, the low uptake and linguistic gains for Kourtali's (2022) TSCMC group may have been due to their lack of experience with the modality, implying the need for prior orientation and training.

Task design and conditions ($k = 14$)

The 14 studies on task design and conditions investigated planning, task type/characteristics, environment, and interaction.

Planning ($k = 3$). Hsu (2012, 2015) and Zeigler (2018) employed picture narration tasks through TSCMC and investigated for an effect of pre-task planning on complexity, accuracy, and fluency (CAF)

of output. Hsu (2012, 2015) involved adult learners in an intensive English program in the U.S. aged 18 to 55. Hsu (2012) had learners take notes on paper for 10 minutes which were taken away before learners paired with the researcher for the task. No significant effects emerged.

Hsu (2015) had learners plan by rehearsing the entire task for 10 minutes in Microsoft Word which they closed before doing the task with the researcher. This planning method produced a significant increase in grammatical verb accuracy during the task and clause length during a subsequent task.

Zeigler (2018) had participants take notes for 3 minutes, 1 minute, and not at all. Learners were paired with each other and allowed to plan collaboratively, taking notes in the same chat window where they remained accessible throughout the task. Planning for 3 minutes produced a significant increase in lexical complexity but did not influence accuracy or fluency.

To summarize, Hsu (2012) found that planning by taking notes for 10 minutes that were then taken away had no effect. However, rehearsing the entire task on the computer for 10 minutes did produce a significant effect (Hsu, 2015). Zeigler (2018) also obtained significant results for just 3 minutes of planning. Hsu's (2015) rehearsal condition may have reduced cognitive load from meaning focus (Skehan, 2009) and allowed the practice of verb forms for increased grammaticity, whereas the shared nature and short duration of the 3-minute planning in Zeigler's (2018) study likely led to an emphasis on meaning, producing a brainstorming effect which increased lexical complexity but otherwise did not affect CAF.

Task Type/Characteristics ($k = 5$). Yilmaz (2011) and Zeng (2017) compared dictogloss versus jigsaw tasks on their facilitation of language related episodes (LREs) where learners discussed or corrected the language they used. The dictogloss task engendered significantly more LREs, and, in the case of Yilmaz, correctly solved LREs. Zeng also found that TSCMC resulted in a higher frequency of LREs than FTFC (though taking nearly three times longer). Learners commented that TSCMC allowed them to look back on, notice, and address errors that might have been missed during FTFC.

Kim (2017) investigated the effect of task type and modality on question production and article use, comparing spot-the-difference, story retelling based on a picture sequence, and decision-making tasks through TSCMC versus FTFC. A significant difference emerged in accurate article use in favor of the spot-the-difference followed closely by story retelling. Kim suggests that the difference stemmed from the need for more descriptive accuracy in those tasks, and their lower demand for logical reasoning and negotiation allowing for more attention to accuracy. Modality also had an effect: TSCMC resulted in a significant increase in advanced question production and accurate article use. In FTFC, learners could often get by with one-word questions, whereas overlapping turns and the absence of paralinguistic cues during TSCMC necessitated the provision of more context and specificity and thus more advanced question forms in order to avoid confusion. This need for specificity combined with the extra time between messages may have also increased attention to article accuracy. Importantly, and unlike other studies, the amount of time taken to complete the tasks was nearly equal for the two modalities.

Bandl (2012) compared the accuracy and amount of output elicited by two different versions of a family tree creation task through TSCMC versus asynchronous CMC. One version of the task was a jigsaw information gap where pairs exchanged information to complete a fictional family tree. The other version was a free information exchange about learners' own family trees. Because the jigsaw task required information to be exchanged for completion, Bandl hypothesized it would elicit more output. However, the information exchange task produced significantly more output, ostensibly because it was more interesting for learners to talk about their own family trees than about a fictional one. A significant difference (marginal in the case of TSCMC) in accuracy emerged in favor of the jigsaw task, but this may have been because the jigsaw worksheets included additional target language input.

Finally, Baralt (2013) paired with learners for a story retell task, with some doing a more cognitively complex version which required inferring rather than simply reading the intentions of one of the characters. Baralt hypothesized based on Robinson's (2001, 2011) Cognition Hypothesis that cognitive complexity would increase language development by demanding more syntactically complex output and thereby increasing learners' attention and responsiveness to input and feedback. Indeed, the more cognitively complex task when done through FTFC led to significantly more language development than two of the other experimental conditions. However, when carried out through TSCMC, the cognitively simpler version led to more language development and, in fact, resulted in the highest language gains of any condition. These findings suggest that the effect of cognitive complexity may differ depending on modality and that a task cognitively optimized for FTFC might be suboptimal for TSCMC and vice versa. Moreover, the results complicate our understanding of the role of cognitive complexity in language learning with those for FTFC seemingly supporting Robinson's cognition hypothesis, whereas those for TSCMC support Skehan's competing Trade-Off Hypothesis (1998, 2009).

In summary, Yilmaz (2011) and Zeng (2017) found that dictogloss, where initial target input is provided and reasoning requirements limited, led to an increased number of LREs and, in the case of Yilmaz, correctly solved LREs. Zeng also found that TSCMC led to more frequent LREs than FTFC. Kim (2017) discovered that doing a spot-the-difference task where context is fully provided, greater specificity required, and logical reasoning minimal led to more accurate article use than other tasks and that TSCMC outperformed FTFC in terms of both article accuracy and question formation and took nearly an equal amount of time. Bandl (2012) attempted to investigate the effect of interaction being required versus optional to complete a task, but other factors may have confounded the results. Finally, Baralt (2013) obtained evidence that, contrary to findings for FTFC, decreasing the cognitive complexity of tasks done through TSCMC may increase their effectiveness for language acquisition. This study, in particular, is worthy of replication and extension as it carries important implications for theories of cognition in SLA.

Environment ($k = 3$). The studies focusing on environment dealt with virtual worlds. Peterson (2012) investigated TSCMC between learners during communicative tasks in the 3D multiuser virtual environment (MUVE) *Second Life* for collaborative interaction hypothesized by sociocultural theory to foster language development (Ohta, 1995). Examples observed included lexical and corrective peer scaffolding, the use of continuers prompting further elaboration, promotion of social cohesion and the establishment of intersubjectivity. Peterson further observed that learners actively utilized their avatars within the MUVE which appeared to enhance their engagement during the tasks.

Rama, Black, Van Es, and Warschauer (2012) investigated affordances for language learning in the massively multiplayer online game (MMOG) *World of Warcraft*, identifying three main affordances: a safe space for learning, an emphasis on communicative competence, and goal-oriented collaboration. The study also contrasted the experience of one participant who was a beginner at the target language but an experienced gamer and another with the opposite characteristics. The MMOG appeared highly beneficial for the gamer, but less so for the other participant.

Collentine (2013) investigated the effect of input complexity in a custom 3D mystery game on learner output produced via TSCMC during their attempt to solve the mystery following game play. Linguistically simple and complex versions of target language messages were created for characters and descriptions in the game and randomly chosen for players such that complexity varied from learner to learner. Collentine hypothesized that linguistically complex input during the game would promote linguistically complex output. However, regression analyses showed that a large amount of linguistically simple input optimally facilitated output during subsequent interaction. Collentine cautions, though, that these results may have been confounded by initial proficiency differences between learners.

To conclude, Peterson (2012) and Rama's *et al.* (2012) investigations of a MUVE and MMOG respectively lay important groundwork for further studies exploring TSCMC as integrated within a larger computer-mediated environment. Their studies are also among the few so far that have answered Sauro's (2011) call for research into pedagogical tools that are specific to SCMC. Also worthy of further exploration is Collentine's (2013) finding that more informative yet linguistically simple input optimally promoted output complexity, which if replicable after controlling for proficiency, may inform input-oriented theories of SLA.

Interaction ($k = 3$). Tare *et al.* (2014) investigated the effect of interaction on output and language acquisition, comparing two classes: one which completed information gap tasks through TSCMC versus one which worked on self-study versions of the tasks. Based on the Interaction Hypothesis (Long, 1985; Gass & Mackey, 2007), interaction was postulated to facilitate more language acquisition. Learners completed three approximately 20-minute assignments per week for six weeks as homework. The interactive group produced significantly more output, achieved significantly higher pre-post vocabulary gains, and demonstrated a significant pre-post increase in production on an oral test. TSCMC featured lexical scaffolding in which one learner encountered target vocabulary used by the other and engaged in NoM if it was not understood, possibly leading to the higher vocabulary gains. Meanwhile, oral production may have increased due to the similarity of TSCMC to speaking and the increased output on the assignments.

Golonka, Tare, and Bonilla (2017) further investigated chat data from Tare *et al.* (2014) to uncover patterns of interaction that may have led to language gains, which included self- and peer-correction as well as NoM. NoM, though, was infrequent, whereas responding positively and self- and peer-correction were more common. Golonka and colleagues postulate that the lack of NoM was due to partners being of similar proficiency. Regardless, this interaction produced significant language gains compared to individual study, suggesting that these other patterns may be as important for language learning as NoM.

Yanguas (2020) compared the effects of L1 versus L2 TSCMC while working on a collaborative writing assignment in which learners narrated a picture sequence. The experimental study also included a group that collaborated on the assignment but were not allowed to chat, as well as a control group that did the assignment individually. A significant difference in accuracy emerged in favor of the L1 group, which was able to take more than twice as many chat turns per minute as the L2 group and thereby exchange more information. Their chat content also differed: whereas the L1 group focused more on task planning, the L2 group devoted more attention to FoF. The L2 group also engaged in NoM, yet no significant effect on their writing emerged. These findings may support Skehan's Trade-Off Hypothesis (1998; 2009) with the L1 chat group experiencing lower cognitive load while writing because they did not need to devote extra attention to simultaneously conversing in the target language. Meanwhile their smooth L1 communications could provide more scaffolding for efficient task completion, freeing up further attention to devote to accuracy.

While Tare *et al.* (2014) presents evidence for the efficacy of TSCMC compared to individual study, the follow-up analysis by Golonka *et al.* (2017) found that the most common features of interaction related to language development were correction and the maintenance of positive affect rather than NoM. Yanguas (2020) may further call into question the interactionist emphasis on NoM as well as the cognitivist emphasis on FoF in the target language, with the finding that interaction in the L2 during a collaborative writing assignment led to no significant improvement in learners' writing despite featuring NoM and frequent FoF. Rather, learners who used their L1 during the writing task significantly outperformed the other groups.

Grouping ($k = 9$)

Nine studies concerned group formation either by proficiency and native/non-native speaker status or by partner familiarity.

Proficiency and status. Van der Zwaard and Bannink (2014) investigated interaction between native (NS) and non-native speakers (NNS) and the effect of modality on NoM. Learners collaborated through video-based SCMC or TSCMC to devise a dramatic scene incorporating jokes specific to the culture of the NS. Given the NNSs' unlikelihood of understanding the jokes initially, communication required indicating non-understanding to initiate NoM for successful task completion (Varonis & Gass, 1985). However, learners may avoid indicating non-understanding to save face (see Brown & Levinson, 1987 and Goffman, 1967), especially when time limitations and nonverbal cues pressure them to respond quickly and when the interlocutor is perceived as an expert on the topic. Indeed, NoM was more stunted during video interaction where nonverbal cues and higher time pressure were present, than in TSCMC which offered (citing Fox, 2004, p. 153) "the illusion of anonymity."

Fredriksson's (2015) investigated TSCMC among student triads in a German literature class involving NSs and intermediate and advanced NNSs. NNSs tended to contribute less to the conversation when their group included a NS. Furthermore, intermediate NNSs contributed more words and clauses when the majority of group members were also intermediate NNSs as opposed to advanced. NoM occurred rarely regardless of grouping with learners more commonly utilizing self-repair.

Eslami and Kung's (2016) study on LREs during communicative tasks through TSCMC complicates the notion that status inequality impedes communication. The researchers randomly paired high- and low-level NNSs with a NS or with each other. Statistical analysis revealed that there was no significant difference between the groups on the number of LREs initiated, but there was a significant difference in the number of correctly resolved LREs in favor of the NNS-NS groups. Post-tests showed no significant difference between groups in learning due to LREs. The researchers conclude that pairing NNSs who have a large proficiency gap between them can result in a similar amount of LREs and learning as pairing NNSs with NSs. Regarding face-saving, the large proficiency gap between partners in the NNS-NNS pairs might have created a similar social dynamic of 'novice' and 'expert' between the NNSs that would have been operating among NNS-NS pairs. Note also that the NSs were language teachers in training and thus likely engaged in LREs actively with NNSs in order to 'teach' them.

Michel and O'Rourke (2019) focused on structural alignment and investigated learner-tutor versus learner-learner interaction in TSCMC. The mean instances of alignment for learner-tutor interaction were slightly higher and eye fixations on n-grams that were aligned to occurred more often and lasted longer for n-grams produced by tutors compared to peers. Alignment occurred rarely for both groups however and no inferential statistics were performed.

Liu's (2017) study involved NS teachers from an outside school and categorized learners as high (H) and low (L) proficiency, assigning them to H-NS, L-NS, H-H, or L-L pairs. Pairs interacted through TSCMC to answer questions about short texts. Significant differences in the amount of NoM emerged between groupings in this order (ranked highest to lowest): H-H, L-NS, H-NS, and L-L, with H-H pairings resolving significantly more NoMs than the others, whereas L-L pairings resolved significantly fewer. Thus, whether being paired with a NS led to more or less NoM depended on learners' proficiency. Note that the high proficiency learners were Applied English majors likely studying to be teachers, so they may have experienced face preservation issues when interacting with the NS teachers.

Torres and Cung (2019) investigated interaction between 46 learners of Spanish as a heritage language (HL) and 14 learners of Spanish as a second language (L2) assigning participants to L2-HL or HL-HL pairings. Pairs completed two decision making and writing tasks through TSCMC and FTFC. FTFC produced significantly more LREs regardless of pairing and despite taking about half the time. Interestingly, whereas the L2-HL pairs also resolved significantly more LREs through FTFC, no significant difference emerged between modes for HL-HL pairs. Thus, the childhood exposure of HL-HL pairs to the target language and their consequent higher proficiency may have allowed them to more effectively adapt to TSCMC.

Finally, Coyle and Reverte (2017) conducted one of the few investigations involving younger participants who were aged 9 to 10. The tandem study assigned learners to lower-level (L-L) and higher-level (H-H) pairings and had them do jigsaw story sequencing tasks in English through TSCMC (and tasks in Spanish that were outside the scope of the study). H-H pairs used significantly more negotiation strategies than L-L pairs while neither group demonstrated substantial uptake. Whereas pairs were technically composed of NNS-NS learners, the results align more with Lui's (2017) H-H and L-L pairings than that study's H-NS and L-NS pairings. The reason may be that partners likely saw each other as equals, as they did tasks in both of their respective target languages and those tasks were free of highly culture-specific content. The participants were also children and may therefore have been less concerned about face.

In summary, Van der Zwaard and Bannink (2014) and Fredriksson (2015) suggest that NS involvement may hinder interaction and NoM due to issues of face. However, Eslami and Kung (2016) and Michel and O'Rourke (2019) found that NNS-NS interaction produces more resolved LREs and alignment respectively, while Lui (2017) discovered that NS involvement increased NoM for low proficiency NNSs but decreased it for high proficiency NNSs. Meanwhile, Coyle and Reverte's (2017) NNS-NS pairings were more similar in their interaction patterns to Lui's (2017) NNS-NS pairings due ostensibly to their perceiving each other as equals. In contrast, although the NSs in Van der Zwaard and Bannink (2014) and Fredriksson (2015) were also fellow students, the tasks in both studies involved highly culture-specific content which may have led other learners to see those NSs as experts not only at the target language but also on the topic at hand leading to face-saving strategies and decreased NoM. Likewise, Lui's (2017) high proficiency NNSs were likely English teachers in training who when paired with NS teachers of English may have experienced face preservation issues due to a conflict in self-perceived roles. Van der Zwaard and Bannink (2014) show that, in such cases where face is likely to be an issue, TSCMC provides a sense of anonymity which may ease face-saving and increase NoM. Finally, the findings of Torres and Cung (2019) suggest that high proficiency learners may be able to adapt to the TSCMC mode more effectively than lower proficiency learners.

Partner familiarity. Dao, Duong *et al.* (2021) and Dao, Nguyen, Duong, and Tran-Thanh (2021) investigated the effect of pairing learners with familiar versus unfamiliar partners. The study by Dao, Duong *et al.* (2021), which has already been discussed in the *Uptake, Noticing, and Alignment* section, sought to determine whether higher partner familiarity would lead to more frequent provision of CF (referred to as 'peer feedback' by the researchers), but no significant effect emerged. A similarly designed study by Dao, Nguyen *et al.* (2021) involved 98 learners from private English schools in Vietnam with a mean age of 16.93 and investigated learner engagement and its effect on the quality of a subsequent collaborative writing assignment. Familiar partners demonstrated significantly higher learner engagement compared to unfamiliar partners, and regression analysis showed that measures of learner engagement significantly predicted the CAF of the written assignment. With regard to modality, all measures of learner engagement were significantly higher for the video-based SCMC condition compared to the TSCMC condition.

In summary, whereas partner familiarity did not affect the provision of CF (Dao, Duong *et al.*, 2021), it did significantly increase learner engagement (Dao, Nguyen *et al.*, 2021), several measures of which were then found to be predictors of the quality of a subsequent collaborative written assignment. These results support the efficacy of allowing learners to partner with familiar peers for TSCMC tasks. The fact that learner engagement was significantly lower for TSCMC in the study compared to FTFC also implies the need for measures to foster greater learner engagement during TSCMC tasks.

Conclusion

The analysis conducted here provides some tentative answers to the two questions posed by this review.

1. What aspects of SLA appear to be enhanced or hindered by TSCMC?

Beginning with hindrances, TSCMC is relatively time consuming with every study comparing TSCMC to other modalities—except Kim's (2017) and those that controlled for time—finding TSCMC to take approximately twice as long or longer than spoken modalities while usually producing about half the output. Also, at least in the case of learner-learner interaction CSs, NoM, CF, and uptake seem to occur less in TSCMC compared to spoken modalities, although these differences may disappear when output amount is controlled for. Furthermore, despite its similarities to spoken language, learners may need orientation and training in order to effectively utilize TSCMC for language learning tasks, and TSCMC may be particularly problematic for non-alphabetic target languages, unless learners have thorough prior experience typing in the language. Finally, it may be harder to foster learner engagement in TSCMC than in spoken modalities, perhaps due to its lack of nonverbal cues and the time delay between messages.

If enough time for orientation and task completion is provided, TSCMC may enhance SLA in several ways. The permanent, textual nature of TSCMC as well as the time delay, may promote more noticing, alignment, and the correct resolution of LREs compared to other modalities. It may also improve question production and grammatical accuracy and lends itself more readily than spoken modes to delayed CF. Additionally, TSCMC can provide the learner a sense of anonymity which may alleviate avoidance of NoM due to face-preservation issues.

2. What are the insights provided and questions raised with regard to SLA theory and practice?

Studies on the effects of group formation suggest a complex dynamic between proficiency and perceived roles. Depending on the proficiency, context, and the cultural specificity of target content, NoM may be avoided in favor of face-saving strategies. TSCMC was also found to alleviate face preservation issues compared to FTFC. In addition, research on partner familiarity found it led to higher learner engagement which in turn predicted learning, and maintenance of positive affect was one aspect of learner engagement which Golanka *et al.* (2017) also found to be a frequent feature of interaction that led to language gains in their study. These findings may be particularly relevant to the sociocultural account of SLA.

Informing the cognitive-interactionist perspective, studies investigating NoM found that it occurred rarely during TSCMC, yet several observed significant language gains. This suggests that other features of interaction besides NoM played a larger role in learning. Tore *et al.* (2014) and Golanka *et al.* (2017) found potential candidates in self- and other-correction as well as vocabulary modeling, while Smith (2012) showed that CF that was noticed led to language gains, providing support for Schmidt's Noticing Hypothesis (1990). Meanwhile, studies on structural alignment, which is presumed to occur unconsciously, found that it too led to language development. However, these other features of interaction also occur rarely in natural communication indicating the need for further research.

Studies on task design and conditions found that tasks featuring large amounts of input or extensive context combined with minimal reasoning or syntactic processing requirements led to optimal language performance in terms of output CAF and the resolution of linguistic problems. These findings may support the Trade-Off Hypothesis and perhaps Krashen's (1980) Input Hypothesis. However, Baralt's (2013) findings complicate the picture, suggesting a possible interaction between cognitive complexity and modality, with TSCMC operating according to the Trade-Off Hypothesis while FTFC aligns more with the Cognition Hypothesis. This interaction, if replicable, would have important implications for SLA theory and practice.

Finally, few studies have answered Sauro's (2011) call for investigating pedagogical tools that are specific to SCMC, with Peterson (2012) and Rama *et al.* (2012) conducting the only studies that investigated TSCMC as integrated within a larger computer-mediated environment and implying much unexplored potential for this higher level of CMC. Future research might experiment not only with adding mediation provided by a virtual environment, but with the direct mediation of learner-learner interaction by the environment. Such dynamic CMC might enhance learner interaction by, for example, making recommendations to interlocutors based on the content of their messages and would be of interest to both the sociocultural and interactionist research paradigms.

This review inherits two main limitations from its narrative approach. First, in order to provide a sufficient amount of detail on each study to enable in-depth comparison, the review draws from a slice of the available literature on TSCMC rather than attempting exhaustive inclusion, and as with Sauro (2011), only reviewed peer-reviewed journal articles, excluding other sources such as conference proceedings, book chapters, and graduate theses. Second, while the emphasis on narrative over systematicity enabled the elucidation of new insights into TSCMC for SLA, this approach may have been more susceptible to bias and error on the part of the author. Also, this review only incorporated studies that were written in English. Still, the review has showcased the potential of TSCMC for language learning and research. The results have important practical and theoretical implications and provide various avenues for future exploration.

Disclosure Statement

The author reports there are no competing interests to declare.

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Appendix

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