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Research Synthesis on Computer-Mediated-Communication

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Introduction

This paper synthesizes recent research into the role of computer-mediated communication (CMC) in language learning, particularly the negotiation interactions believed to be related to second language acquisition (SLA). Computers are increasingly prevalent in language learning and present prospects for new learning styles. CMC, e-mail, texting, voice chat, and blogs involve computer communication, but their quality of communication style differs significantly from the conventional communication (face-to-face communication). Kelm's (1992) examination of SLA using an online chat program shows that CMC offers many advantages that are absent in conventional conversation, including more substantial self-active utterances and equalization of participants' utterances. Warschauer (1996) notes that learners' familiarity with CMC engenders more positive attitudes during discussions. During the mid-1990s, research into CMC shifted toward the negotiation of meaning following Long's (1983) introduction of the interaction hypothesis. Chun (1994) and Kern (1995) confirm that CMC contributes more than conventional conversation to SLA because more negotiation of meaning occurs, promoting understanding of input through interactional modification. However, current research suggests that input and output are insufficient for language development and that awareness of one's limited knowledge and ability is necessary for successful SLA. (Schmidt, 1990, 2001).

1. Earlier studies of CMC

CMC entered ESL settings in the early 1990s. Initial studies mainly compared students' perceptions and linguistic features with face-to-face conversation. Kelm (1992) presented the first studies in a foreign language setting using CMC for SLA. Kelm employed a synchronous conferencing program (Interchanger) in a class of 15 undergraduates studying Portuguese at a university in the US. In traditional teacher-fronted classrooms, teachers

dominate the floor and do most of the talking; however, students' contributions are expected in a CMC setting. She observed that computer-assisted discussions increased students' participation as measured by the mean length of utterances.

Sullivan and Pratt (1996) examined turn-taking by teachers and students in oral and interchange situations among 38 intermediate EFL students at the University of Puerto Rico. They observed that the teacher dominated 65% of the oral class, whereas students' participation increased dramatically in a CMC setting. The anonymity of the CMC setting encourages participation (Kelm, 1992; Beauvois, 1992; Kern, 1995; Warschauer, 1996) and reduces the anxiety that is often characteristic of face-to-face conversation (Kern, 1998). Warschauer (1996) finds CMC ideal for students who seldom speak in class because they can communicate without being seen. CMC reduces intimidation, allows students sufficient time to formulate their utterances, and permits them to express themselves more freely, comfortably, and creatively. Furthermore, students pay greater attention to the target language and increase their thinking ability more than is the case in oral discussions. Overall, research indicates that reduced anxiety and increased motivation enhance the quantity and quality of language production (Beauvois, 1992; Chun, 1994; Kern, 1995).

Several scholars have quantified language functions used in online communication. Regarded as one of the most influential studies of the 1990s, Kern (1995) quantitatively compared language usage of 40 elementary French classes in the US in a CMC setting and a face-to-face environment. He observed that CMC encourages twice to three times more turns per student and a larger number of sentences and words compared to oral discussion. In contrast, however, Sullivan and Pratt (1996) studied 38 intermediate EFL students at the University of Puerto Rico and observed that turn-taking in discussions was three times greater in the oral class, a finding they attribute to typed comments taking longer time to produce than oral responses. Ortega (1997) warns of the difficulty in linking the quantity of language produced and the relative time to compose messages, because learners expend time reading others' messages, editing, and revising their own texts before submitting them. Kern (1995) qualitatively examined the linguistic features of online discussions and showed that learners produce greater numbers and variety of verb forms and clausal types. Students employed all basic verb tenses and moods during CMC sessions but not during oral discussions. A wider variety of discourse functions also appeared. Students used question forms seven times more frequently in CMC settings.

Among the first to study interactional modifications in CMC conversations, Chun's (1994) study of fourth-semester German students yielded more detail regarding question types. She

observed that students in a CMC setting ask each other more questions using expansion, clarification, and confirmation requests and that self/other repairs were more frequent than those in a conventional classroom.

2. CMC interactional studies

2.1 Interactionist SLA model in conventional conversation

Long's (1980, 1983) interaction hypothesis proposes that input is rendered comprehensible by modifying interactional structures of conversations when miscommunications arise. He argues that modified input alone is rarely sufficient for comprehensibility, but modified interaction in conversations between speakers is significant for SLA. Comparing conversations between native speakers (NS) and between NS and non-native speakers (NNS), he observed that interactional modification is more frequent than linguistic modification when NSs spoke with NNSs. He suggests that NS modify their speech to NNS to avoid conversational difficulties and to repair discourses when they occur. He identified interactional modifications that occur significantly more often in NS/NNS conversations than in NS/NS conversations. They primarily involved negotiations of meaning, including clarification requests, confirmation checks, and comprehension checks.

Varonis and Pica define negotiation as the "modification and restructuring of interaction that occurs when learners and their interlocutors anticipate, perceive, or experience difficulties in message comprehensibility" (Pica, 1994, p. 494). Although Long's interactional hypothesis has gained limited empirical support (Pica, Young, and Doughty, 1987; Pica, 1991), it has motivated numerous studies, particularly examinations of interactions in L2 discourse, teacher-fronted classrooms, small-group conversations, and peer conversations (Gass and Varonis, 1985; Varonis and Gass, 1985; Pica and Doughty, 1985; Pica, 1986, 1992). Gass and Varonis (1985) and Varonis and Gass (1985) assessed the frequency of negotiations in NS/NNS and NNS/NNS conversations as measured by indications of non-understanding and repair sequences, finding that negotiation of meaning is more prevalent among NNS/NNS pairs than NS/NNS pairs. They suggest that negotiation mainly occurs during NNS/NNS interactions because participants recognize their "shared incompetence" in the target language (p. 84). Subsequent studies of learner-to-learner negotiations show that although learners provided each other with ungrammatical input, their interactions contained features potentially crucial to SLA (Long and Porter, 1985; Porter, 1986; Gass and Varonis, 1989a).

2.2 Interactionist SLA research into CMC

CMC studies during the 1990s mainly focused on linguistic features. More recent attention has been given to CMC's implications for L2 learning, building upon SLA theory. Studies have shown that CMC provides an ideal medium for students to benefit from interaction and can facilitate SLA in a manner similar to face-to-face negotiation (Beauvois, 1992; Chun, 1994; Kern, 1995; Sotillo, 2000; Smith, 2003a). This is because the quality and negotiation patterns observed in CMC resemble the interactions of oral conversation (Warschauer, 1998; Blake, 2000; Beauvois, 1992; Chun, 1994; Kern, 1995). This speculation has motivated researchers to operationalize the negotiation of meaning in CMC settings (Blake, 2000; Gonzalez-Lloret; Smith, 2003a; Blake and Zyzik, 2003; Tudini, 2003). Many CMC researchers have adapted the interactionist SLA model to analyze negotiations of meaning in face-to-face conversations. Among the first to do so, Blake (2000) assessed CMC interactions of 50 intermediate learners of Spanish and observed that negotiations arising in CMC generally follow the schema of Varonis and Gass (1985), who identified four components of negotiation routines: <T> triggers, which catalyze negotiation routines; <I> indicator signals, which indicate communication difficulty or incomprehension; <R> responses, which respond to the indicator; and optional <RR> reactions to the response (Figure 1).

Figure 1 Proposed model for non-understandings (Gass and Varonis, 1985. p. 74)

Trigger	Resolution		
<T> Trigger → Speaker	<I> Indicator → Hearer	<R> Response → Speaker	<RR> Reaction to Response Hearer

Smith (2003a, 2009) investigated how extensively negotiations of meaning in a CMC setting resemble face-to-face negotiations and argued that computer-mediated interaction among learners does not occur to the degree and in the manner of face-to-face interaction. Analyzing CMC conversations from 14 NNS/NNS dyads, Smith observed that over 75% of negotiation routines exceeded Varonis and Gass' (1985) four-component schema. Indeed, 82% of negotiation routines incorporated two additional phases: <T>→<I>→<R>→<RR>+<C>→<RC>. Smith terms these confirmation <C> and reconfirmation <RC>, and suggests that both appear often in CMC discourse because CMC reduces paralinguistic and non-linguistic aspects of face-to-face speech that facilitate verbal communication. He concludes that CMC requires more explicit marking of understanding and non-understanding and of "turn boundaries" than face-to-face conversation (p. 47).

In face-to-face conversation, the optional reaction to the response <RR> mainly serves to close the negotiation routine through an explicit indication of understanding; however, that is not the case with CMC conversations. It seems likely that reactions to responses serve as the indicator <I> of a subsequent lack of understanding (Smith, 2003). Smith documented new negotiation routines — negative reactions to responses <RR−> and affirmative reactions to responses <RR+> — which indicate an incomplete and a proper understanding, respectively. The real-time nature of CMC discourse resembles spoken communication although it possesses features of oral and written language. However, CMC negotiations must allow for delays between utterances, and they lack the strict turn adjacency of face-to-face communication (Smith, 2003). He concludes that CMC negotiation patterns feature too many unique characteristics to fit the face-to-face negotiation pattern developed by Varonis and Gass (1985). The components of negotiation routines can be categorized. A trigger <T> is an utterance or part of an utterance that is not understood, whether for lexical, syntactic, discourse, or content reasons. An indicator <I> expresses lack of comprehension and can serve as confirmation checks or clarification requests to repeat the problematic part of the previous phrase. A response <R> from the initial speaker, which can be expressed by reformulation or elaboration, seeks to resolve the problem. The optional reaction to the response <RR> may include extensions or responses to the previous phrase (Varonis and Gass, 1985, Long, 1999a; Doughty, 2000b; Gonzalez-Lloret, 2003).

Just as lexical items generally trigger negotiations in oral interactions (Ellis, Tanaka, and Yamazaki, 1994; Pica, 1994), CMC research shows that triggers of negotiation routines are primarily lexical (Blake, 2000; Pellettieri, 2000; Toyoda, 2002; Gonzalez-Lloret, 2003; Smith, 2003). Studies of task-based CMC interactions discuss this phenomenon (Blake, 2000; Pellettieri, 2000; Sauro, 2001; Smith 2003). Pica et al. (1993) observe that jigsaw tasks generate more negotiation than information gaps, and problem-solving and decision-making tasks. Blake (2000) examined CMC interactions of 50 Spanish learners with native speakers of English. Students were asked to execute tasks, and interactions were arranged in dyads. Jigsaw tasks produced more negotiations than other tasks (information gap, decision-making, and learner discussions); however, lexical items triggered 75% to 95% of negotiations involving all types of tasks. Pellettieri's (2000) similar study classified triggers of CMC dyads according to task type among 20 native-English-speaking Spanish learners. He observed that lexical items trigger the most negotiations regardless of task type with few negotiations addressing problems in syntax or content. Tudini (2007) examined CMC interactions of 27 Italian learners of English with native speakers of Italian to explain occurrences of lexical

confusion by NNSs. Most triggers occurred when native speakers introduced new words. NNSs initiated lexical negotiations more actively than NSs (77% vs. 23%), and NSs initiated more syntactic negotiations (56% vs. 23%).

Smith's (2003) task-based CMC research examined how learners of English negotiate interactions when encountering new lexical items and to what extent those items affect the amount of negotiation. Contrary to Pica et al. (1993), Smith observed that learners negotiated significantly more often when engaged in decision-making than jigsaw tasks. The study infused new lexical items into both types of tasks and revealed that unknown lexical items affected the amount of negotiation differently for both types. When new lexical items were seeded in decision-making tasks, most negotiated interactions involved these items. On the other hand, learners engaged in jigsaw tasks often relegated new lexical entries to secondary importance although they were presented to help them complete the task speedily. Smith concludes that jigsaw tasks elicit more incidental negotiation during CMC interactions, as Pica et al. (1993) predict; however, decision-making tasks generated more negotiation sequences than jigsaw tasks when new lexical items were infused. In sum, most studies reveal that lexical items generate the most common types of triggers in CMC interactions. These results coincide with findings from studies of oral interaction.

Communicative problems triggering negotiations in a CMC setting are usually followed by indicators expressing a lack of comprehension, as in oral interactions. Indicators can take several forms (e.g., confirmation checks or clarification requests) from listeners seeking to clarify the speaker's utterance. The difficulty in negotiating through written discourse without non-verbal cues prompts different negotiation strategies. Among those, studies indicate that clarification requests are most frequent among NNSs during CMC interactions (Lee, 2000, 2001, 2009; Gonzalez-Lloret, 2003; Kotter, 2003; Jepson, 2005; Lai and Zhao, 2006). Gonzalez-Lloret (2003) examined CMC interactions of 12 English-speaking intermediate-level students of Spanish at the American University. Consistent with previous literature, he observed that a lexical item was the most common trigger; clarification requests were the preferred indicators, followed by confirmation requests (46 and 27 times, respectively). Such requests are often used to prompt speakers to modify their output in face-to-face conversation (Long and Sato, 1983); they are invaluable in CMC interactions where paralinguistic cues and intonation are missing.

Lee (2001) observed that clarification requests were the preferred modification device following misunderstandings. Students often asked "How?" or "Can you explain further?" (p. 240). In Lai and Zhao (2006), most efforts to clarify meaning involved explicit indications

of difficulty in understanding, such as “What...?” (p. 113). This greater explicitness arises because the CMC interface requires indications that speakers must interrupt the conversation, and it lacks the visual salience of face-to-face conversation (Pellettieri, 2000).

Overall, studies of CMC demonstrate that NNSs negotiate and use interactional modification successfully. Some studies have investigated the extent to which NNS learners provide each other with corrective feedback through structural modifications (Pellettieri, 2000; Tudini, 2003; Sotillo, 2005). Pellettieri (2000) observed that Spanish learners of English respond to feedback by offering explanations or elaborations. Data show that learners incorporate high percentages of target-like explicit feedback (70%) and target-like implicit feedback (75%) in conversation. Only two non-target forms were incorporated into subsequent conversation. Pellettieri (2000) invokes Gass and Varonis (1989), saying “learners are able to recognize what is correct and what is incorrect even in the absence of a native speaker and even when their own forms are not in conformity with the target language” (p. 82.).

Sotillo (2005) examined corrective feedback in NS and NNS dyads, and NNS and NNS dyads involving problem-solving activities in CMC conversations. She observed that NNSs provided more explicit corrective feedback and NSs more implicit feedback. Although most correction episodes in NNS interactions involved queries about lexical items, NSs concentrated on the content of NNSs’ utterances. Furthermore, her study showed that more advanced NNSs notice learner’s output errors more often than NSs. Pellettieri (2000) showed that learners with higher metalinguistic awareness might be better at giving feedback to interlocutors.

Although most CMC studies of communication difficulty or failure examine lexical, syntactic, discourse, and content issues, some address social interaction (Blake and Zyzik, 2003; Kitade, 2008; Lee, 2005, 2009; O’Rourke; Ware and O’Dowd, 2008). Blake and Zyzik (2003) examined dyadic interactions in a CMC setting among 11 university heritage Spanish speakers and 11 native English speakers learning Spanish. Results indicate that output is not always modified following a communication breakdown. Rather, students collaborated to solve a two-way jigsaw task. With respect to collaborative interaction in a CMC setting, Lee’s (2002) study among 34 Spanish learners of English showed that learners provided each other with feedback and collaborated to construct knowledge. Lee indicates the importance of social perspective in CMC interactions, noting “the major function of social interaction is to provide scaffolding by which the learners help each other to achieve a performance that they typically execute alone” (p. 276).

Several studies discuss learners’ tendencies to negotiate meaning and form in collabora-

tions (Lee, 2001; O'Rourke, 2005). Lee (2001) paired 40 Spanish-speaking students of English to discuss open-ended questions about everyday topics. Data show that use of incorrect forms did not prevent learners from interacting; they were more interested in exchanging ideas. To maintain the conversational flow, learners often ignored feedback about syntactic errors from native-speaker partners. Learners collaborated using modification devices such as clarification requests and comprehension checks, and sometimes self-corrected their utterances.

Recycling interlocutors' messages is a unique characteristic of collaborative interactions via CMC (Blake and Zyzik, 2003; Lee, 2001, 2005; Ware and O'Dowd, 2008). Blake and Zyzik (2003) found instances of knowledge gained through recycling being used appropriately among learners in a CMC setting. One learner asked his partner to clarify the use of an unfamiliar Spanish word and used it correctly later in the exchange. Ware and O'Dowd (2008) examined dyads in CMC interactions among 11 EFL students at a Spanish university and observed that many instances of feedback reformulated the interlocutor's original message. Blake (2005) describes such output as a feedback loop that provides the learner with new input, a second chance to get the utterance right, and structural integration. By seeing typed utterances on the computer, learners can compare, monitor, and elaborate. CMC's visual advantage allows learners to concentrate on language form and to note gaps in their interlanguage (Pellettieri, 2000; Blake, 2005). Several studies suggest that this feature may promote attention and notice, which are principles emphasized in SLA theory (Tudini, 2003; Sotillo, 2005; Lai and Zhao, 2006).

3. Conclusion

This study has synthesized recent research that combines CMC language learning with theoretical approaches to SLA. The literature shows that CMC enables learners to experience the process of selecting suitable words and create messages using existing knowledge. This advantage enhances learners' cognitive development and promotes internalization of knowledge, but precisely how CMC aids thought processes of acquiring a second language remains unclear.

Considerable CMC research analyzes only printed data, and in doing so disregards learners' thought processes. Future studies need to examine writing to discern how learners correct messages and use verbal protocols such as thinking-aloud or talking-aloud. Such studies might advance understanding of learners' thinking and internalization using CMC, thus clarifying its utility in SLA.

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